REPUBLIC OF KENYA

MINISTRY OF EDUCATION

State Department for Basic Education

TERMS OF REFERENCE

For the Establishment of the Kenya Education Management Information System

Directorate of KEMIS

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1.0 INTRODUCTION

The Ministry of Education (MoE) recognizes the critical role of timely, accurate, and integrated data in planning, policy formulation, resource allocation, and monitoring of the education sector. To this end, the Ministry seeks to modernize and operationalize the Kenya Education Management Information System (KEMIS) as a unified digital platform that supports data-driven decision-making across all levels and subsectors of education

1.1 BACKGROUND

As the global community focuses its efforts toward Sustainable Education and training, the importance of quality education has become more apparent than ever. The provision of access to quality education, training, and research considerably assists in positioning learners for acquisition of relevant skills and preparedness to make contributions to the world around them. Underlying quality education is quality data, defined by its availability, relevance, timeliness, accuracy and coverage. Quality data offers planners and managers the evidence needed for sound decision-making in education.

The Ministry has been pursuing establishment of EMIS for a considerable period of time. In 1998-2000 EMIS was a component of the Strengthening Primary and Secondary Education (STEPS) project. Initiatives that were carried out during this period resulted in a needs assessment report, draft design and preparatory activities that included establishment of a facility to support processing of school data returns at TSC and a similar facility at the Ministry headquarters. It was noted that some of these initiatives had substantial contributions to reforms particularly on the School Data Returns and modernization of the payroll at TSC.

In 2004, the Ministry once again mobilized partner support for creation of EMIS units in each of the 84 District Education Officers and 8 Province to allow capture of data tools, hence decentralizing the function of data capture, while the central function was consolidation and analysis. In 2008, the Ministry got support from UNESCO for acquisition of StatEduc (source code written in French) Application and used to capture aggregate data from school level for the period 2008 – 2015.

A conversation to have a homegrown solution targeting student-level bio began in 2012 through the support of World Bank. A Technical Working Team composed of Directorates of the Ministry of Education, Science and Technology and representatives from E-Government Directorate of Cabinet Office was formed with the major task of helping design the envisaged EMIS of education and training sub-sector. Due to limited involvement of Management and resource constraints, little was achieved. When Management stepped in, EMIS Steering and Technical Committees were formed in 2015 leading to establishment of National Education Management Information System (NEMIS) and its launched in 2018 as a single source of truth on data and information on all Kenyan learners/ students and schools/institutions as a cornerstone on effective monitoring and evaluation, quality assurance, budgeting and allocation of resources, policy and planning. NEMIS was done in phases: Phase I entailed capture of information for pre-school, primary, junior, secondary and teacher training colleges. Phase II was to have TVET and Universities be captured.

With support from the African Development Bank (ADB), TVET MIS was established in 2019 to help mobilize capture of information in the TVET sub-sector. The platform was to address data needs of TVET and guide policy intervention towards skills development. Although we don't have a system coordinating Higher Education Institutions, the Commission on University Education (CUE) has had close collaboration and data collection from Universities as part of course approval and University Compliance to provisions.

1.2 RATIONALE

The current Automation Endeavors are hinged on the Recommendations of the Presidential Working Party on Education Reforms 2023. This Working Party was appointed on 29th September 2022 by the President through Gazette Notice No. 11920, and they did duly submit their Report titled, "***Transforming Education, Training and Research for Sustainable Development in Kenya"*** to HE the President. In the report, it was recommended that a Kenya Education Management Information System (KEMIS) be established to handle tracking of a learners/students from preschool to higher education levels, perhaps to try solved the data gaps and growing concerns towards accountability and integrity on data used in planning and financing most education interventions.

In the ensuing, the **Cabinet Secretary**, Ministry of Education in Consultation with Cabinet Secretary for Information Communication and the Digital Economy formed a KEMIS Steering Committee to start off the process of establishment of a comprehensive Data Management Regime in the Sector. There's a Technical Team formulated to help inform and advise this Leadership.

2.0 SITUATION ANALYSIS (CURRENT STATUS)

2.1 Global Trends in Education Management Information Systems (EMIS)

At the United Nations General Assembly meeting on 25 September 2015, 193 UN member nations unanimously adopted a new development agenda 'Transforming our world: the 2030 Agenda for Sustainable Development' (the 2030 Agenda). The agenda incorporates 17 broad and interrelated sustainable development goals (SDGs) which address 'economic development, social inclusion, environmental sustainability, and good governance.' SDG 4, specifically, aims to 'ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.' Better known as the 'education goal', SDG 4 is made up of 10 targets and 11 global indicators.

There are four primary data sources used in calculating the Sustainable Development Goal (SDG) 4 indicators. These include **household-based survey** and assessment data, **census data**, **school-based survey and assessment data**, and **Education Management Information System** (EMIS) or administrative data. The school/individual-based administrative data can produce around half of the 43 thematic indicators. Thematic indicators based on the EMIS are included in regional SDG 4 monitoring indicators adopted by many regional bodies in the world (U[1]IS, 2018). The EMIS is a vital element of an education system as it provides systematic, quality data in a structured environment that facilitates the use of information produced in planning and policy dialogue.

Globally, all countries collect data from schools on an annual basis, and many developing countries have recently started collecting information on individual data on teachers and students, which provides an opportunity to disaggregate the indicators. Some countries use paper, some use spreadsheets, and the majority of the countries use online and offline software to collect administrative data from schools. Countries primarily collect data on enrolment, new entrance, repeaters and graduates from schools, which are required to calculate SDG 4 thematic indicators.

2.2 Regional Perspective

Africa faces significant challenges in assessing progress in achieving the SDG 4 and CESA targets due to missing data groups, types and purposes. Additionally, countries are at different starting points in terms of national capacities to effectively formulate evidence-based policy, monitor, evaluate and plan interventions using sector wide data sets. For some countries having more than one Ministry responsible for education and training, collection of data and information leads to duplication, varying definitions and poor national coordination of sector-wide data, thereby affecting the timely, quality and availability of education statistics.

2.3 Kenya's Situation Analysis

A lot of efforts towards establishment of EMIS in Kenya over time is shown in the summary figure below.

[1] UIS - UNESCO Institute of Statistics

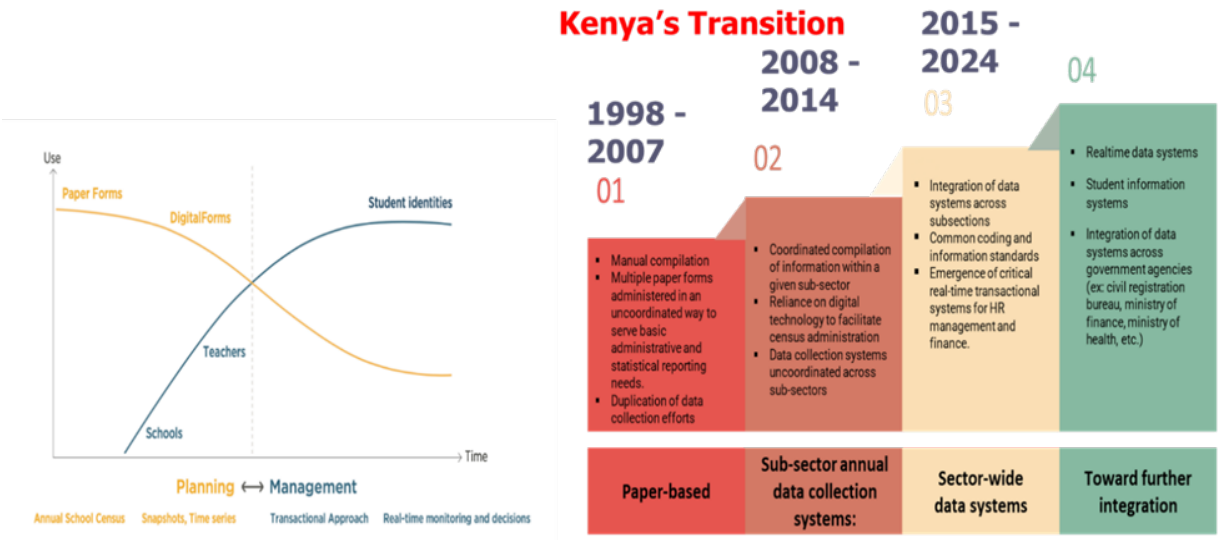


Figure 1: Phases in Transition of EMIS

Table 1: Summary of Kenya's EMIS Development Journey

Period	Description	EMIS Platform
1998 - 2007	Largely paper based with printing of forms A, B and C in different colors denoting the levels targeted by each tool. Tedious and laborious work in filling the form by Heads of Institutions; Response rate low, up to 78% return of forms and hence data largely depended on estimates.	MS Access Data Capture (developed internally by MOE Staff)
2008 - 2014	Paper based by online platform provided at the District Education Offices, summary of data captured consolidated by Central Planning Unit at MOE HQs. Response rate increased with close supervision by DEOs. Highest response rate achieved was 89%, leaving 11% estimation of indicator achievements in the sector.	StatEduc (largely donor supported, developed not in Kenya)
2015 - 2024	The management of the Ministry of Education adopted online capture of individual bio of teachers, learners / students and institutions. With integration of application to capitation, school feeding and EduAfya, capture of data became driven by supply / demand, hence 98% response. Global view of data and school compliance made it easier to demand school's compliance to various data requests by MOE.	NEMIS (home developed application by Government System Developers) TVET-MIS (home developed through support of ADB, source codes held by State Department for TVET)
2024 - Future	There is an urgent need to have a single platform for reporting and tracking learner/ student data from preschool to higher education levels. The platform is expected to include close inclusion of alumni, parents and wider community on data and information derived from each educational institution.	KEMIS (Agile, Cloud based, Micro service model) Expected to be home grown, owned by MOE / MoICT, Source Code handled by Government System Developers.

a) NEMIS

National Education Management Information System (NEMIS) was established in 2015 after a series of attempts in the last decade. The platform implemented in two phases was expected to deliver data needs to stakeholders in all departments and agencies in the Ministry of Education. Due to complex data needs and challenges encountered while onboarding heads of institutions (HOIs), the progress made has been witnessed due to targeted interventions including capitation function, inclusion of health care for high schools and administrative utilization of data held by NEMIS.

