

# Investigating HEMIS pre-implementation factors in Kenyan universities

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**Background:** A few Higher Education Institutions (HEIs) in African countries have successfully implemented the higher education management information system (HEMIS). Aside from technological challenges, studies indicate that other contextual elements (social and economic) play a critical role in influencing implementation.

**Objectives:** This article investigates HEMIS pre-implementation factors in Kenyan HEIs, specifically Universities.

**Method:** The article adopts a qualitative multiple case study approach, focusing on the HEMIS implementation journey of four Universities. Participants from the HEIs cases comprise HEMISs staff who are directly involved in the implementation projects. Data is collected using interviews. Data analysis comprises of reviews of iterations and document analysis.

**Results:** The findings reveal that technological and organisational factors play a key role in motivating implementation. Environmental factors are least significant. Integration, automation, information access, usability, efficiency, cost and scalability are the key influencing factors that influence HEMIS implementation. Other elements include accountability, security, robustness, contractual issues, technological support and need for greater capacity for storage.

**Conclusion:** HEMIS implementation is complex and challenging. Recommendations were offered to incorporate implementation factors and considerations within African or developing countries context to enable the development of more practical solution-oriented perspectives on HEMIS implementation.

**Contribution:** The findings provide an understanding of pre-implementation of HEMIS implementation through its investigation of pre-implementation factors. The findings reveal that technological and organisational factors play a key role in motivating implementation. Environmental factors are least significant. The article recommends adopting a socio-technical approach in the review of pre-implementation in determining HEMIS implementation.

**Keywords:** pre-implementation; context; universities; higher education management information system; Kenya.

## Introduction

Universities pursue higher education management information system (HEMIS) implementation to increase organisational efficiencies and the quality of education (Ndibalema 2022). These include the HEMIS implementation projects highlighted by Al-Hilali (2020) and Kisanjara (2020) related to teaching and administration by Kayanda (2022) and Lamey et al. (2023). Despite the significance of HEMISs, concerns arise about their impact and failure on higher education (HE). This underscores the fact that there are fundamental issues regarding the basic justification for HEMIS implementation and use (Kiruki & Mutula 2023; Mbatia, Ndegwa & Okello 2023). This study sharing similar concerns acknowledges that indeed much needs to be understood about HEMIS implementation especially in unique contexts such as in Africa (Fafunwa and Aisiku 2022). Recent studies show that socio-technical influencing factors including contextual elements (culture, norms) and type of management of organisations implementing HEMISs play a critical role in influencing implementation of HEMIS. Drawing from this, this study sought to investigate and explain information system (IS) pre-implementation factors to improve its comprehension and the implementation of HEMIS in unique contexts such as Kenya.

In extant literature, numerous contributions on IS implementation focus on and investigate critical HEMIS implementation aspects (Liu, Geertshuis & Grainger 2020). However, despite these initiatives, the inter-relationships and the manner of interaction of implementation factors (social, political,

economic and technological) which determine HEMIS implementation in Africa are not yet understood (Rakgoale, Bag & Pretorius 2024; Sofyani, Abu Hasan & Saleh 2022). It is suggested that existing explanations and postulations lack clarity of how factors develop and influence IS implementation (Asadi et al. 2022; Lubinga, Maramura & Masiya 2023). This lack of clarity of the origin and type of causative factors contributes to the lack of comprehension and the manifestation of superficial explanations of HEMIS implementation (Kiprono, Rop & Langat 2020; Lubinga et al. 2023). Given this scenario and the various challenges faced by universities in African countries including the increased numbers of students seeking admission, decreasing quality of education and limited resources, it is imperative to look into the implementation of HEMISs so as to provide in-depth comprehension of implementation factors in unique contexts in African countries such as Kenya (Oyelere et al. 2022; Kerubo 2023).

The foregoing discussion indicates that there is an urgent need for further review and investigation of HEMIS pre-implementation factors in unique contexts such as Africa.

The article is structured as follows: This introduction provides the reader with a background of HEMISs implementation and its related issues. The second section provides the research question, problem, objective significance and framework. This is followed by the literature review. This section discusses the status of IS implementation and highlights shortcomings. Thereafter, the methodological approach applied in the research is presented in the methodology section followed by a discussion of the findings. The methodology used is qualitative and discussions highlight the pre-implementation factors. A section on conclusions and finally recommendations is presented at the end of the article.

Notably, in reviewing IS implementation, this study similar to other works including that by Lamey et al. (2023) and Harrison and Monica (2019) adopts the view that implementation has three key phases. These are pre-implementation, implementation and post-implementation. This research focusses on the pre-implementation phase. This is the planning and preparatory phase which involves reviews, suitability assessments of IS and related implementation factors of ISs (Qiu 2014; Xu et al. 2023; Stinken-Rösner et al. 2023).

## Research question

This research is guided by the following research question:

*What are the HEMIS pre-implementation factors in universities in Kenya?*

Answering this question will provide insight into the types of pre-implementation factors that influence HEMIS implementation in Kenya.

## The problem

The key research problem presented in this research is the high IS implementation failure which is greater in universities

compared to other sectors (Abu et al. 2022; Lamey et al. 2023; Ndibalema 2022). This challenge is more severe in unique contexts including in African countries (Kerubo 2023; Okai-Ugbaje, Ardzejewska & Imran 2022; Rakgoale et al. 2024). A significant percentage (more than 70%) of ISs implementation initiatives fail in the early phases of implementation (Chofreh et al. 2020; Clark, Liu & Isaias 2020). This underscores the fact that, there are many IS implementation aspects and challenges that have not yet been comprehensively examined and addressed (Aggrey, Acakpovi & Peters 2022; Okai-Ugbaje et al. 2022).

The foregoing points to the problem addressed in this study, which consists of two elements. Firstly, as noted by Kerubo (2023) and Njenga et al. (2019) among others, the lack of practical research and output on HEMIS implementation in unique contexts such as Kenya, which are considered to have a great need given their resource-constrained nature, manifest unique challenges and need to uplift the status of their citizenry (Varghese 2016).

Secondly, there is a lack of in-depth analysis and understanding of the factors that influence or hinder HEMIS implementation by practitioners in unique contexts such as Kenya (Kiprono et al. 2020; Kithinji & Nasong'o 2023).

## The objective

The overall aim of this research is to advance the understanding of HEMIS implementation within the context of Kenyan universities through the investigation of pre-implementation factors. To this end, the research investigates HEMIS pre-implementation factors in real organisational settings in universities. It is hoped that by so doing, this will provide insight on the pre-implementation factors that influence HEMIS implementation thereby improving implementation success prospects.

## Significance

By understanding influencing pre-implementation factors, the research contends that it will be possible for relevant agencies, universities and HE stakeholders in Kenya to better plan for the HEMIS implementation. This, in turn, will support the implementation of HEMIS and the attainment of national development goals through informed directives, relevant policy and prudent decision-making. Specifically for:

### Planners and policymakers

University managers and higher education institutions (HEIs) can utilise the findings of the study for better decision-making and in the implementation of HEMIS projects.

### Strategy planners

The research provides information for HEMIS practitioners on the pre-implementation factors and assists them in crafting an improved strategy for HEMIS implementation that will help in implementation initiatives.

### Future researchers

Future researchers can use this study as a source of reference and may be motivated by the study to undertake further research in the HEMIS subject area.

### Conceptual framework of the study

The research draws from the structuration theory to formulate the conceptual framework that is applied in the study. Figure 1 shows the conceptual framework. Structuration theory has the ability to examine action and interaction variables (Nyandiere, Kamuzora & Lukandu 2012; Orlikowski & Scott 2008). It is able to provide the study with a comprehensive outlook and insight on HEMIS pre-implementation factors as suggested by Stillman (2006) and Yin, Wang and Liang (2023). It has been used in IS research by Khando, Islam and Gao (2022) and Nyandiere, Kamuzora and Lukandu (2012) to investigate IS implementation and related factors in similar cases.