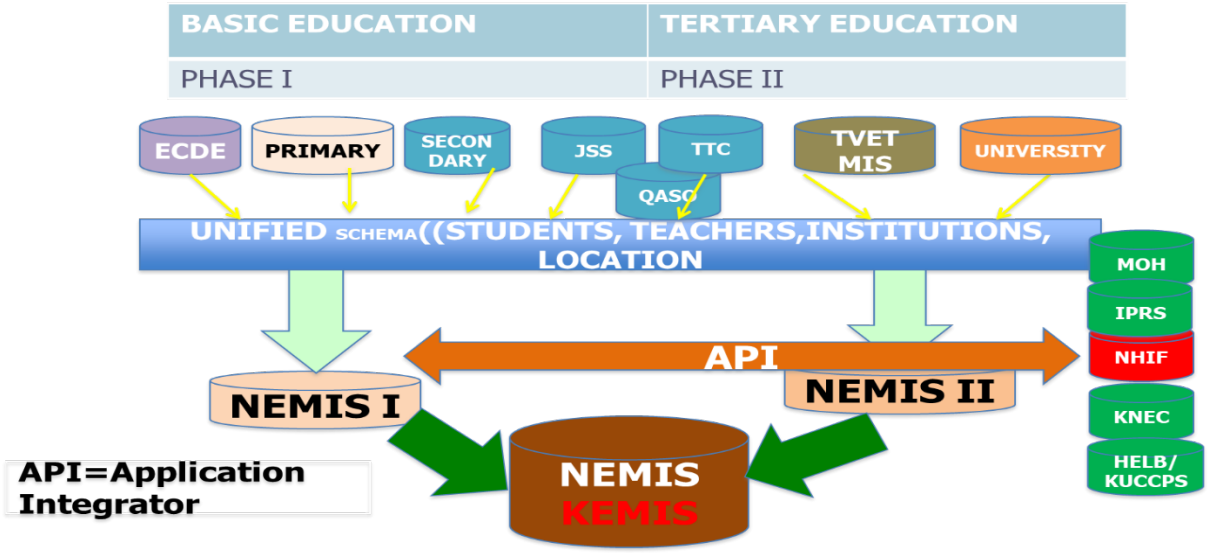


Figure 2: NEMIS Architecture - EMIS 3.0

From the table above, NEMIS has been modeled on the UNESCO's EMIS 3.0 where individual learner biodata is captured with decisions and utilization being based on data generated from it. From the Presidential Working Party Report of 2023, NEMIS was to be renamed or remodeled to KEMIS to move Kenya to EMIS 4.0 stature.

Although the platform was developed using in-house government team, the technologies used are old and not agile, hence time for upgrade is timely. The web-application was developed using Active Server Pages (technology of 2005).

Some of the achievement of NEMIS include:

i. Capitation of primary, junior and secondary schools – more than 54,000 institutions;
ii. A total of more than 13.2 Million learner personalized records captured in the platform;
iii. A total of 22 Million parents / guardian information mapped to above learners;
iv. Ability of established a data sharing validation with Ministry of Health for verification of learners attended to in health facilities under universal health coverage;
v. Use of NEMIS for school meals programme management and reporting;
vi. Reporting on text books and other learning materials;
vii. Integration of data from quality assurance and standards assessment and viewership of National Indicator dashboard.

b) TVET-MIS

Initially developed in 2017 with support of African Development Bank (ADB), TVET-MIS scope of development consist of nine (9) modules namely; namely (1)

configuration module, (2) institution module, (3) trainees' module, (4) personnel (staff) module, (5) courses/ programmes modules, (6) management/governance module, (7) user management module, (8) monitoring and evaluation module and (9) reports module.

Although the system was completed and deployed, it has faced a lot of challenges characterized by low data captured as indicated by the current statistics i.e. only 211 TVET institutions' have been captured instead of 238, with an enrollment of 151,887 students' records against expected 300,000 students (50%).

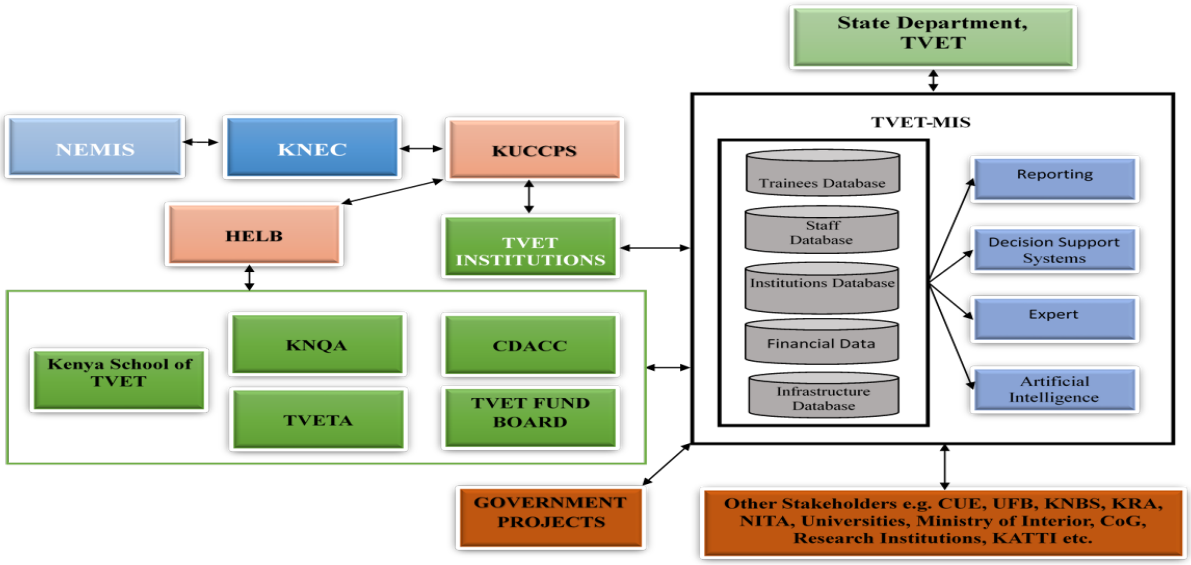


Figure 3: TVET Design

The department has five (5) Semi-Autonomous Government Agencies (SAGAs) including TVETA, KS-TVET, KNQA, TVETFB and CIDACC, each expected to seamlessly draw its data from the system through a data sharing regime. The following were limitations of TVET-MIS as deployed at the Ministry's infrastructure:

i. **Capitation module**: did not take into consideration development of capitation module, which is key in the disbursement of funds.
ii. **Integration of data from SAGAs**: The system also left out lacks integration of data from the SAGAs.
iii. **Collection of revenue by institutions:** revenue collection has to be included in the new system as majority of SAGAs and learning institutions do collect revenue.
iv. **Hosting of the system**: The hosting of the application has proved to be very unstable due to frequent internet failures.
v. **System Platform**: although the platform is web-enabled, it did not consider mobile application which is critical in a modern platform development.
vi. **Transfer of skills to the Technical team:** Technical team in the Ministry were not trained adequately to take over the management of the system, since only for user support training was offered thus making it difficult for system take-off.

c) Higher Education Management Information System (HEMIS)

Kenya has a total of seventy-eight (78) universities; thirty six (36) public chartered universities, six (6) public universities constituent colleges, twenty five (25) private chartered universities, three (3) private constituent colleges and eight (8) universities operating with letters of interim authority (Commission for University

Education (CUE), 2023). All these HEIs, public and private are eligible for enrolling Government sponsored students. As of 2021/2022 academic year, there are a total of 562,066 learners up from 522,059 in the 2017/2018 academic year. The public universities take up approximately 75% of this population while the rest are enrolled in private universities.

There is massive data that is continuously generated by these institutions of higher education on student enrollment information; academic programmes; staff; academic, training and research resources held by the universities, funding received by the universities, innovations from these universities. All this data remains stored away in "siloed" databases that would be mined to provide good insights on the status of the higher education for planning and strategy.

Universities have continued to establish individual databases by procuring or developing ERPs to meet own needs oblivious of the needs of stakeholders who need their data. Data that is stored in these individual databases do not follow a standard data management policy leading to each of them capturing data in varied formats and extents and any other needs are addressed as need arises.

If all these data would be managed using a coordinated approach, the benefits across the higher education space would include but not limited to the following: Data security; a single source of truth on the status of a university student; Harmonized data on staff in both public and private universities; Information sharing; Enrollment planning and Strategy formulation and planning.

In previous studies and proposed designs, the model below had been proposed to guide the sector data management system.

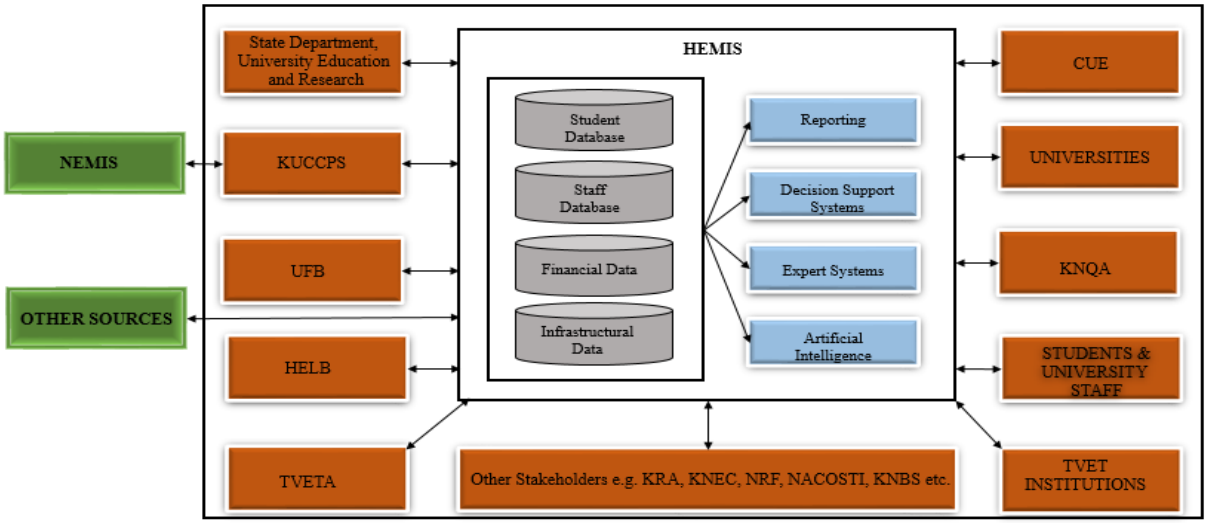


Figure 4: Higher Education MIS Design

With this Terms of reference, Kenya intends to establish a comprehensive data management regime to be used from basic to higher education supporting both administrative data requirements and also statistical reporting.

4.0 PURPOSE AND OBJECTIVE OF THE ASSIGNMENT

4.1 Purpose of Assignment

The purpose is to help the education sector establish a single data management regime that helps coordination and guide policy interventions from pre-school to university levels.

4.2 Objective of The Assignment

The assignment will include strategic planning, Design, Supply, Implementation, Installation, Configuration, Data migration, Integration, Testing, Training, Commissioning, Security and support the various components of the ecosystem.