### Status of information system implementation in African universities

Universities use ISs to accomplish various tasks. An example of an IS used in the Kenyan HE sector is the Student Management Information System (SMIS). The SMIS is used by Kenyan universities to support and manage the bio-data decision-making processes. According to Makokha and Mutisya (2016), 90% of the Kenyan universities have websites with fully functional SMIS. The SMIS provides enrolled university students, in any programme, access to the Internet and information and communications technology (ICT) resources, enabling them to obtain the necessary data from any location in the globe (Andollo, Bowa & Rambo 2023). Students find it easier to access and use SMIS and avoid swarming system administrators' offices before, during and after residential sessions in April, August and December (Makokha & Mutisya 2016). The SMIS makes it possible to enter student data and records, and various student-related activities inside university programmes (Ndede-Amadi 2013). However, despite the fact that 90% of the universities in Kenya use SMIS as the premier management system for student information, there are still challenges of its use owing to the restrictive ICT infrastructure that causes SMIS to be underutilised (Andollo et al. 2023; Mutisya & Makokha 2016). Universities in Kenya lack essential ICT infrastructure especially those in the outlying areas where users can access SMIS to check their schedules, register or even communicate with their

various institutions (Kiruki & Mutula 2023). As a result, these institutions cannot be compared to those in other parts of the world. Additionally, these issues are compounded by the fact that African countries have a number of difficulties including unstable power supplies, incomplete data and telecommunications networks, and exorbitant energy and telecommunications costs (Avordeh et al. 2024; Qobo & Qobo 2022).

From the foregoing, it is established that there are various factors influencing HEMIS implementation in Kenyan universities including poor infrastructure and incomplete IS implementation among others. Albrecht et al. (2023) and Sharma and Rai (2015) categorise these factors into individual, organisational, technological and environmental factors.

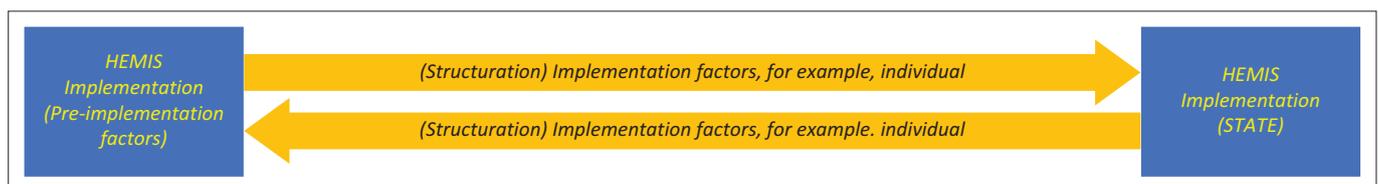
### Research methodology

Creswell and Poth (2016) and Hirose and Creswell (2023) identify qualitative, quantitative and mixed method approaches to research. Of these, two basic research strategies, qualitative and quantitative strategies, are most used in IS. Each of the identified perspectives has its own characteristics, modalities and operations. These are selected for use in specific research based on their suitability and nature of research (Coombs 2017). In this instance, research data are collected within a natural setting, transforming the researcher into a qualitative inquirer (Creswell & Poth 2016; Hirose & Creswell 2023).

The lack of practical oriented literature of contextual HEMIS implementation in Africa (Mohamed & Noorliza 2021), the nature of the research problem and the multidisciplinary nature of HEMISs also indicated that a qualitative approach was appropriate for the research.

The qualitative approach provides the research with the relevant tools and techniques to investigate complex socio-technical aspects comprising multiple variables (Myers & Klein 2011). This suits the article's objectives of investigating and reviewing HEMIS implementation factors in the Kenyan context that requires the investigation of pre-implementation factors.

The study uses hermeneutics as the analysis technique and interpretivism as the research paradigm. Figure 2 provides a graphical representation of the research methodology and relationships within the elements of the study.



Source: Nyandiere, Kamuzora & Lukandu 2012 and Khando, Islam & Gao 2022

Note: Please see reference list for full details.

HEMIS, higher education management information system.

FIGURE 1: Conceptual framework and related theory used in the study.

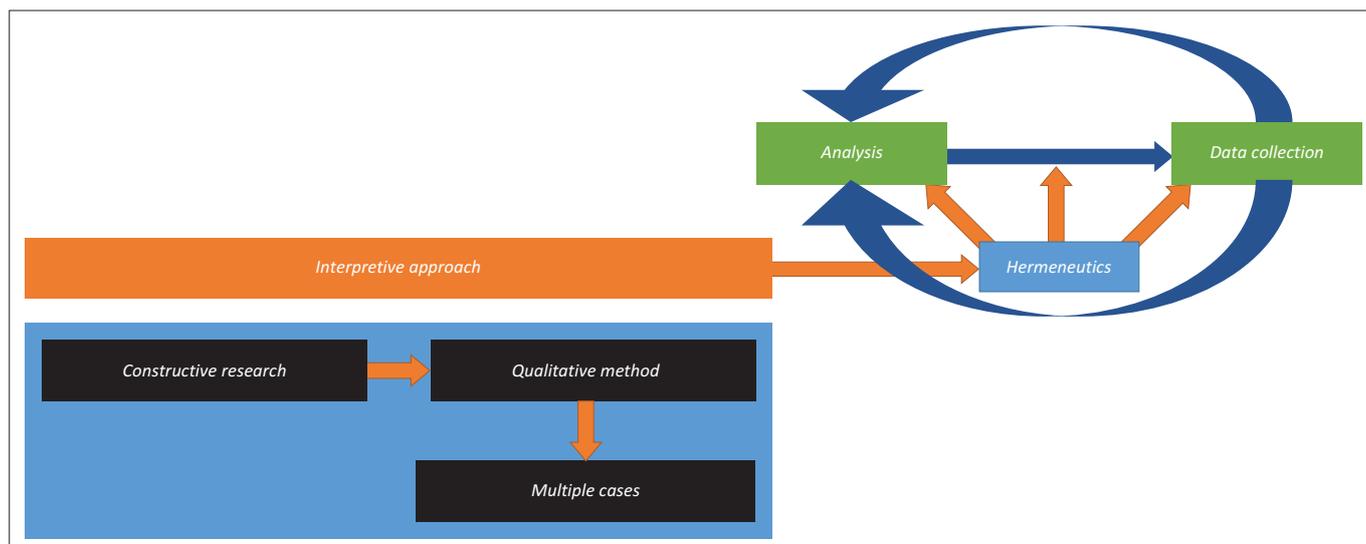


FIGURE 2: Research flow.

## Case study

Hunziker and Blankenagel (2024), Pearlson, Saunders and Galletta (2024) emphasise the use of case studies in IS research to contribute to knowledge about individuals, groups, organisations, social, political and related phenomena. It allows investigators to retain the holistic and meaningful characteristics of real-life events, such as organisational and managerial processes, international relationships and the maturation of industries (Creswell & Poth 2016; Hirose & Creswell 2023). Therefore, case studies provide a thorough, holistic description and analysis of a phenomenon in its specific context, providing insight into real-life situations (Hirose & Creswell 2023). This fits this study which seeks to examine a broad range of HEMIS pre-implementation factors.

Case studies have also been used in similar IS research initiatives by various scholars such as Calandra et al. (2023) and Masiero (2023), who have demonstrated the effectiveness of case studies in contributing to the greater understanding of IS implementation in similar scenarios.