4.3 Proposed Architecture

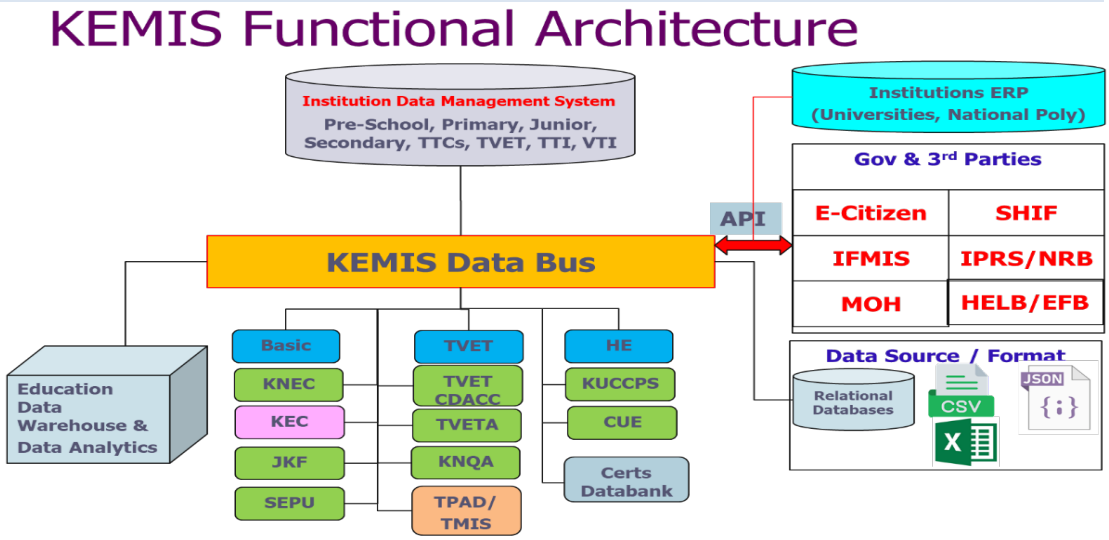


Figure 5: KEMIS Functional Architecture

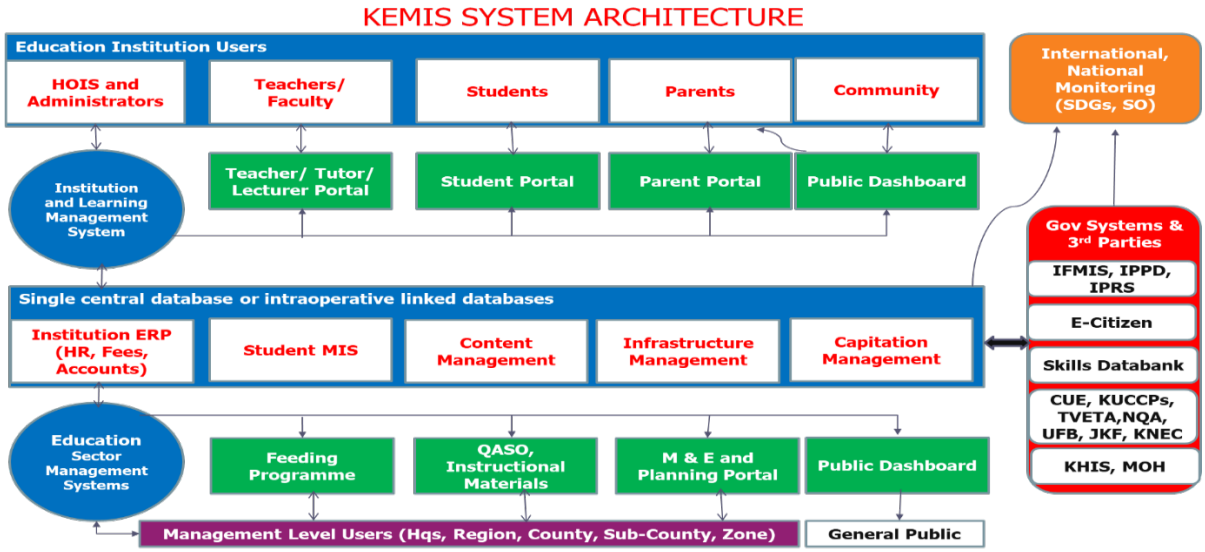


Figure 6: KEMIS System Architecture

Table 2: KEMIS System Architecture Domain and Functions

Domains	Teacher/ Faculty / Support Staff	Student / Learner	Institution	Course / Subject Schedule	Alumni/ Parent	Community
A: INSTITUTION						
i) Portals	• Teacher • Faculty • Support Staff (HR)	Student Portal	Institution LMS and Admin Portal	LMS, Content	Parents Portal / Alumni Portal (use e-citizen)	Public Dashboard (Info from institutions)
ii) Functions	• Teachers /Faculty • Teaching Areas • Responsibility • Work History • Disciplinary / Accountability • Lesson Index	• Student • Enrolment • Attendance • Student Capitation • Sports/ Talents • SNE, Refugee • Need Level	• Institution Bio • Geospatial • Assets • Sports Facilities • Projects • BOM / Council • Registration • Quality Index	• Teacher / Lecturer / Tutor • Workload • Timetable	• Study Duration • Sponsored Projects, • Schedule of Activities	• Tenders, • Institution • Calendar of • Events, • School • Infographics
iii) Users	Staff and Roles	Student	HOIs, Admin, HODs, Registrars	Teacher / Lecturer / Tutor	Alumni	General Public
B: MANAGEMENT (HQs)						
i) Functions						
a) Basic	• Teacher Placement • Support Staff • Teacher Work History • Responsibility List of Teachers	• Enrolment • Capitation Learners • Sports/Talent Supervision	• School List • Project Status • Wash Facilities • Sports Facilities • Capacitation Institutions	• Teacher Workload • Curriculum Coverage • Utilization of Internet	• Resource Mobilization • Attendance • Resource Mobilization • Certificate Validation	Public Dashboard

Domains	Teacher/ Faculty / Support Staff	Student / Learner	Institution	Course / Subject Schedule	Alumni/ Parent	Community
	• Disciplinary Issues on Staff	• Creative Economy support • SNE Learners • Refugee Learners • Out of school learners / dropout / attendance	(primary, junior, senior, TTC) • Registration of Institutions • BOM Tracker	• Digital Content in Schools • Capacity Building of Teachers		
b) TVET	• Tutor List • Support Staff • SNE Staff • TVETA Trainers • Responsibility matrix • Training Data	• Student Enrolment • Student Capitation • Course Enrolment • Transition	• TVET Institutions • Institution Capitation List	• Tutor Workload • Course Lists • Content Delivery Tracker	• Resource Mobilization • Graduation List • Certificate Validation	Public Dashboard
c) Higher Education	• Faculty Staff • Support Staff • Research portfolio	• Student enrolment • Student finances • Dropout Cases • Student Council • Sports	• Institutions Bio • Council and Management Database • Partnership Management • Assets • Finances	• Lecturer Workload • Programme / Course List • Course Enrolment	• Resource Mobilization	Public Dashboard

4.4 SCOPE OF WORK

The Scope of work should include among others:

1. Undertake a needs assessment and requirements documentation of all existing education systems to evaluate strengths, gaps and future functional requirements;
2. Undertake system design, development, implementation, data migration, integration, testing, training, commissioning, security of Education Institutions Data Management System (IDMS).
3. Undertake system design, development, implementation, data migration, integration, testing, training, commissioning, security of Education Management (Capture Functional Features for Higher Education, Basic Education and TVET Departments) Portal.
4. Undertake system design, development, implementation, data migration, integration, testing, training, commissioning, security of Education Data Exchange Protocols with Institutions ERPs and Custom Solutions (Universities and National Polytechnics Established ERPs).
5. Undertake system design, development, implementation, data migration, integration, testing, training, commissioning, security of Education Data Exchange Protocols with Agencies of Education Dealing with Educational Institutions and Student Data (KNEC, KUCCPs, KNQA, KEC, JKF, SEPU, TSC, KISE and KEMI).
6. Undertake system design, development, implementation, integration, testing, training and commissioning of secured Data Bus, Sharing Regime (API Interface) within the Education Sector that supports Relational Databases, Flat file subsystem, NoSQL formats etc.
7. Establishment of Education Data Warehouse and Data Analytics.
8. Provision appropriate infrastructure for the hosting, efficient operations and functioning of the KEMIS platform.
9. Capacity building of all users across all levels including system administrators, head of institutions (HOIs)

4.4.1 Needs Assessment and Requirements Gathering

The firm contracted will undertake a needs assessment and requirements documentation covering all the state departments and agencies including county governments dealing with education data from preschool, primary, junior, senior/secondary schools, teacher training colleges, TVET institutions and Universities. Needs assessment will document data requirements and the utilization in decision-making and administrative tasks.

Each state department / agencies will identify stakeholders and help convene the necessary meetings to facilitate the firm capture accurately the data requirements to be covered in the envisaged KEMIS design.

4.4.2 Institutions Data Management System (IDMS)

From the functional architecture, the Institution Data Management System aims to establish a portal that institutions will use to capture and validate information required. Specifically, the IDMS will be expected to allow educational and training institutions to capture:

- Institution bio-data (including upload of necessary legal documents
- Capture of Institution Board of Management or Council including the appropriate legal instruments
- Capture of Institutions assets
- Capture of Institution Staff – both teaching and non-teaching
- Capture of Learners / students – biodata, SNE segregation (types), parents / guardians information
- Capture of financial receipts including acknowledgement (including fees as reflected in e-citizen platform)

A provision for parents, student portal is critical to ensure participation in institution's affairs.

4.4.3 Education Management Portal

The state departments of basic, TVET and higher education have administrative tasks linked to data captured on each institution such as disbursement of funds (capitation), planning for capacity building, quality assurance work, school meals programme, deworming, supply of learning materials and sanitary materials.

This section aims at development of portal that address data requirements and reporting for state departments and agencies responsible for manipulation or change of data in KEMIS. Current functionality of NEMIS, TVET-MIS and HEMIS must be met and much more to make KEMIS fit future needs of the sector.

4.4.4 Education Data Exchange Protocols with Institutions Custom Solutions

Taking cognizant that universities and advance TVET institutions such as Polytechnics have existing ERP and portals, this section captures development of a data sharing regime that will ensure the data requirements of part 4.4.2 is achieved. The data sharing protocols will ensure there is seamless exchange of data between existing platforms and KEMIS, thus ensuring no institution misses in data submission in KEMIS.

This component will ensure once information is captured in ERPs or automated institutions' portal, the same is automatically relayed to KEMIS without human intervention.

4.4.5 Data Exchange Protocols with Agencies Dealing with Educational Data

Agencies of various state departments undertake programmes which require or generate specific data linked to institutions, staff or learners/ student. KEMIS should provide for SAGAs to undertake administrative tasks based on information in KEMIS and ability to update or validate information therein.

Table 3: Agencies role in KEMIS

Agency	Some Critical Task
KNEC	• Assign assessment numbers to all learners in basic education – for competency-based assessment (CBA) • Release results for each learner or student in basic institutions and some TVET institutions

Agency	Some Critical Task
JKF	• Mandate to coordinate and harmonize scholarship and bursary management in basic education
KUCCPS	• Places learners from basic to TVET and higher education – allocation of learners to various training programmes
TSC – TPAD / TMIS	• Regulation of Teachers (both in public and private institutions)
KISE –EARCs	• Undertake assessment of special needs learners/ students and validation of registration
KEMI	• Undertake training of education managers across all levels

Above list will validated during needs assessment and appropriate features provided in KEMIS to ensure data is accurate and valid.

4.4.6 KEMIS Data Bus, Sharing Regime (API Interface)

KEMIS data bus is a data-centric software framework for distributing and managing real-time data in intelligent distributed systems. It allows applications and devices to work together as one, cohesive system. Considering that the various platforms deployed to facilitate the services access in KEMIS will utilize varied data formats and data storage such as flat files, relational databases, the firm contracted will be expected to establish this high-speed data distribution platform.

Application Programming Interface (API) for sharing of data and allowing updates from external sub-systems will be established and enabled to rely on KEMIS Data Bus.

Appropriate security protocols shall be established to ensure the data sharing and transfer is secured meeting the ODPC requirements. This component shall be protected and automated logs to help track on time any threats to KEMIS data infrastructure.

4.4.7 Establishment of Education Data Warehouse and Data Analytics

Data warehouse is unique in that it stores both live and archived data in one location. This means that the same data is available both as a result of business processes being completed or operations being performed and also because it is simply existing data stored in one place. The data warehouse is a repository of data that has been extracted from a variety of sources, including data captured by users, agencies, and third-parties. It has been organized into tables and other databases to make it more accessible and easier to use.

This component entails creation of databases and necessary storage for various file systems in KEMIS. The firm contracted will be responsible in creation in close collaboration with DBAs of various sub-systems in Education for sustainable management of education data.

After creation of data warehouse, it is responsibility of the contracted firm to ensure seamless migration of existing data into new databases, configure necessary reporting tools to serve the current and future needs of all stakeholders using data contained in the data warehouse.

KEMIS System Architecture anticipates a statistical module to handle data analytics for the sector including appropriate dashboards. The Data analytics is expected to track

time series data as well to allow education report nationally (KNBS data requirements) and internationally (UNESCO reporting).

4.4.8 KEMIS Infrastructure

Infrastructure shall be provided to host the KEMIS applications and platforms developed and implemented in these terms of reference. It is the responsibility of the firm to utilize existing infrastructure and that which shall be provided on need basis. Appendix 2 has the specification of hardware infrastructure anticipated for use in KEMIS deployment.

4.4.9 Capacity Building of all Users Across All Levels

Training and purposeful engagement of system team of government will ensure KEMIS is developed and handed to system developers in Government as a sustainability measure. It is expected that in teams' skills exchange will be expected throughout the project rollout. Training will be done to the following groups:

- System Developers and System Support Team
- System users at Ministry Departments and Agencies, Counties
- Institution Users
- Public sensitization of parents and alumni
- Validation of Certificates users
- Data analysts

The stakeholders firmed up during the needs assessment and requirement gathering will identify all user groups requiring training to utilize KEMIS appropriately.

5. TECHNICAL SPECIFICATIONS

5.1 General KEMIS Technical Requirements

The technical requirements and specifications provided below are the minimum requirement that must be met during the proposal. The specifications are as below:

a. **General Technical Requirements**

- **Language Support:** All information technologies must be provided in English language.
- **Dates:** All information technologies MUST properly display, calculate, and transmit date data. The date must be in the DDMMYYYY format and time zone must be EAT.
- The system should be developed with trending technology standards. It should be based on open standards.
- Employ technology agnostic system solutions and devices to be usable with emerging technologies in perpetuity
- The system should be modular allowing for replacement & phased implementation of additional modules.
- Allow for flexible configurations based on the user environment. The system must be easy to configure e.g. the form is dynamic, and the fields can be added and removed and edited with ease.
- **Patch Management:** Develop a patch management strategy to address security vulnerabilities.
- **Versioning and Upgrades:** Plan for system upgrades to incorporate new features and address evolving security requirements.
- **Licensing:** The licensing should be perpetual and paid once upon acquiring a device or system. No limitation to use of the licenses by Government.

b. **Scalability and Performance**

- **Modular Architecture:** Design a modular system to facilitate scalability and future enhancements.
- **Technology Agnostic:** Develop a system that can adapt to emerging technologies and standards.
- Solution architecture should have the ability for scale up as and when new applications and services are added and transaction volumes increase without compromising the performance of the overall solution.
- It should provide for Scalability on the Application, Web Servers, Database Servers, Application Integration Servers, and all other solution components.
- The system must be design in order to accommodate growing number of users, both in number of users/accesses, data processor, data analytics, visualization and reports.
- The system technical design (hardware, database, etc.) must be able to scale to support projected transaction volumes over time.
- The system must be able to identify duplicate records and de-duplicate them
- The system must be able to perform as load (user and transactions) increase following micro service design.

- The system transaction response to user data entry should be minimum 2 seconds (turnaround time) and maximum 5 seconds (turnaround time) on an online workstation
- The system must allow users to monitor system availability and performance
- The system can sync data with the main server (in case of offline use)
- The system must track and record all changes (update/add/delete) to the data by system and by users
- The solution must create person centric records and ability to search and view vital events of a person

c. Availability and Accessibility

- Solution should be designed to remove all single points of failure. The solution should provide the ability to recover from failures, thus protecting against multiple component failures.
- Solution should be available 99.999% time.
- The system must allow user to work online and offline. If offline, data should be synchronized when an internet connection is available.

d. Interface

- The system should have a highly customizable and intuitive user friendly interface with extensive online help facilities as below among others :
    - **User registration:** Define the fields required for user registration (e.g., name, email, password) and specify any validation rules
    - **Authentication Methods:** Specify the supported authentication methods (e.g., username/password, biometrics, multi-factor authentication) and their implementation in the User Interface (UI)
    - **Password Policy:** Define password complexity requirements and any other security measures related to password management.
    - **User Profile management:** Specify the functionalities available for users to manage their profiles, including updating personal information, changing passwords, and managing security settings
    - **Consent Management:** Define how the UI handles user consent for data processing and sharing. Specify the design and flow for obtaining and managing user consent
    - **Forgotten Password/Account Recovery:** Describe the process and UI elements for users to recover their accounts or reset forgotten passwords securely.
    - **Security Token and Session Management:** Specify how security tokens are handled in the UI, including session expiration, refresh mechanisms, and token storage.
    - **Error Handling and Messaging:** Define error messages and how they are presented to users. Include clear instructions for resolving common issues.
    - **Responsive Design:** Ensure that the UI is responsive and accessible across various devices and screen sizes
    - **Accessibility:**Specify how the UI complies with accessibility standards (e.g., WCAG) to ensure that it is usable by people with disabilities.

- **Branding and Theming:** Define guidelines for branding and theming to maintain a consistent and recognizable visual identity
- **User Feedback:** Specify how the UI provides feedback to users during actions such as login, registration, or account updates.
- **User Notifications:** Define how the system notifies users of important events (e.g., account activity, security alerts) and the channels used for notifications.
- **Localization:** If the system serves a global audience, specify how the UI supports multiple languages and cultural preferences.
- **User Education and Help:** Provide user education features and help documentation within the UI to assist users in understanding security practices, features, and functionalities.
- **Cross-Browser compatibility:** Ensure compatibility with major web browsers to provide a consistent experience for users
- **Integration with Authentication Providers:** If the system integrates with third-party authentication providers, specify how the UI accommodates these integrations.
- **Session Timeout and Auto Logout**: Define session timeout periods and auto-logout mechanisms to enhance security.

e. User Authentication.

- The system should provide Multi factor Authentication of users using OAuth 2.0.
- Each user must be authenticated with a unique user-id / username, password and one-time login code generated by the application while logging on the application. The User IDs / Usernames should be case sensitive.
- User accounts management activities include but not limited to new user creation, user maintenance, and user authentication (during login).
- All new user accounts must have a system generated random password when created. A secure way of communicating the initial password to the user should be utilized, e.g. via an email account or SMS.
- The system must prompt users to change their passwords the first time they log on to the application. During password change, if the new password doesn't comply with the complexity policy, the error message should describe every complexity rule that the new password does not comply with.
- The system must support password expiry features with a configurable frequency. This should be parameterized to allow flexibility in adjusting this value as required (from non-expiry to activation of expiry).
- The system should not support automatic logins to guard against brute force attacks. The login page should include a code generating mechanism.
- The system shall generate a code at log in. The code shall be sent to the registered e-mail or SMS through a registered mobile phone number. The code shall be entered on the log in page to grant authentication.
- These password features should be configurable to support future complexity requirements.

- The solution should implement a secure self-service password recovery mechanism in the event the user forgets their password using verification of existing parameters.
- The login page and all subsequent authenticated pages must be exclusively accessed over Transport Layer Security (TLS). All active sessions must be encrypted.
- The solution should support expiring of newly created accounts if not used for a configurable period of time. This should be parameterized to allow flexibility in adjusting this value as required. An auto generated alert should be sent to the users some set days before the account is deactivated.
- The password must be changed after a configurable duration. This should be parameterized for flexibility. An auto generated password change alert should be sent to the users some set days before the password expires.
- The solution must support password lock out after a configurable number of unsuccessful login attempts. This should be parameterized to allow flexibility in adjusting this value as required.
- The solution must log out a user account after the session has been idle for a configurable duration. This should be parameterized to allow flexibility in adjusting this duration as required.
- The solution must not allow the re-use of a past password until a set period of time and a set number of password changes have been made. This should be parameterized to allow flexibility in adjusting this value as required.

f. Workflow Automation

- The bidder should map the business process and to automate all the processes.
- The System should provide for hosting of commonly used forms and documents so that users can open, fill, sign and forward them for processing and online approval without printing them.
- System should allow for digital signatures for online approvals.
- Automatic alerts e.g. notification for pending work to officers
- The system should support time and event based reminders and automatic escalations to relevant users after specified time intervals pending work items, completed items, items pending with specific users etc.
- The system should provide a facility for assigning tasks and deadlines for users in a workflow.
- The system should provide for the change of deadlines based on user requirements.

g. Documentation.