## Sampling

The selection of the specific Kenyan university cases is guided by appropriateness and adequacy.

Appropriateness is concerned with matching the method to the purpose of the research and the phenomenon under investigation (Graebner et al. 2023; Shakir 2002). The research being exploratory adopts a multiple-case study research design. To explore the contingent organisational factors that may affect HEMIS pre-implementation and integration, this study targeted universities that had at least 5 years' experience of using HEMIS, setting the following boundaries for case selection:

- A university that has implemented and has been using HEMIS for at least 5 years.
- A university that operates in Kenya (although it need not necessarily be Kenya owned).

Considering the foregoing parameters, four Kenyan universities which had implemented HEMISs for institutional management were selected. This comprised the following:

- Two public institutions including Maseno University (Case A) and Moi University (Case B).
- Two private institutions including Africa Nazarene University (Case C) and St. Paul's University (Case D).

After the cases were identified, requests to formally undertake the study were sent out using letters and emails to the institutions through their gatekeepers. After receiving the necessary consent to undertake the study, introductory visits to the institutions were organised through the university gatekeepers, Vice Chancellors' (VCs) offices, through which participants were subsequently identified to participate in the study. For instance, in Case A, a letter was written to the in-charge, the VC of the university, for permission to undertake the study. The matter was referred to the Deputy Vice Chancellor (DVC) (Partnerships, Research and Innovation) who facilitated access to the IT and IS departments.

## Participant selection

The literature highlights the critical role of HEMIS managers and staff during the implementation of ISs (Mohamed & Noorliza 2021; Napitupulu 2023). This study requested the participating institutions to nominate potential respondents who met the following criteria:

- Involvement in HEMIS-related implementation activities from initiation of the project.
- Participation in HEMIS-related implementation decision-making.
- Involvement in deployment and use of the HEMIS.

They included the following personnel:

- HEMIS implementation project managers in Kenya.
- HEMIS implementation IT specialist staff in Kenya.
- Staff responsible for HEMIS operation.
- Staff members using HEMIS.

In total, 18 HEMISs implementation staff from the case institutions were identified for the study. Five HEMIS implementation staff members were selected from Case A institution while four members of staff were selected from Case B institution. Four HEMIS implementation staff members were selected from Case C institution while five members of staff were selected from Case D institution (see Table 2).

### Data collection

This research used semi-structured interviews to collect data. A general interview guide approach was used together with an informal conversational format to aid the free flow of discussion. This ensured that the focus and progression of the interviews were maintained (Neubaum & Weeks 2023; Dibley et al. 2020). The interview guide is based on:

- the research question
- The literature review
- The HEMIS implementation reports.

The interviews were tape recorded; notes were taken and were later transcribed. This allowed for the complete account of the interviews to be analysed and provided a comprehensive understanding of the interviewee's perspectives. This also assisted the researcher to focus on the feedback from participants and to avoid being distracted by other events from what was being communicated. Additionally, multiple interviews were undertaken to clarify issues and allow reflexive thinking to eliminate contradictions that might surface in the data (Myers 2019; Vandermause & Fleming 2011). Table 1 presents a sample of the interview question used. The interview sessions lasted between 35 min and 45 min. A total of 32 interviews were undertaken.

This included 9, 7, 7 and 9 interview sessions at Cases A, B, C and D, respectively. The universities' HEMIS participants were anonymised using pseudonyms. This was communicated beforehand to allow the uninhibited provision of information (Hollweck 2016; Patton 2002). The cases, participants, their designations, departments and frequency of interviews are presented in Table 2. Research notes aided in the pacing of interview sessions and were used for following up on requests and for clarification (Hirose & Creswell 2023).

Secondary data sources included HEMIS strategic plans, news articles, research reports and HEMIS presentations. The HEMIS strategic plans, research reports and HEMIS presentations hardcopies were accessed from institutions. Aside from this, research reports, news articles and presentations were downloaded from institution sites and online research and media sources. During the interviews, these secondary resources were referenced as discussion points to gauge the participants perspectives on pre-implementation factors.

### Analysis

In this research, data analysis was conducted based on the patterns which emerged during the research. Analysis initially focussed on the description of the cases, relying on data collected through interviews and document reviews. This was followed by the analysis of patterns. Thereafter, the data collected were coded in various themes and categories. As the categories emerged, these were noted and captured. With the emergence of categories, the researcher reviewed and refined the themes (Braun & Clarke 2022; Byrne 2022). This was based on the hermeneutic principles for interpretive research formulated by Klein and Myers (1999). This comprised of contextualisation, interaction, abstraction and generalisation, dialogical reasoning, multiple interpretations and suspicion.

The hermeneutics perspective seeks to draw meaning from the interpretation of texts (Folgueiras-Bertomeu & Sandín-Esteban 2023; McBride 2023). Interpretations are used to assess and further comprehend the context; and through iterations and reinterpretations, new comprehensions are realised (McBride 2023; Svensson & Jacobsson 2022). The text is interpreted, evaluated and placed in context to help the reader better understand it. This process is repeated until conclusions are reached.

**TABLE 1:** Sample interview question.

No.	Interview question	Progression	Research question
4	What were the initial reasons for implementing the new system for your organisation?	An understanding of the reasons for HEMIS implementation by the organisation.	<i>What factors influence HEMIS implementation in Kenya?</i>

HEMIS, higher education management information system.

**TABLE 2:** Participants and interview details per university.

Case	Participant designation	Department	Pseudonym	Frequency
A	System Administrator	ICT	AA	2
	E-Learning Officer	Distance learning	AB	2
	System Administrator	ICT	AC	2
	MIS Support Officer	MIS	AD	2
	MIS Support Officer	MIS	AE	1
	Sub-total	-	5	9
B	System Administrator (Network infrastructure)	ICT	BA	1
	ICT Technician	ICT	BB	2
	ICT (Head)	ICT	BC	2
	Database Administrator	ICT	BD	2
	Sub-total	-	4	7
C	System Administrator	ICT	CA	2
	ICT (Assistant Director/Database Administrator)	ICT	CB	2
	Head (Strategy)	Administration	CC	1
	ICT (Director)	ICT	CD	2
	Sub-total	-	4	7
D	Accounts Officer	Finance	DA	2
	Head (Finance)	Finance	DB	2
	ERP Administrator	ICT	DC	2
	Head (ICT)	ICT	DD	2
	Database Administrator	ICT	DE	1
	Sub-total	-	5	9
	<b>Total</b>	-	<b>18</b>	<b>32</b>

E-Learning, electronic learning; ICT, information and communications technology; MIS, Management information system; ERP, enterprise resource planning.

## Process of analysis

In the first step, the researcher became acquainted with the data collected (Piecychna 2023). The researcher, thereafter, through data immersion, reviewed the data collected and checked for consistency. The researcher then transcribed all the interviews. This was followed by the review and re-examination of the collated summarised data. Data were coded and categorised. This aided the process of generating meaning from the qualitative data collected (Sackstein, Mathee & Weilbach 2023). The data were reviewed once again, confirmed and categorised. This process was repeated attesting to the iterative nature of the research. A step-by-step account of this is elaborated on in detail further on.

Data analysis is undertaken systematically using a sequential progression of activities. Stage One laid the foundation for the article and facilitated acquaintance, confirmation and corroboration of the compiled data. Personal transcription by the researcher also enhanced familiarisation with the data (see Table 3 for an example).

Initial codes pertaining to areas of interest of the primary data were formulated in Stage Two. A brief list of themes of concepts that related to the concepts was drawn up. This, as suggested by Sackstein et al. (2023), was based on the principles formulated by Klein and Myers (1999) and Myers and Klein (2011). Thereafter, through reference to the themes addressed in the interview questions, an initial coding framework was initialised for the article (Table 4 has an example).

Leveraging the coding approach developed in Stage Two various potential themes were identified. This formulated the components essential for Stage Three. In this stage, it is essential to note that no potential themes are eliminated because however insignificant they appear they can later be merged with other themes (see Table 5). An example is feedback indicating the need to use current technology that is categorised under the current technology sub-theme and the technology category. These broadly classified factors based on their key area of focus and relationship. For example, the factor of current technology is categorised under the technology theme.

Stage Four consisted of the refinement of potential themes. This comprised of new theme identification, merging and elimination of other themes (Sackstein et al. 2023). The conclusion of Stage Four resulted in a final coding framework extending the entire data domain, which was improved and refined in Stage Five (see Table 6). An example is the review and categorisation of robustness, scalability factors in the technology theme and category.

In Stage Five, the article focussed on further review and refinement (iteration) of themes and providing an accurate matching explanation based on the data extracts. Interpretations are utilised to assess and further comprehend

the context. This is facilitated through iterations and reinterpretations of data, and new comprehensions are realised (McBride 2023; Svensson & Jacobsson 2022). The iterative interpretation of text is done while considering the researcher's personal beliefs, values and knowledge of literature already in existence. This process is repeated until conclusions are reached. This process demonstrates the iterative and interpretive rigour of the research. From this exercise, a final institution-specific breakdown of factors and their categorisation was constructed from the refined themes formulated during Stage Five (Table 7, Table 8, Table 9 and Table 10).

Participants from Case A presented factors that motivated HEMIS implementation which were noted and aggregated. The identified themes are current technology, technological support, efficiency, accountability, automation and reporting. These were reviewed to confirm accuracy and placement. Thereafter, these were categorised based on the broad classifications of environment, organisation, individual and technology. In Case A, the categories technology, environment and organisation were noted.

In Case B, different factors that influenced IS implementation were identified, confirmed and aggregated. These comprised integration, accuracy, technology, scalability, efficiency, usability, cost and robustness. These were then aggregated. These were reviewed and rechecked. Thereafter, these were categorised based on the broad classifications of environment, organisation, individual and technology factors. In Case B, the categories technology and organisation were identified.

In Case C, various themes were identified including reporting, automation, efficiency and integration. These were reviewed, confirmed and aggregated. With refinement, the themes reporting, automation, efficiency and integration were identified. These were categorised based on the broad classifications of environment, organisation individual and technology. In Case C, the categories organisation and technology were represented.

**TABLE 3:** Collated data extract sample.

No.	Data extract
1	The major thing as far as our lot is concerned is the fit of the HEMIS to the organisation's business requirements. Our desire is a system that addresses our requirements as required.
2	The users face a lot of challenges in the use of systems because they cannot access information in other departments.

HEMIS, higher education management information system.

**TABLE 4:** Raw data extract with initial coding.

No.	Data extract	Provisional theme
1	The major thing as far as our lot is concerned is the fit of the HEMIS to the organisation's business requirements. Our desire is a system that addresses our requirements as required.	HEMIS fit HEMIS ability to address business functionality (Usability)
2	The users face a lot of challenges in the use of systems because they cannot access information in other departments.	HEMIS information access

HEMIS, higher education management information system.

**TABLE 5:** Compilation and categorisation of factors from the cases.

No.	ID	Reason for IS implementation	Explanation of reason for implementation	Theme	Category
1	AA	To use current technology	The institutions identified the need for using current technology as a reason for implementation to be able to have more resources and improve on their IS capabilities	Current technology	Technology
2	AC	To use current technology			
3	BA	To use current technology			
4	DD	Outgrown system			
1	AC	Efficiency within the organisation	The institutions identified the need to be efficient as a reason for implementation to be able to be more productive and optimise its resources	Efficiency	Organisation
2	AD	Operational efficiencies			
3	AE	Operational efficiencies			
4	AB	To get real-time reports			
5	BC	Improve efficiencies			
6	CB	Efficiency of the organisation			
7	CD	To make operations efficient			
8	DA	More efficient organisation			
9	DE	Efficiency within the organisation			
1	AA	Lack of vendor support	The institutions identified the need of support from the vendor as a reason for pursuing implementation to be able to manage the ISs and address challenges	Support	Environment
1	AC	Security	The institution identified the need for having a secure system as a reason for pursuing implementation to be able to ensure the integrity and safety of its records	Security	Technology
1	AD	Automation of the functional areas	The institutions identified the need to automate its processes as a reason for pursuing implementation to enable effective working	Automation	Organisation
2	AE	Complete automation of the functional areas			
3	CA	Automate processes			
4	CB	Automate functions			
5	CD	Automate processes			
1	AD	Integration of sub-systems	The institutions identified the need to integrate HEMIS and related sub-systems as a reason for pursuing implementation to ensure seam less working and resource utilisation	Integration	Technology
2	AE	Integration of sub-systems			
3	BA	Lack of standardisation			
4	BD	Integrate systems			
5	CD	Integrate systems			
6	DC	Integrate systems			
7	CB	Integrate systems			
8	CD	Integrate systems			
1	AC	Accountability	The institutions identified the need to be efficient as a reason for pursuing implementation to enable process ownership	Accountability	Organisation
1	AD	Easy access to information	The institutions identified the need to have ready access to information as a reason for undertaking implementation	Information access	Organisation
1	AE	Centralised reporting	The institutions identified the need to enhance their reporting capabilities as a reason for undertaking implementation	Reporting	Organisation
2	AE	Comprehensive reporting			
3	CA	Centralised reporting			
4	DE	Comprehensive reporting			
5	AD	Centralised reporting			
1	BD	For robustness	The institutions identified the need for a robust system as a reason for undertaking implementation	Robustness	Technology
2	DD	Robust system			
1	BC	Improve user satisfaction	The institutions identified usability as a reason for undertaking implementation to ensure that staff can effectively undertake tasks and achieve organisational objectives	Usability	Technology
2	DA	Ease of use			
1	BC	Reduce operational cost	The institutions identified the need to cut operational costs as a reason for undertaking implementation to ensure the fiscal prudence of the institution	Cut costs	Organisation
1	BC	Outgrew existing ISs functions	The institutions identified the need of scalable ISs as a reason for undertaking implementation to offer the institution the capability of addressing new and emerging issues	Scalability	Technology
2	BD	Improve scalability			
1	DA	Larger database/greater capacity	The institutions identified the need to have greater storage capacity as a reason for undertaking implementation to enable the storage of growing institution data	Capacity	Technology

IS, information system; HEMIS, higher education management information system.

In Case D, several themes were captured including capacity, efficiency, usability, integration, technology, robustness, reporting and contract and were aggregated. Further reviews identified and refined the themes. These were categorised based on the broad classifications of context, organisation, individual and technology. In Case D, the categories technology, organisation and context were synthesised.

A summary of the entities which influenced pre-implementation across the cases are shown in Table 11.

Implementation motivating factors identified across the cases included technology, efficiency and integration. The need to use current technology was noted in Cases A, B and D. Efficiency and integration were also key motivating factors for implementation in Cases A, B, C and D.