- System inception report.
- System Analysis and Design
- Provide technical documentation
    - User manuals
    - Operation manuals
    - Maintenance manuals
- Create a backup and disaster recovery plan.

h. **Business continuity.**
   - Scheduled backup and real-time replication of data.
   - The system should provide automated back-up and restore functionality
   - Transaction Rollback after Crash, System Integrity Check for file and data corruption.
   - Ability to email reports directly on back-ups
   - Redundancy: Establish redundant systems for disaster recovery.
   - Load balancer: To manage and process high traffic requests.

i. **Usability.**
   - The use of the tool should be easy and intuitive in order to reach users with different levels of computers use experience.
   - The system should be able to generate prompts for users on actions or documents verifications.
   - The system must provide the option on every page of system to view the headings, menus, labels, and any software control values on any page.

j. **Error handling.**
   - All written software to be subjected to a comprehensive error handling regime.
   - Error and warning messages should be informative and identify the error as completely as possible (e.g. identify the module, the procedure or functions, the identifier of the error, etc.)
   - All error and warning messages shall be written into the system logs.
   - Critical error shall be emailed to all relevant software support personnel

k. **Location**
   - The system must maintain a record of all entities with their unique IDs, Location and geo-codes.

5.2 Institutions Data Management System (IDMS)

5.2.1 Technical Requirements

Institutions accessing KEMIS should have flexible interface including easily pre-configuration to take colours and logos specific to an institution thus generating unique views of each institution. It is expected that if an institution has created its own profile with unique features, the users and stakeholders should view institution using its preferred colours and logo.

Institutions login should only for assigning rights to users of institutions found in staff, students, parents or alumni, and at no time should a general institution code be used as login credentials. A staff should be given a role of Head of Institution (head teacher, principals), head of department etc which will be assigned transactional roles including verification of receipts or capture of information in KEMIS.

It is noted that when a user is transferred from one institution to another, previous rights ceases until the user is predefined in the new station, and appropriate work history generated in KEMIS.

KEMIS platform should allow for partitioning of institution access such as that access should be in the format i.e. kemis.go.ke/{{school code}} e.g. kemis.go.ke/1227 will open view for school whose code is 1227 in KEMIS.

5.2.2 Functional specifications

1.1 Institution LMS and Admin Portal: All institutions will access KEMIS to undertake various functionality including:

1.1.1 **Acknowledgement of Funds received**: School heads are required to declare money received from MOE and attach appropriate receipts.

1.1.2 **Capture of learners**: The heads of institutions are supposed to capture learner biodata including the SNE details, Refugee Information; constitutes enrollment of institution.

1.1.3 **Capture of Teachers**: KEMIS will allow heads of institutions to capture teachers / tutors, including those engaged by management boards/ council.

1.1.4 **Capture of subordinate staff**: KEMIS allows capture of support staff and their designation.

1.1.5 **Capture of Assets**: KEMIS should allow institutions to capture assets of the school and nature of depreciation/appreciation.

1.1.6 **Capture of E-Readiness**: KEMIS should allow heads to capture e-readiness of institutions including power, digital learning devices, Internet status.

1.1.7 **Wash facilities**: KEMIS should allow institutions to declare the wash facilities.

1.1.8 **Sports facilities**: KEMIS should allow institutions to capture the sports facilities as part of requirement for new CBC.

1.1.9 **BOM/Council**: Institutions are ran by the board of management or council whose appointment and timeline is tracked.

1.1.10 **Registration/Renewal of Registration**: Institutions are expected to apply for renewal of registration every 5 years or on end of provisional registration.

1.1.11 **Whole school/institution quality index**: All institutions get an Institution Quality Index a composite from Quality Assurance Team, hence a view of the Quality Index is expected to be provided.

1.2 Student Portal: Students in Teacher Training and Higher-Level Institutions are expected to access the Institution's Data Management System:

1.2.1 **Timetable / course schedule**: Student would like to access timetable related information, course allocation and assignment.

1.2.2 **Counselling and Guidance:** is expected to allow students book counselling and guidance services from staff.

1.3 Staff Portal: KEMIS should provide for access for teachers or tutors to access:

1.3.1 **Timetable / course schedule**: Staff require access to schedule – Teaching areas.

1.3.2 **Responsibility:** Responsibility assignment is linked to functions in KEMIS.

1.3.3 **Work history:** The KEMIS should have function for tracking work history of staff especially teaching staff.

1.3.4 **Lesson Quality Index**: Quality Assurance undertake observation on lesson delivery and an Index is computed giving the teacher or tutor the level of lesson quality.

1.4 Learning Management System / Content Management: KEMIS should provide for schools tracking of content management and linkage to Kenya Education Cloud:

1.4.1 **Timetable / course allocation**: Head of Institution to should capture subject / course allocation.

1.4.2 **Content coverage:** The content delivery is monitored as captured by institutions into KEMIS. Provision to capture progress delivery of each subject / course per class.

1.4.3 **Access to Digital Content:** KEMIS should provide access to digital content hosted in Kenya Education Cloud.

1.5 Parent Portal: KEMIS should provide for parents access to their learner / student progress (options to have this functionality single sign-on with e-citizen should be provided):

1.5.1 **Learner/Student Bio**: Parent should authenticate bio of their children in KEMIS.

1.5.2 **Finances Information:** For institutions required of payment of children fees, KEMIS should provide to the parent such information including download of receipts, balances.

1.5.3 **Children Progress reports:** KEMIS should provide access learner / student progress reports, including provision to check what KNEC is collecting as CBA for their children.

1.6 Alumni Portal: KEMIS should provide for alumni access to their past schooling (options to have this functionality single sign-on with e-citizen should be provided):

1.6.1 **Study history**: Alumni should check their study journey.

1.6.2 **Results:** Alumni should have access to their results of each level.

1.7 Public Portal: KEMIS should provide for public access to institutions where the following should be found:

1.7.1 **School summaries**: General school or institution statistics.

1.7.2 **Tenders:** Institutions able to publish tender.

1.7.3 **Public notices:** such as events in institutions, such as closure, parents' meetings.

5.3 Education Management Portal

This captures the functional features for the three-state department of Basic Education, Technical and Vocational education and training (TVET) and Higher Education and Research

5.3.1 Technical Requirements

It is expected that each state department will have its management panel to define its functions and roles as per the system features developed to fulfil its mandate. The users of each department shall be expected to register on KEMIS platform as per

prescription on section 5.1. For flexibility and performance optimization, the state departments will be created as sub-domains of the KEMIS platform having extension on load balance for high-availability and reliability. For example, sdbe.kemis.go.ke, sdtvet.kemis.go.ke or sdhe.kemis.go.ke, will allow exposure of functionality of each state department differently but within the same KEMIS platform.

5.3.2 Functional specifications

a. Basic Education Functions

1.8 Institutions Module: This module captures registration and physical aspects of an institution. It achieves this through its six sub modules as presented below.

1.8.1 **Institutions Registration**: The purpose of this sub module is to register institutions with the Ministry; this will be used by both Existing schools and news schools. County Education Boards will be sensitized to utilize this sub-module for the purpose of adding schools into KEMIS.

1.8.2 **School infrastructure**: It captures equipment and fixed assets in terms of quantity and acquisition date

1.8.3 **School Utility**: Captures the utility name and brief description on the utility type.

1.8.4 **Co- Curricula**: Captures the co-curricular activities that take place in institutions, year and the highest level achieved.

1.8.5 **Teaching and learning material**: Captures specific quantity of learning materials both the course books and the supplementary books and DLP / Power Source Reporting

1.8.6 **Emergency reporting**: Enables the school administration to capture any disaster that affects the institution.

1.8.7 **Board of Management**: KEMIS should facilitate capture of the BOM/Council Management records and tracking of expiry periods of the members.

1.9 Learners Module: This module captures every detail necessary from learners beginning from their registration; their performance and progression in the education system; and their transition from one level to another. The learner module has five sub modules as follows:

1.9.1 **Unique Personal Identifier**: This module enables the learner to input birth certificate, ID number or Alien number whereupon the system will auto generate a UPI.

1.9.2 **Learner Registration**: Captures contact details of the learner

1.9.3 **Student mobility**: Captures details of the learner, mobility type, discharging institution and the new institution.

1.9.4 **Performance Progression**: Captures performance details of each learner after completion of specific level e.g. Primary, Secondary etc.

1.9.5 Learner Talent: Captures details on learner's talents.

1.9.6 **SHIF Number allocatio**n for health support.

1.9.7 **Capture of Deceased Learners** which is done in real time as learners die due to one reason or another. This has been further enhanced with support on NHIF last expense facility.

1.10 **Staff Module**: This module captures every detail necessary from members of staff (teaching and non-teaching) beginning from their appointment and mobility within the education sector. The module has five sub modules as follows:

1.10.1 **Teachers (in both Public and Private Schools) and Non-teaching staff** registration Module: This interface captures teachers and non-teaching staff personal details in an institution. Can help in estimating the cost of support staff remuneration and support.

1.10.2 **Teacher Mobility**: This interface captures transfers of teachers from one institution to the other. It also displays the transfer history of a teacher.

1.10.3 **Teaching areas**: This Interface captures subjects/units a teacher is teaching in an institution.

1.10.4 **Study Areas**: This interface captures areas a teacher is trained on.

1.10.5 **Teachers' responsibilities**: This interface captures responsibilities assigned to a teacher within an institution.

1.11 **Finance Module**: The finance module helps track income and expenditure in all institutions through its five sub modules.

1.11.1 **Fees**: This interface captures the fee amount of an institution with all the approved fee items (this is pending management approval).

1.11.2 **Capitation**: This interface is for setting up the capitation to be disbursed to public Primary, Junior and Senior/Secondary schools in a given term within a calendar year. Special Needs Capitation to be defined to allow top-up based on approved per student funding.

1.11.3 **Income Returns**: This interface captures all amounts received by the Institution within a given year.

1.11.4 **Development Fund**: This interface captures projects funded in an institution within a given financial year and tracks their progress utilization.

1.11.5 **Expenditure Returns**: This interface captures the actual amount spent, milestones achieved and the percentage completed in a project.

1.11.6 **Reports Module**: The reports interface allows the user to generate routine and adhoc reports specific to their mandate. This interface will allow export of data for advanced analysis based on prescribed formats (Excel).

1.12 **Senior school Admission Management Module**: The Senior school admission management module tracks placement of learners into all senior schools (both public and private) through its five sub modules.

1.12.1 **Selection**: This interface displays the selection results from form one placement (entails search using Index Number). This displaces the outcome of the selection process which is done outside NEMIS.

1.12.2 **Change of school request**: This sub-routine allows parents country-wide to place requests for change of school to respective school of choice, upon which Principal will capture the details

1.12.3 **Calling Letters**: This is an API which facilitates parents and guardians to download school calling letters online. NEMIS is used to verify and retrieve appropriate letters for a given candidate.