**TABLE 6:** Sample extracted and reviewed categorised implementation factors (Case A, B and C).

No.	Category	Reviewed theme(s)	
		Theme	Data extract
1	Technology	Technology	Robustness Scalability Fit/Relevance Security
2	Environment	Support	Technical Organisational
3	Organisation	Efficiency	Automation
4	Technology	Technology	Information access

**TABLE 7:** Aggregated reviewed Case A implementation elements, themes and factors.

Code	Reason	Themes	Reviewed themes	Factor category
AA	Current technology	Technology	Technology	Technology
AA	Lack of vendor support	Support	Support	Environment
AB	To get real-time reports	Efficiency	Efficiency	Technology
AC	Security	Technology	Technology	Technology
AC	Efficiency	Efficiency	Efficiency	Technology
AC	Accountability	Accountability	Accountability	Organisation
AC	To use current technology	Current technology	Technology	Technology
AD	Automation of the functional areas	Automation	Automation	Technology
AD	Integration	Integration	Reporting	Organisation
AD	Centralised reporting	Reporting	Information access	Organisation

**TABLE 8:** Case B implementation elements, themes and factors.

Code	Reason for IS implementation	Themes	Reviewed themes	Factor category
BA	Lack of standardisation	Integration	Integration	Technology
BA	Poor and inaccurate records	Accuracy	Accuracy	Technology
BA	Current technology	Current technology	Current technology	Technology
BA	Integration	Integration	Integration	Technology
BB	Integration	Integration	Scalability	Technology
BC	Poor and inaccurate data	Accuracy	Efficiency	Technology
BC	Outgrew existing ISs	Scalability	Usability	Technology
BC	Improve efficiencies	Efficiency	Cut costs	Organisation
BC	Improve user satisfaction	Usability	Robustness	Technology

IS, information system.

**TABLE 9:** Case C implementation elements, themes and factors.

Code	Reason for IS implementation	Themes	Reviewed themes	Factor category
CA	Centralised reporting	Reporting	Reporting	Organisation
CA	Automate	Automation	Automation	Organisation
CB	Automate	Automation	Integration	Technology
CB	Efficiency	Efficiency	Efficiency	Technology

IS, information system.

Automation was noted in Cases A and C; usability in Cases B and D was important. Therefore, the key common influencers across the institutions were usability, integration, efficiency, automation, information access and current technology. Other elements included contractual issues, scalability, technological support, robustness and

**TABLE 10:** Case D implementation elements, themes and factors.

Code	Reason for IS implementation	Themes	Reviewed themes	Factor category
DA	Larger database/greater capacity	Improved capacity	Storage capacity	Technology
DA	More efficient	Efficiency	Efficiency	Organisation
DA	Easy to use	Usability	Usability	Technology
DB	Integrate sub-systems	Integration	Integration	Technology
DC	Integrate sub-systems	Integration	Current technology	Technology
DD	Outgrown system	Current technology	Robustness	Technology
DD	Robust system	Robustness	Reporting	Organisation
DE	Efficiency	Efficiency	Contract	Environment

IS, information system.

**TABLE 11:** Implementation factors across institutions.

No.	Case A	Case B	Case C	Case D
1	Current technology	Integration	Reporting	Greater capacity
2	Support	Accuracy	Automation	Efficiency
3	Efficiency	Current technology	Efficiency	Usability
4	Security	Scalability	Integration	Integration
5	Accountability	Efficiency	-	Current technology
6	Integration	Usability	-	Robustness
7	Automation	Cut costs	-	Reporting
8	Reporting	Robustness	-	Contract
9	Information access	-	-	-

need for greater capacity for storage concerning databases also emerged. In reviewing the categorised factors, it was established that technological factors (23) were the majority followed by organisational (15) factors across the cases, and that environmental (2) factors were the least influential (see Table 12).

## Discussion

Several issues need to be considered while implementing HEMIS in African universities. These can be broadly divided into three categories: environment, organisation and technology. Technological factors (23) have the highest influence followed by organisational factors (15), while environmental factors (2) are least significant. It is thus deduced that technological and organisational factors play a critical role in influencing HEMIS implementation. This was arrived at after the aggregation of implementation factors which were iteratively reviewed, affirmed and rechecked to finally identify the influencing factors. The process of analysis highlights how these were synthesised. The summary of the analysis is presented in Table 12. The pre-implementation factors that were identified, reviewed and confirmed in institutions are as follows:

### Technology-related pre-implementation factors

These elements centre on the technological capabilities and aspects that must be taken care of prior to introducing a new IS. These include:

- Use of current technology
- Security

**TABLE 12:** Summary of the categorised implementation factors across institutions.

No.	Case	Technology	Environment	Organisation
1	A	11	1	5
2	B	6	-	2
3	C	1	-	6
4	D	5	1	2
<b>Total</b>	-	<b>23</b>	<b>2</b>	<b>15</b>

- Automation
- Integration
- Robustness
- Usability
- Scalability
- Capacity

### Organisation-related pre-implementation factors

These variables refer to how the IS fits in with the goals and requirements of the organisation. These include:

- Efficiency
- Accountability
- Information access
- Reporting
- Cutting costs

### Environment-related pre-implementation factors

These variables have to do with external elements that affect how the ISs are implemented. This includes:

- Support

Across the cases, the factors that influenced implementation differed. Several similar motivating entities were identified across the cases. These included technology, efficiency and integration. The need to use current technology was noted in Cases A, B and D. Efficiency and integration were also key motivating factors for implementation in Cases A, B, C and D. Automation was among a factor in Cases A and C, while usability was also important in Cases B and D. The key common influencers across the institutions therefore were usability, accountability, integration, efficiency, automation and current technology. These were primarily related to technology and its features. Other influencing elements included information access, robustness, contractual issues and need for greater capacity for storage concerning databases. The factors information access, accountability, cut costs, reporting are categorised under organisational factors. Factor support was categorised as environmental. Table 12 provides a summary of the frequency of identified categorised pre-implementation factors across the institutions. It is therefore deduced that technological and organisational factors play a critical role in influencing HEMIS pre-implementation across the cases. This seemed to partly align with the deterministic research that emphasises on specific technology affordances (Adelle et al. 2018). However, the emergence of organisational and environmental factors brings a new angle of the role of the organisation and its

elements including people in influencing the course of implementation. In doing so, it informs the need for a broader conceptualisation of implementation including at the initialisation stage emphasising on the need of using a wholesome approach which accommodates various elements as suggested by Purohit, Dadhich and Ajmera (2023) and Zahrt et al. (2023). This conceptualisation in education is advocated for by Owusu (2023) and Mazzurco and Daniel (2020), also. It is suggested that such a view addresses the technological component while also acknowledging social, business aspects and the interaction between man and machinery within the organisation. This coincides with the thinking that focussing on technology solely translates to meaningless conclusions (Sahaym et al. 2023). Therefore, this supposes a middle ground reconciliatory approach suggesting an all-inclusive single-core model that incorporates interdisciplinary openness and flexibility of ISs and implementation (Adhikari et al. 2023). The factors influencing implementation across the cases are expounded on next.

### Factors influencing implementation (Case A)

Maseno University (Case A) is a public chartered university, located in Maseno Township, in Kisumu County. It has four campuses, a college and a constituent college. The university uses both taught and virtual techniques in delivery of content. It has 14 schools including school of education, school of biological and physical science, school of computing and informatics, among others. The institution has a long history of using various HEMISs for over 10 years. At the university, ICT is viewed both as a learning resource and a tool for work. The HEMIS was hosted and managed by the local ICT department, which provided support to user departments. It had been using the older version of Navision, Microsoft Navision 2009. There were various factors that influenced the implementation of HEMIS in the Case A institution. These included use of current technology, efficiency, integration, technological support, accurate reports, automation, information access, security and accountability. These are explained next.

### Current technology

This focusses on ensuring that the ISs make use of cutting-edge technology to achieve present and future requirements (Alshahrani, Pileggi & Karimi 2024). The Case A's legacy of IS was problematic in terms of capacity owing to the increase in the number of students and courses offered both on and off campus, which had a direct effect on several technical matters, such as connectivity, bandwidth, the email service and overall system performance. The older Microsoft Dynamics NAV 2009 was unable to effectively address new challenges as the organisation grew and expanded in size. It also had challenges of working contemporary solutions. Participant AA noted that it was incompatible with new solutions available in the market. In mitigating this issue, the institution sought new current technologies to suit its needs including that of better processing, security and applications. As highlighted by Farid, Warraich

and Iftikhar (2023), current technologies offer advanced capabilities such as protection against security threats. The Case A institution in addressing this, opted for Microsoft Dynamics 365 Business Central 2018.

### Efficiency

Organisational efficiency is a critical concern for businesses facing increasing demands in the workplace (Aiqun 2018). Owing to greater demands at the workplace and growth, organisations need to streamline work processes and improve efficiency (Chisom et al. 2024). The Case A institution had grown and had new emerging challenges, including the fact that the university had expanded student enrolment number, new programmes, infrastructure and the services it was offering. It therefore needed more advanced capabilities to offer quality service and to achieve its organisational goals. According to participant AA, the legacy system using the Microsoft Dynamics NAV 2009 was also incompatible with add-ons available in the market.

Among the various initiatives in addition to its academic offerings, were businesses like the Kisumu Hotel and the University farm, where it grows crops for internal use and sells the excess to nearby markets. These were business organs of the institution. It also had the Centre for sustainable Development and Global Health (CSDGH) and the Potentials of Agro-ecological practices in East Africa with a focus on Circular Water-Energy-Nutrient Systems (Practice) project, which are key research centres (Maseno University 2024).

### Integration

The interoperability capability of various systems is essential for effective system functionality (Sanchez-Puchol, Pastor-Collado & Borrell 2017). Integration reduces complexities, enables progress monitoring and enhances the overall administration of HEIs (Mbatia, Ndegwa & Okello 2023; Nyambane & Nzuki 2019). Information system interactions require seamless interoperability between various data management systems, content repositories and software applications, and the integration of administrative and educational applications with local and system-wide enterprise software systems (Nyambane & Nzuki 2019). The shared organised, integrated multilevel data are of value for management because various perspectives and missing data are incorporated (Sanchez-Puchol et al. 2017). In Case A, incompatibility was cited as a key challenge. With phased automation, the institution had other systems such as the library and hostel systems still operating. To improve performance and centralise the work of the organisation, it needed to integrate these autonomous systems into the main system. This was witnessed in two areas. The first instance was with existing data and records. This was highlighted by participant AD. The new system was unable to readily access the existing records, and reconfigurations and revisions of the existing data had to be undertaken. The second area was integration with the existing standalone systems within the institution. This was identified by participant AC, who

identified the need to examine and standardise functions including the data bases.

### Technological support

For African HEMISs to be implemented successfully technological support is essential, and vendor support – including upgrades, troubleshooting, and training – must also be available (Nzama 2021). Support can take several forms, such as ongoing development, infrastructure and technical help (Kolog et al. 2022). However, often this is a challenge in Africa (Damoah, Khalo & Omodan 2023). For instance, Case A institution found it hard to acquire support services while using the legacy system, an older version, Microsoft Navision 2009. The institution was unable to acquire relevant fitting add-ons and support for the legacy system. Available support strategies and software's available were inefficient and at times incompatible.

### Accurate reports

Reports inform decision-making in organisations and policy (Kereto, Ndirangu & Sang 2021). Adhering to reporting standards and providing accurate reports poses a significant hurdle for organisations planning (Padmanaban 2024). This was the case for institution A where the old IS was inadequate when it came to producing usable reports. According to respondent AA, resultant reports required further refinement or review to ensure use for planning and reporting.

### Automation

Automation can greatly increase productivity, lessen administrative load and enhance the quality of education in Africa (Okanda & Andugo 2023). Although universities had made great strides towards automation, literature underscored that institutions still comprised of sub-systems which were part-manual or automated often overlapping inefficient systems (Hadullo, Oboko & Omwenga 2017). Case A had some processes that were still manual and wanted to automate these processes to improve the overall HEMIS working and organisation performance and productivity.

### Information access

The key reason for non-achievement of development objectives is the non-availability of valid and reliable information required for policy analysis, planning, implementation and effective monitoring (Mncube et al. 2023). There exists a demand for the right education data to service these requirements within institutions. That means data that are comprehensive, relevant, reliable and timely (Trubaini et al. 2011). However, accessing such information readily is a challenge (Segooa & Kalema 2023). Case A institution in sourcing and accessing information centrally pursued IS implementation.

### Security

There are various risks associated with the malicious use of ISs and contemporary innovations including artificial intelligence (AI) in African nations (Pantserev 2022). The privacy and integrity of educational data and systems may

be compromised by serious security issues in Africa (Ntorukiri, Kirugua & Kirimi 2022). Universities face similar challenges with their ISs (Almigheerbi, Ramsey & Lamék 2020). Case A institution had security challenges with its own ISs. The institution in mitigating this issue sought to improve the security of the system to ensure the safety of records for the institution.

### Accountability

Accountability is the guarantee that an entity is assessed based on how it performs or behaves in relation to something that they are responsible for (Bravo, Nistor & Ramírez 2021). In order to ensure that roles and activities are clearly defined, the IS should improve traceability and transparency (Bantwini & Moorosi 2023). In seeking to improve accountability within the organisation, the institution implemented the HEMIS. This was premised on the realisation that over all, the university had grown in terms of student enrolments, programmes, infrastructure and the services it was offering. The respondents explained that this growth needed an improved system to handle and manage its processes and activities.

In summary, in Case A the factors influencing pre-implementation are current technology, efficiency, integration, technological support, accurate reports, automation, information access, security and accountability. These are categorised as technology and organisation factors.

### Factors influencing implementation (Case B)

Moi University (Case B) is a public chartered university located in Kesses Town. It was established with a focus on science, technology and development. It has three constituent colleges: Garissa University College, Bomet University College and Alupe University College. It has two campus colleges, College of Health Sciences within Eldoret Town and Odera Akang'ó Campus College in Yala Town. The institution has a long history of using HEMISs of over 20 years. It has the directorate of Quality Assurance, Compliance & Performance Contracting, Information and Communication Technology and Resource Mobilization, Enterprise Development and Institutional Advancement (RMEDIA). The university has the following institutes: Open Distance and e-Learning and the Confucius institute. The university had the following centres: Centre of Excellence for Educational Research, Methodologies and Management (CERM-ESA), African Centre of Excellence in Phytochemicals, Textile and Renewable Energy (ACE II-PTRE) and the Centre for Strategic Leadership Development (Moi University 2024). Case B institution has various ISs in place including Financial, Library Information Management Systems and Students Accommodation Systems. The institution had various centres and directorates totalling 13. There were various factors that influenced the implementation of HEMIS in Case B institution. These included accuracy, integration, cost, efficiency, usability, scalability and robustness. These are expounded on next.

### Accuracy

Data accuracy implies the capability of systems to store, process and retrieve intended information (Padmanaban 2024). Ensuring the integrity of diverse processes and making dependable decisions depend heavily on accurate data (Laudon & Laudon 2013). Most African universities are challenged in the provision of accurate data (Segooa & Kalema 2023). Case A institution had similar issues and identified a need to improve the data management capabilities at the institution. According to participants, data from the various institutional, standalone systems required reconfiguration for use in other systems. This was identified in finance department where according to participant BA, the balancing of the books and records was not clear in the legacy system, resulting in inaccurate reports. Another challenge was the issue of missing student marks.