1.12.4 **Admission Reporting**: When form ones report, NEMIS is used to track reported form ones in schools. This module has since been stabilized after the chaotic experience of 2019 with better infrastructure and connectivity. NEMIS now has a mobile feature which allows Principals to capture Form one learners who have reported offline and sync to NEMIS Server once a week or within two weeks.

1.12.5 **Reporting Returns**: various reports on form one placements and admission in NEMIS for administrative and management use.

1.13 School Feeding Module: The school feeding module is aimed at helping the Ministry track and monitor food distribution and management of meals programmes in public primary schools in selected regions (30 ASAL and Arid sub-counties) through its five sub modules.

1.13.1 **HQ Approval and procurement**: This handles the initial process of simulation of food item quantities based on budget amounts; approval template, capture of bid awards and handling of deliveries from suppliers.

1.13.2 **Sub-County Distribution Management**: This sub-module allows capture of waybill and its details; receipt of food items at sub-county; distribution plan / allocation of food quantities for a given term; preparation of food distribution routes and delivery notes.

1.13.3 **School Meals Management**: At the school receive food items; based on daily attendance, release food ratio to kitchen for food preparation for the learners; handling of other food items either based on cash-based or sub-county led.

1.13.4 **Cash Disbursement**: NEMIS supports cash funds transfer to schools and sub-county; Based on school enrollment and approved cash per child will lead to calculation of funds expected to each school or agency.

1.13.5 **Reporting**: various reports on school meals programme in NEMIS for administrative and management use.

1.14 Scholarship and Bursary Management: The module has the following features:

1.14.1 **Scholarship Definition**: All scholarships are defined and managed by various agents i.e. Jomo Kenya Foundation, County Bursaries, National Government Constituency Development Fund Bursaries, Equity, KCB, Co-op amongst others.

1.14.2 **Scholarship/Bursary Application**: Applicants register and apply for consideration in various scholarships on the platform.

1.14.3 **Applicants Vetting Feature**: MOE has a rigorous vetting process with members present in all sub-county areas. The vetting teams have features to capture the level of need of applicants to help prioritize the applicants to various bursaries defined in the system.

1.14.4 **School Verification of Bursary Disbursement**: Functionality is provided which allows schools and colleges to declare the

beneficiary students and amounts receipt (as part of transparency and accountability).

1.14.5 **Publishing of Beneficiaries in the Public Portal**: As the case with all bursaries, the beneficiaries are supposed to be published for public scrutiny and confirmation of needy students supported.

1.15 Data Sharing Regime: As should in the module diagram, there is a sharing regime guided by the Data Protection regulations:

1.15.1 **KNEC**: All learners are supposed to be shared with KNEC for the purpose of guiding assessments.

1.15.2 **SHIF/Health**: Learners mapped to parent / guardian verified by API link to KEMIS.

1.15.3 **MOH/KHIS**: Deworming of learners happens in schools and data captured directly in NEMIS. There is a data sharing framework with the Ministry of Health's KHIS platform using an API.

1.15.4 **KUF/KUCCPS**: There is a data sharing framework with Kenya Universities and College Placements for the purpose of confirming the schools of students.

1.15.5 **NACONEK**: There is a daily attendance platform for tracking food consumptions in our schools through NACONEK.

1.16 National Dashboard Reporting: Dashboard reporting will handle the following:

1.16.1 **Quality Assurance and Standards Whole School Assessment** as per requirements of QASO to undertake whole school assessment to generate the overall school index on performance of components to a school wellbeing. This is a process for the Directorate of Quality Assurance and Standards.

1.16.2 **Lesson Plan Observation Tools** done by QASOs and CSOs on teacher delivery of curriculum, generating an Index for each teacher teaching a given subject. Tool has been harmonized to cover both 844 and CBC curriculums.

1.16.3 **WASH Observation Tool** with help of UNICEF, developed a WASH tool automated in MOE Mobile app for capture of wash indicators at school level.

1.16.4 **Remedial Programme Monitoring Tool** with the impact of Covid, MOE and stakeholders created a remedial programme to facilitate learners worst affected by pandemic, and this tool is used to track remedial programme implementation at school.

1.16.5 **Dashboard through Power BI** is the reporting module used to create various charts and global views of performance of various indicators tracked by above tools.

b. TVET Functions

1.17 TVET Institutions Management: KEMIS should be able to capture TVET institutions under central input or as registration approval:

1.17.1 **TVET Institution**: TVET institution is regulated by TVETA and State Department for TVET. This module will capture basic bio-information of TVET institution.

1.17.2 **Assets / Facilities**: TVET Institution Assets including the value / depreciation/ functioning status.

1.17.3 **Institution Capitation**: TVET Institution by default are not mapped into capitation and require each institution to apply for inclusion. State Department of TVET will have a functionality to allow management of institutions into capitation. The capitation administration requires the student's enrolment, fund definition and a number of reports.

1.18 **TVET Tutor Module**: TVET Tutor should be provided with a module for accessing tutor details and course administration:

1.18.1 **Tutor List**: As captured by institutions, help in listing the various tutors.

1.18.2 **SNE Segregation**: TVET Staff mapped to various SNE if any, this could be empty if there is no staff with SNE category.

1.18.3 **TVETA Trainers**: TVETA undertakes regulation of TVET Trainers in close collaboration with State Department of TVET.

1.18.4 **Training Data**: Course attendance and professional training is critical to ensure tutors are.

1.19 **TVET Student Module**: TVET Students should be highlighted in KEMIS summarized for use at Management Module:

1.19.1 **Student Enrolment List**: Student list is captured at IDMS hence summary and listing of learners linked to courses.

1.19.2 **Student Capitation List**: KEMIS should provide for student list for each capitation for purpose of accountability.

1.19.3 **Student Mobility and Transition**: Student mobility is ability for students to be moved from one grade / year to another as well transit to another level i.e. TVET to University.

1.20 **Course Module**: TVET Courses are regulated by TVETA where it is recommended that KEMIS shall provide for validation of courses as approved to be offered by various TVET Institutions:

1.20.1 **Course List**: As approved and validated by relevant agency of government.

1.20.2 **Course Enrolment**: KEMIS should provide for application and approval of TVET institutions to various approved courses – compliance list on each course might be prescribed by TVETA.

1.20.3 **Tutor Workload / Analysis**: KEMIS should provide for course allocation to tutors and allow for various reports on the same.

1.21 **Alumni**: TVET graduates require to be access key information from their TVET institutions:

1.21.1 **Transcripts**: Course attainment while studying in the TVET institution.

1.21.2 **Course attainment**: KEMIS should provide alumni to be able to download a course attendance validation certificate with QRCode for validation.

1.21.3 **Alumni Coordination Programme**: KEMIS should provide alumni participation in resource mobilization and engagement in TVET institution development agenda. It is proposed alumni will create own structures.

1.22 **Public Portal**: TVET institution information and course list ought to be provision in KEMIS:

1.22.1 **TVET Statistics**: Public access to information highlights the right to access to statistics and other vital information.

1.22.2 **TVET Institution Location**: Public would like access location details for various institutions to guide reach-out.

1.22.3 **TVET Advertising**: TVET adverts on tenders or job offers.

1.22.4 **Course Listing and Requirements**: KEMIS to provide courses offered in each TVET institutions and requirements.

c. Higher Education Functions

1.23 **Universities Management**: Universities do capture information in own ERPs or customized developed applications. The information derived here for State Department of Higher Education will be shared by universities on:

1.23.1 **University Bio-data**: captures university description and location information.

1.23.2 **University Senate and Council Module**: As per statutes management council timelines and membership is tracked by this module. SDHE will have global view of the membership.

1.23.3 **University Assets**: University assets inventory and valuation register.

1.23.4 **University Finances and Expenditure Reporting**: This subsystem allows university to declare all income as captured in e-Citizen payments as well as periodic reporting on expenditure.

1.24 **Faculty Staff/Support Management**: Faculty and support staff will be captured reflective of:

1.24.1 **Bio-data and designation / titles**: Faculty will comprise of research, professors and all cadres of staff, inclusive of support staff of university.

1.24.2 **Research portfolio**: KEMIS shall provisioned research portfolio linked to each faculty member and scope. This will be refined according to SDHE information requirements.

1.24.3 **Faculty workload**: linked to course allocation and schedule and student enrolment.

1.25 **Programmes and Courses**: Universities are expected to share the following:

1.25.1 **Programmmes and Courses**: as per approved courses and programmes by Commission for University Education.

1.25.2 **Course student enrolment**: KUCCPs enrolment of students to each course is validated.

1.25.3 **Course Funding**: each course has approved costs for training each student. SDHE will provide for capture of criteria and cost units reflective of each course.

1.26 **Student Enrolment**: Universities will keep student enrolment and mobility yearly, hence module will capture:

1.26.1 **Student list per course**: Initial enlisting for the cohort by KUCCPs As per 1.25.2 above.

1.26.2 **Student fee payment**: The module will track student fee payment and track student needs based on HELB/UFB model.

1.26.3 **Student progress tracker**: track progress in academic participation including dropout cases for follow-up and psycho-social support for re-entry.

1.26.4 **Student leadership**: KEMIS to provide for capture of student leadership in institutions of higher learning. Student Councils and participation in governance issues is critical.

1.27 **Partnership and Resource Mobilization**: Universities do attract various research partners who contribute resources used in the institutions. KEMIS is expected to capture:

1.27.1 **Partners**: partners' information and nature of collaboration with university.

1.27.2 **Programmes and projects**: KEMIS should provide for capture of programmes.

1.28 **Public Dashboard**: Universities have programmes and course which are of public consumption:

1.28.1 **General statistics**: KEMIS shall provision for general stats on University data.

1.28.2 **Council Membership Tracker**: KEMIS shall display to public the membership of Council and duration of their stay.

5.4 Education Data Exchange Protocols with Institutions ERPs and Custom Solutions (Universities and National Polytechnics Established ERPs)

5.4.1 Technical Requirements

Institutions of higher learning have independent applications used to capture a lot of data already expected to be in KEMIS. This component aims at facilitating the data sharing and onboarding to KEMIS using security protocols defined as well as format of data required. API shall be defined in the KEMIS Data Bus platform prescribed in section 5.6 with data sets required by SDHE or SDTVET for universities and TVET institutions respectively. The normal interface for Institution access defined in 5.2 shall be available to universities and other tertiary institutions with its own ERPs to login and verify information shared from their institutions.

5.4.2 Functional specifications

1.29 **Interface API**: Universities and/or tertiary institution with ERPs or automated solution shall share information of their institution using a developed interface in KEMIS on:

1.29.1 **General info**: KEMIS shall provision for general information on University or tertiary institution as defined in section 1.23.

1.29.2 **Faculty/support staff**: KEMIS shall provide interface for submission of data or information as defined in section 1.24 above.

1.29.3 **Programmes and courses**: KEMIS shall provide interface for submission of data or information as defined in section 1.25 above.

1.29.4 **Student Info**: KEMIS shall provide interface for submission of data or information as defined in section 1.26 above.

1.29.5 **Partnership and Resource Mobilization**: KEMIS shall provide interface for submission of data or information as defined in section 1.27 above.

1.29.6 **Public Information**: KEMIS shall provide interface for submission of data or information as defined in section 1.28 above, for public access or utilization.

5.5 Education Data Exchange Protocols with Agencies of Education

KEMIS will require exchange protocols with agencies of education dealing with Educational Institutions and Student Data (SAGAs in the Education i.e. KNEC, KUCCPs, KNQA, KEC, JKF, SEPU, TSC, KISE and KEMI amongst others)

5.5.1 Technical Requirements

API shall be defined in the KEMIS Data Bus platform prescribed in section 5.6 with data sets required of each agency for KEMIS fulfilment. Specific API with naming associated with each agency for ease of securing and monitoring utilization is critical. For example, kemis.go.ke/api/kuccps for KUCCPS, while kemis.go.ke/api/kemi for KEMI agency.

System development team of MoE shall be capacity built to handle continuous improvement / continuous development (CI/CD) for sustainability of KEMIS API Component.

5.5.2 Functional Specifications

1.30 Interface API: Developed interface in KEMIS for sharing of data by various agencies.

As shall be defined during the needs assessment and requirements documentation, each of the semi-autonomous and independent commissions dealing with educational institutions shall be provisioned in KEMIS appropriate secured interface API to share or update where applicable information of institution, staff, student/ learners or share appropriate data or information as might be necessary for integrity or accountability of platform. Table 4 will guide the nature of Interface API to be developed and implemented in KEMIS in respect to each agency enlisted. The list may be extended list after extensive engagement with identified stakeholders in education sector.

Table 4: Interface API for Agencies in Education

Agency	Interface API
1.30.1 KNEC	• Generation of Center Codes to Administrative units and educational institutions i.e. KNEC Codes • Assign assessment numbers to all learners in basic education – for competency-based assessment (CBA) • Share of results for each learner or student in basic institutions and some TVET institutions, accessible by each student/ learner
1.30.2 JKF	• Capture of scholarship / bursary • Under to coordinate and harmonize scholarship and bursary management in basic education as per functional requirement 1.14
1.30.3 KUCCPS	• Interface to share all placement data for past years – candidates, programmes/ courses, institutions • Interface for placing learners from basic to TVET and higher education – allocation of learners to various training programmes – help track transition from secondary / senior school to tertiary institutions

Agency	Interface API
1.30.4 TSC - TPAD TMIS	• Interface for validation of all registered Teachers (both in public and private institutions) • Interface for validation of TSC Codes captured in KEMIS by institutions – public institutions • Interface for validation of current teacher stations – update during transfers, newly employed teachers • Interface for access of latest enrolment of student data from KEMIS for use in various TSC systems
1.30.5 KISE - EARCs	• Interface to access all educational institutions with special needs learners / student, staff with special needs • Interface to facilitate undertake assessment of special needs learners/ students and validation of registration with persons with disability national database • Interface to facilitate undertake assessment of special needs staff and validation of registration with persons with disability national database
1.30.6 KEMI	• Interface for inventory of all educational managers at all levels • Interface to facilitate documentation of and harmonization of all training of education managers across all levels • Interface for declaration of management training courses for educational managers
1.30.7 KNQA	• Interface for accreditation of all qualification offered by institutions in Kenya • Interface to equate qualification attainment and credit transfer for learners / students within Kenyan institutions
1.30.8 University Fund	• Interface for sharing of student need as captured in KEMIS Scholarship and Bursary Module • Interface for sharing of beneficiary applicant students and fund provided - for validation by institutions
1.30.9 Talenta / Science Congress	• Interface to authenticate learners / students participating in talent/sports or science fairs • Interface for identification and nurturing talents and gifts within education sector
1.30.10 KEC / KICD	• Interface to allow education institutions access to digital content in Kenya Education Cloud • Interface for parents and learners/ students have validated channel to access digital content and resources in KEC and other approved digital learning materials • Interface for curriculum coverage tracker by all educational institutions under basic
1.30.11 TVETA	• Interface for accreditation and regulation of TVET institutions • Interface for accreditation and regulation of TVET courses • Interface for regulation of TVET Trainers and validation
1.30.12 TVET CDACC	• Interface for curriculum coverage tracker by all TVET institutions

The number of interfaces shall be derived from needs and requirement documentation of stakeholders in this assignment.

5.6 KEMIS Data Bus, Sharing Regime (API Interface)

5.6.1 Technical Requirements

KEMIS data bus is expected to standardize the implementation methods of data sharing and exchange in homogeneous systems and heterogeneous systems in a large integrated application system, as well as data exchange standards between systems.
From figure 7, the firm will be expected to design and demonstrate the various components highlighted on KEMIS Data Bus, which will facilitate data exchange between various system modules and stakeholder platforms.

a. API: is developed using any of the prescribed language which makes it easy to scale and integrate with KEMIS Application. Once API is developed, firm should be able to demonstration publish-subscribe, request-reply and all necessary CRUD functionality. Component to be developed using one of progressive development tools such as. NetCore or Java which support micro-service deployment.
b. Data Resource Model: Various data types and formats are handled by KEMIS Data bus. This component highlights the critical data types which stakeholders might use in sharing or updating data in KEMIS. Data can be JSON for no-sql platform such as one of QASO tools, excel for data uploads to various information needs.
c. Governance: The proposed system shall support distributed resource management architecture that encompasses a set of algorithms for resource monitoring, QoS Mapping, admission control, resource reservation and resource negotiation. Ensuring QoS and maintaining cyber security are two main requirements of KEMIS Data Bus. The design shall also address QoS and security guarantees for multicast flows for efficient implementation of publisher / subscriber model of data communication.

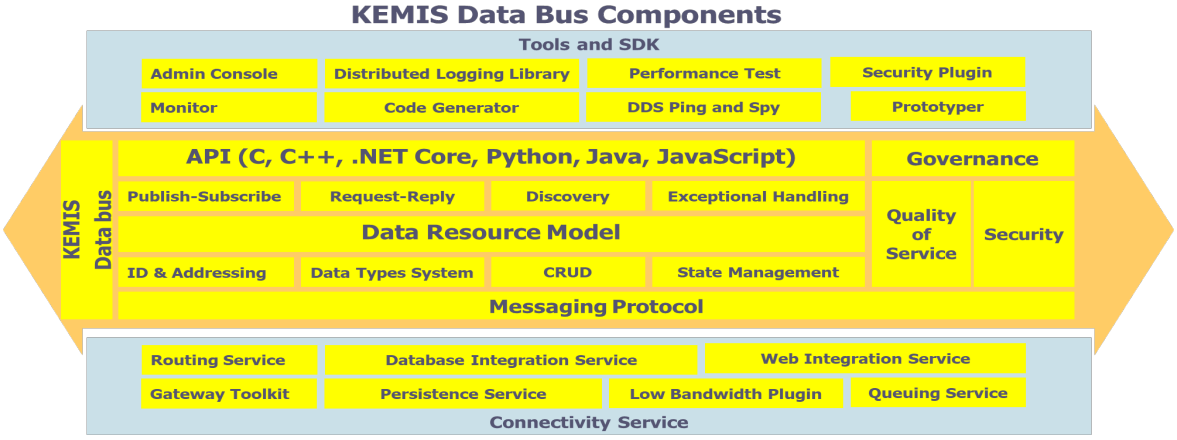


Figure 7: KEMIS Data Bus Components

d. Messaging Protocol: is a set of rules and conventions that define how messages are formatted, transmitted, received, and processed in a communication system. Messaging protocols are used in various contexts, including computer networks, distributed systems, IoT (Internet of Things) devices, and messaging applications.
e. Connectivity Service: KEMIS Data Bus shall utilize various connectivity service such as Data Integration Service (connecting to databases of KEMIS), Web Integration Service (for facilitating the utilization of APIs by stakeholder systems), Persistence Service (provide guarantee of delivery) amongst others.

f. Development tools and SDKs: it is expected that firm contracted shall handover after capacity building government developers on various tools used to create and maintain the components of KEMIS Data Bus. Each of the tools should be documented and application towards enhancement of KEMIS data bus.

5.6.2 Functional specifications

KEMIS data bus is a critical component of KEMIS that enables efficient transfer of data between components, facilitating operations of the system as a whole. The following should be delivered by KEMIS Data Bus:

1.31 **API interface**: KEMIS Data bus shall be used to deliver API requirements of KEMIS platform. API will service:

1.31.1 **Institutions Data Sharing**: To deliver the requirement of 5.4 of Education Data Exchange for Universities and other institutions of higher learning.

1.31.2 **API for Agencies**: for data exchange requirements to meet section 5.5.

1.31.3 **API for sharing with Government Systems and 3rd Parties**: As captured in KEMIS Functional Architecture, government system such as e-Citizen platform, IFMIS, HELB amongst others will be facilitate by the API infrastructure.

1.32 **Data Resource Model**: KEMIS Data bus should facilitate:

1.32.1 **CRUD functions**: that enables various application updates and inserts to occur seamlessly through KEMIS data bus.

1.32.2 **Data formats**: support data formats for mobile applications (QASO Observation tool, Student attendance app, School meals reporting app etc.).

1.32.3 **State management**: KEMIS platform is expected to manage session and other state tracker techniques, ensuring security and quality of service is maintained.

1.33 **Messaging Protocol**: KEMIS Data bus should facilitate:

1.33.1 **Alerts and notification**: allows prompts to specific roles to take action on predefined workflows.

1.33.2 **Logging of security and QoS incidents**: KEMIS Data bus should have efficient messaging of logs and warnings including threats, resource constraints (computing overstretch) and violations captures.

1.33.3 **General system analytics**: Can be observed at the admin console or dashboard of KEMIS as prescribed in the next section.

1.34 **Governance**: KEMIS Data bus should facilitate:

1.34.1 **Quality of Service**: Setting defined minimum allowable matrix, components should have self-recreation and recovery mechanism with minimal disruption of services offered through the KEMIS Data Bus.

1.34.2 **Security**: The Bus shall be expected to provide for optimal security encryption keys and authentication. The provisioning of KEMIS Data Bus should ensure redundancy.

1.35 **Connectivity services**: KEMIS Data bus should facilitate:

1.35.1 **Database Integration Service**: This service will enable data abstraction to KEMIS Databases as shall be established in section 5.7.

1.35.2 **Web Integration Service**: Will provide web-service integration to IPRS, KNEC, KUCCPS, E-Citizen and other subsystem which will require data exchange with KEMIS.