### Integration

There were other standalone, small systems across the institution that according to participant BA could not be run on a network or be shared across the whole institution. According to participant BA, the running and management of these many systems from different schools was difficult. These included legacy systems of the university such as the Financial Management Information System (FMIS). Considering that these systems were standalone and school and/or department-based, integration and information access and use were a key challenge. According to participant BC, the university was growing with increasing numbers of staff and students and was becoming unmanageable partly because of the distributed legacy systems. Moreover, the quality of service was dropping.

### Cost

Universities in Africa have high operational costs (Tewe et al. 2024). Operational costs of Case B institution were a strain on its finances. Participant BA noted that the institution wanted to reduce such operational costs. The various ISs and sub-systems were viewed as an added cost for the organisation in terms of maintenance and operation. It was also considered that the automation of processes would reduce operational costs. In addressing this, as per Chugh et al. (2023) and Laudon and Laudon (2013) guidelines, the institution opted to pursue IS implementation to reduce operational costs.

### Current technology

Africa's university institutions may improve access to resources, expedite administrative procedures and improve educational achievements by incorporating modern technologies (Yunusa, Umar & Bervell 2019). By putting contemporary technologies into practice, educational experiences can be greatly improved, increasing the competitiveness and capacity of African institutions to tackle the problems of the 21st century (Ayiro, Muriithi & Munyao 2022). The need to use modern solutions was identified at Case B institution. It was suggested by participant BA that there was a need to use current technology, which according to him, offered a wider range of resources and was more usable and efficient.

### Efficiency

According to participant BC, within the institution, it was acknowledged that there was a need to look at the efficiency of existing systems and improve on it. He alluded that, the university had grown with increased numbers of staff and students, and it had become unmanageable with the existing resources. Furthermore, the productivity and quality of service were going down. He noted that the institution had challenges of processing required output, and data access of required information from various sections and functions was problematic. Inefficiencies included reduced turnaround time and delayed responses to service requests. Therefore, there was a need for an overhaul and rethink of operations and processing strategies to make the organisation more efficient.

### Usability

The term 'usability' describes how simple it is for a user to interact with a system, good, or service in order to accomplish their intended goals (Macakoğlu, Peker & Medeni 2023). Improving end user and customer satisfaction was viewed as being critical (Kereto et al. 2021). For African educational IS to effectively serve administrators and students, usability is imperative (Van Der Merwe, Serote & Maloma 2023). Participant BC noted that there was a need to improve customer satisfaction by improving on the delivery of services offered by the organisation through system process reviews. This included improving user satisfaction.

### Scalability

Scalability is the ability of a system to manage an increasing volume of work or the possibility of expanding it to meet that expansion (Kuyoro et al. 2016). It is an important factor to take into account when integrating technology into university systems, particularly in Africa's diverse and expanding educational environment (Ayiro et al. 2022). In Case B, participant BD highlighted the need to have expandable systems, allowing for adding a range of new functions in the future, as the need arose.

### Robustness

System robustness refers to the ability of a system to continue operating and functioning in the face of unforeseen circumstances or disturbances (Li, Xiao & Zhang 2023). Robust systems can withstand a range of stresses without breaking down or giving false results. In the context of African universities, robust ISs refers to frameworks that are resilient to a variety of obstacles and still perform well (Muchungi et al. 2023). Robustness can be especially important in these universities because of the varied and frequently complex environments in which they operate especially in Africa (Chugh et al. 2023). Case B identified the need for robust systems as being critical.

In summary, the factors influencing pre-implementation in Case B institution are accuracy, integration, cost, current technology, efficiency, usability, scalability and robustness. These are categorised as technology and organisation factors. By factoring these pre-implementation issues, institutions ensure that the IS is compatible with the organisation's technology infrastructure, that it supports its objectives, and that external vendors are providing sufficient support. When these variables are properly considered, the implementation process may go on more smoothly, user acceptance rates can rise and the system will eventually be more effective and efficient.

## Factors influencing implementation (Case C)

The Africa Nazarene University (Case C) is a private chartered university. It has its origins in the international Church of the Nazarene. It has two campuses – the main campus at Nairobi and the Leah Marangu campus. Its size has also grown from initially two campuses providing face-to-face learning to incorporate distance learning also. Case C institution, had been using HEMISs for a period of over 10 years. There are various factors that influence IS implementation in organisations. In Case C, these included automation, efficiency, integration and reporting. These are elaborated on next.

### Automation

According to participants CA and CB, Case C legacy institutional HEMIS comprised of sub-systems, with poor automation of the functions of the organisation. This shortcoming is identified in African universities in literature by Chisom et al. (2024). The need for automating functions was therefore essential for the purpose of improving productivity (Mian et al. 2020). Laudon and Laudon (2013) consider automation as being critical for the competitive advantage of the organisation and for quality service delivery.

### Efficiency

Efficiency refers to how well universities make use of their resources to accomplish administrative and academic objectives (Soliman & Karia 2017). Through a variety of techniques that improve academic management, expedite administrative procedures, HEMIS can support efficiency in African institutions. The need for efficiency in organisations such as universities is a key driver for IS implementation (Kolog et al. 2022). According to participants CB and CD, this was identified as a need for Case C institution which sought to make its processes and functioning more efficient.

### Integration

Case C institution had legacy systems including the Student Information Management (SIMS) and the Financial Management System (FMS), both standalone systems that were not integrated. The sub-systems operated independently. The institution sought to implement a comprehensive system that would offer a common platform for their functions.

## Reporting

In Case C institution, the legacy system was problematic in terms of the reports it provided. The system was error-prone and was characterised by duplications and redundancies. As was the case with Case A, Case C had the challenge of speedy and accurate reporting. It was suggested that outputs required further refinement or review. To address this challenge, the institution required a system that could centrally be accessible and would provide comprehensive university data readily.

Case C participants identified reporting, automation, efficiency and integration as key HEMIS implementation motivators. These are categorised as organisation and technology factors.

In summary, the factors influencing pre-implementation in Case C institution are automation, efficiency, integration and reporting. These are categorised as organisation and technology factors.

## Factors influencing implementation (Case D)

St. Paul's University (Case D) is a private chartered university located in Kiambu County along Nairobi-Limuru Route A, near Nairobi. It is a Christian institution and has three other campuses in Nairobi, Nakuru and Machakos. It upholds Christian principles and values. Its students and faculty are from various nations a testament of its richness in diversity. It offers degree and graduate programmes in various disciplines. Case D institutions had its own reasons for implementing HEMIS. These included integration, efficiency and robustness. These are explored further as follows.

### Greater capacity

Developing effective systems to meet the rising demand for educational institution needs and data is necessary to increase the capacity of education ISs in Africa (Mncube et al. 2023). Various scholars, including Nafukho, Wekullo and Muya (2019), De Oliveira, De Almeida Cunha and Nakayama (2016) and Ribeiro et al. (2016) have identified the significance of IS capacity in IS implementation. Staff at Case D institution, while implementing the IS, noted the same issue. They suggested that the institution needed to improve the data storage and management capacity of the system. According to participant DA, the institution needed a larger database that offered greater capabilities. This informed the need to transition to new ISs with better data management capability.

### Efficiency

Principally, IS should make it simple and quick to obtain the data required for everyday operations and decision-making (Kereto et al. 2021). The efficiency of ISs is integral to their functioning and achievement of organisation objectives (Aiqun 2018). In Case D institution, staff highlighted the need for system efficiency, which according to participants DB and DE is essential to improve service delivery at the institution.

## Integration

A key critique of implementation is the dismal integration capabilities of ISs (Chugh et al. 2023). The extent of capabilities of implemented ISs differed and the limited integration capabilities limit their capacity to communicate and share information and services with one another (Nyambane & Nzuki 2019; Ribeiro et al. 2016). In some cases, sub-systems cover only the database of their own application and cannot be used together with other sub-systems within the organisation (Lamey et al. 2023). This limits the scope, effectiveness and capabilities of organisational ISs (Okai-Ugbaje et al. 2022). This leads to tensions between the business requirements of educational institutions and their available technological capabilities which should be managed holistically and in an integrated and coherent manner (Kavre, Sunnapwar & Gardas 2023; Riaz, Morgan & Kimberley 2023). In Case D, the institution initially used Sage Accpac and UNIPLUS, which were standalone systems. These, as suggested, were not integrated and were also not meeting the institutions needs as required. According to participant DC, this manifested in the mismatch of data between finance and academics sub-systems, resulting in erroneous receipting and charging. According to participants DC and DB, it was, therefore, necessary to initially attempt to integrate the sub-systems to improve their functioning, information access and flow within the organisation as a stop gap measure.

## Robustness

In their studies, Kiruki and Mutula (2023) and Mbatia, Ndegwa and Okello (2023) document the usefulness of systems with sufficient capacity for analytics and processing. These, they suggest, are essential for contemporary system functioning because of the improved capacity and capabilities they offer. The majority of African HEMIS, however, are limited in their capacity and capabilities (Simwaka, Malanga & Chipeta 2023). In this instance, although Case D was appraised of the need for advanced capabilities in its systems, which according to participant DD, would provide better features compared to the existing legacy systems, it lacked such functionality. This, the participant noted ought to include a greater level of robustness and a larger storage capacity within the system.

## Reporting

A related issue was including similarly advanced capabilities for institutional reporting. It was suggested that there were challenges in reporting capabilities. According to participant DD, this was a challenge related to the existing systems working separately. Similar compatibility and format challenges are common in HEMIS implementations, as documented by Dintoe (2019) and Simwaka et al. (2023). Therefore, combining reports or access to reports was a challenge.

## Usability

Usability of systems is identified as a critical component of ISs. It has been suggested that it enhances functionality and

improves productivity (Kamaghe, Luhanga & Kisangiri 2019). Case D recognised this factor as being important for HEMIS implementation. According to participant DA, it stressed the need to work with technology that was more responsive to the needs of individuals and the organisation, and hence more usable.

### Contractual

According to participant DA, Case D institution had contractual obligation challenges with a previous vendor, CoreTEC Systems and Solutions Ltd, who did not complete a prior IS implementation for the institution. Participant DA added that this necessitated the search for another suitable solution with a more responsive vendor.

In summary, the factors influencing pre-implementation in Case D institution are greater capacity, efficiency, integration, robustness, reporting, usability and contractual issues. These are categorised as organisation, technology and environment factors.

Across the cases integration, automation, information access, usability, efficiency, cost and scalability were the key influencing factors that influence HEMIS implementation. Other elements included accountability, security, robustness, contractual issues, technological support and need for greater capacity for storage concerning databases emerged.

### Limitations

The major limitation of the article was that the context-specific approach undertaken in the article restricts its generalisability to other situations or instances. The article is an investigation of four cases of HEMIS implementations. This was undertaken with a mix of both public and private institutions. The study did not seek to generalise across settings, but it offered insightful information for other institutions operating in comparable environments.

The primary data-gathering method, in-depth interviews, has a shortcoming in that some participants are unable to commit to the lengthy interview duration of almost an hour, because of other obligations. In mitigating this, the interviewer notified them prior to the actual engagement to ascertain their willingness and availability.

This is an explorative study on HEMIS implementation. The study is therefore restricted by the realisation that solutions provided are based on the Kenyan HE context and do not include other developing countries.

A limitation of the qualitative design is that the results can be subject to other interpretations (Bryman 2016; Byrne 2022). However, this study should be understood as an exploratory enquiry of factors influencing HEMIS implementation in universities in Kenya, and it makes no claims beyond this.

In this study, HEMIS refers to ISs used in universities. The researcher looks specifically at the various factors that influence pre-implementation in universities.

The study is limited to Kenyan educational institutions of higher learning, specifically universities. For reasons of accessibility, not all universities in the different geographical regions of Kenya are included in this study. The study is undertaken in universities that have had HEMIS implementations for at least 5 years. This group of universities are reputable institutions within the Kenyan HE system.

### Recommendations

The research discusses and highlights the unique issues affecting HEMIS implementation in the context through its focus on pre-implementation. The sub-themes current technology, support, efficiency, security, accountability, integration, automation, reporting, information access, accuracy, scalability, efficiency, usability, cutting costs, greater capacity, robustness and contacts emerged. These and related sub-themes formulated from the inductive data-driven process involved minimal referencing to related literary content. Therefore, subsequent studies may follow up with comprehensive in-depth reviews to identify causality and inter-relationships.

This study established that there was need to incorporate unique contextual factors and considerations within African or developing countries context to enable the development of more practical solution-oriented perspectives on HEMIS implementation.

More contextual studies to deepen the comprehension of HE ISs implementation in the context would provide comprehensive insights by elaborating in detail the interdependent, interconnected and historical nature of the HE ISs phenomenon. This would also assist in comparative reviews.

### Conclusion

Using a hermeneutical perspective and adopting a data-driven approach with inductive reasoning, themes associated with HEMIS pre-implementation identified in the research are: current technology, technological support, efficiency, security, accountability, integration, automation, reporting, information access, accuracy, scalability, efficiency, usability, cutting costs, greater capacity, robustness and contracts. The key influencing factors across the case institutions are integration, efficiency, information access, reporting and automation. Other elements included robustness, security, contractual issues, technological support and need for greater capacity for storage (databases). The elaboration of these themes and sub-themes in the research provides insight of HEMIS implementation factors specific to Kenyan universities (see Table 12).

The research contributed by analysing and explaining the pre-implementation factors by looking at different situations across the case institutions. This provides

information of the existing state and it highlights the similarities and variances of the implementation factors across the cases. It identifies these factors and their role in influencing implementation. This offers insight of the respective influencing factors across the cases. The study categorises these factors on the broad classifications of technology, organisation and environment highlighting the most significant factor. In this case, technology has been identified as the most influencing factor.

The case study highlights the need for universities seeking to implement HEMIS to take a comprehensive approach that considers both social and technological factors. Universities need to understand which factors are relevant and need consideration to implement HEMIS effectively. These decisions should be supported by requisite knowledge on HEMIS implementation factors. Practitioners must undoubtedly make the right choices and considerations. It is also established that the comparative variances in ISs pre-implementation factors between universities indicated that one size does not fit all and for this reason it is imperative to adjust to the local social milieu. Thus, institution's implementation process is guided by institution's custom-specific factors. For instance, Case D had a unique challenge of contractual obligations not being met, scalability factor in Case B and accountability factor in Case A. Therefore, universities and practitioners should acknowledge that pre-implementation factors are unique to institutions, although there may be some similarities such as integration. Consequently, rather than focussing on just adopting a generalised approach, caution should be taken while planning and undertaking implementation.

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## Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

## Authors' contributions

K.K. and B.C. contributed to the conceptualisation of the research, review of research tools and review of research content. P.W. undertook data collection, analysis and compilation.

## Ethical considerations

Ethical approval to conduct this study was obtained from the University of South Africa (UNISA), College of Science

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## Data availability

The data that support the findings of this study are available upon reasonable request from the corresponding author, P.W. The data are not publicly available due to it containing information which could compromise the privacy of research participants.

## Disclaimer

The views and opinions expressed in this article are those of the authors and are the product of professional research. The article does not necessarily reflect the official policy or position of any affiliated institution, funder, agency or that of the publisher. The authors are responsible for this article's results, findings and content.

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