1.35.3 **Routing Service**: Due to demand for redundancy on network infrastructure as well as connectivity, routing service will ensure KEMIS data bus operations will have ability to switch routing dynamically with minimal disruption of services.

1.35.4 **Persistence Service**: includes handling file system (CSV/Excel, Photos/Images) and enterprise relational database management system (RDBMS) logical data models and architecture, physical data deployment, storage services, performance and resiliency characteristics including RAID implementation, security etc.

1.36 Development Tools: Creating various components of KEMIS Data Bus require adoption and use of various tools:

1.36.1 **Code Generator**: used for creation of APIs, WebService, Integration Services, CRUD implementation within KEMIS.

1.36.2 **Performance Test and Monitoring**: Ensuring efficiency of KEMIS and optimal performance, logs guiding identify bottlenecks within KEMIS.

1.36.3 **Documentation of Toots and SDKs used**: firm engaged shall do deliberate documentation and skills transfer to various groups as shall be formed by Government to ensure gains in NEMIS and TVET-MIS capacities is enhanced further in KEMIS.

5.7 Establishment of Education Data Warehouse and Data Analytics

5.7.1 Technical Requirements

KEMIS Data Warehouse Architecture

Education would like establishment of a Tier-2 Data Warehouse which analytical process is separated from a business process. This allows for greater levels of control and efficiency. A two-tier system also provides a better understanding of the data and allows for more informed decisions.

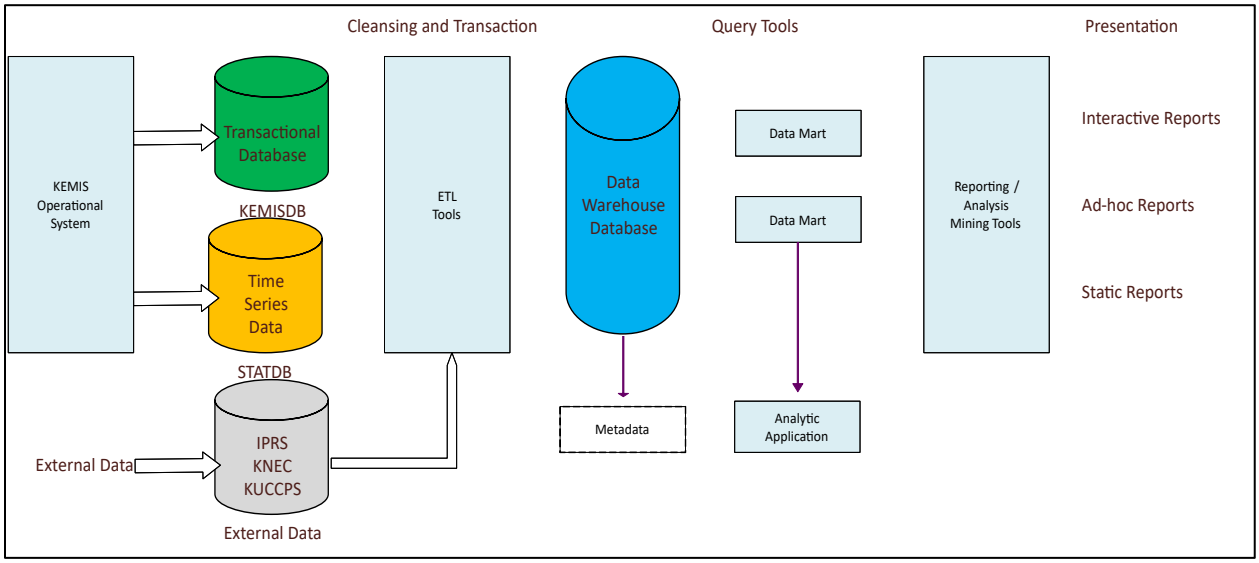


Figure 8: KEMIS Data Warehouse Architecture

The Data Warehouse will compose of:

a. **Relational Database Management System (RDBMS)**: It is recommended that an enterprise version acquired once with perpetual licenses be used to setup KEMIS. This will be used to host live KEMIS DB data as well as established time series database STATDB which is used to undertake statistical reporting in the education sector.

b. **Query tools**: A number of RDBMS are supplied with query tools which can be utilized to create various analytics and reporting. Free tools easily available on open standards are recommended to be adopted and presented by the firm engaged on this assignment.

c. **Reporting tools**: It is recommended web-based, easily configurable reports will be embedded into this KEMIS Data Warehouse. The reports will be derived from the needs' assessment and requirements documentations of various stakeholders

5.7.2 Functional specifications

KEMIS Data Warehouse will have the following components:

1.37 RDBMS: the following databases to be created:

1.37.1 **KEMIS DB**: to host live transactional data from KEMIS Application, migration of data from NEMIS and TVET-MIS and access of past historical data on capitation and associated reports used to verify disbursement of funds and other critical reports.

1.37.2 **STATDB**: Time series data is needed and already some work has been established by Planning Department within SDBE. It is expected that time series spanning 2014 to date shall be created and populated on key indicator data required for national and international reporting.

1.37.3 **External Database**: KEMIS expected to receive data from external agencies and government systems. It is recommended. All Agencies and Universities and Tertiary Institutions that will be using web-

service to share data will have data stored in this external database (which might be partitioned for efficient operations).

1.38 **Reporting and Analytics Dashboard**: KEMIS platform being multi-tenancy should have customized views of reports to meet requirements of various stakeholders:

1.38.1 **SDBE**: Capture reporting tools for basic education management.

1.38.2 **SDTVET**: Capture reporting tools for TVET management.

1.38.3 **SDHE**: Capture higher education management reporting.

1.38.4 **Institution Level**: As by IDMS, every institution have specific data needs which should be provisioned, including the indicator reporting status.

1.38.5 **Partners and stakeholders**: Stakeholders including parents, students, alumni and partners have interests on key reports derived from the platform. .

1.38.6 **Public dashboard**: flexible configurable reports which public can access from KEMIS. Analytics dashboard for public view should be prepared and provisioned.

It is critical that the KEMIS Data Warehouse be established and configured as a data component for KEMIS Data Bus infrastructure above.

5.8 Infrastructure optimization for the hosting, efficient operations and functioning of the KEMIS platform

5.8.1 Technical Requirements

Though the infrastructure is not part of supply for the firm developing KEMIS Platform, configuration for optimal performance is including in this section.

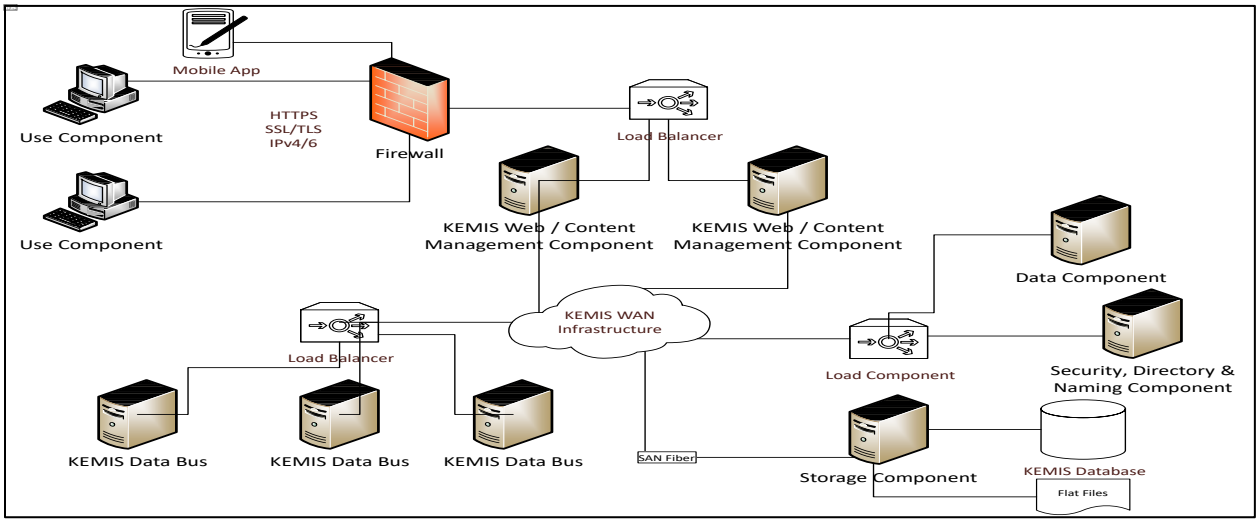


Figure 9: KEMIS Infrastructure Layout

The infrastructure shall comprise of WAN, Data Bus, Data Storage (Warehouse), Web/Content Management (IDMS, Management Portal, API /Web Service Access). Security is critical in the configuration where appropriate firewalls and authentication mechanism is implemented at all stages. Load balancers are critical considering the number of users and traffic anticipated in use of the KEMIS platform. The diagram

indeed depicts the overall deployment of all components expected to function as one unified solution for the education sector.

5.8.2 Functional specifications

1.39 Infrastructure optimization for KEMIS: the following components are expected to be established by the contracted firm:

1.39.1 **KEMIS WAN Infrastructure:** Will be used to connect KEMIS Data Bus (provisioned in redundant and load balancer), KEMIS Data Warehouse (accessible on Storage Component and Data Component) and Presentation Layer provisioned to Institutions through IDMS, MOE Management through KEMIS Management portal reflected in three sub-domains (tvet.kemis.go.ke, sdbe.kemis.go.ke and sdhe.kemis.go.ke) and Data Sharing Protocols for APIs and web-services.

1.39.2 **KEMIS Security layer:** Security layer will have firewalls, security keys and directory services. Authentication scheme shall be established to ensure APIs and data sharing protocols are secured at all times during transaction sessions.

1.39.3 **KEMIS Load balancer:** the firm should establish the requirement for load balancers in provisioning the services to various stakeholders to ensure optimal delivery of KEMIS solution.

1.39.4 **KEMIS Business Continuity and Disaster Recovery:** it is expected that a primary and secondary sites shall be established where KEMIS solution shall be configured to function and full failover mechanism. Consideration shall be utilizing existing infrastructure as well as cost effective Government cloud.

1.39.5 **KEMIS Infrastructure Management and Maintenance:** It is expected that the firm shall engage MoE and MoICT Technical Team members on a continuous capacity development and skills transfer for smooth management and maintenance of the infrastructure environment established.

6. CAPACITY BUILDING

6.1. Digital Development Perspectives

The Development of ICT Capacities is an important policy objective for any country seeking to harness the power of ICT for development, and the Ministry needs to act swiftly and decisively to ensure that it provides an enabling environment for innovations in ICTs and use of the technologies in creative ways towards sustainable service delivery.

ICT is a key engine for transforming economies through developing the required human resource capacities, and Strategic planning of ICT capacity building should start at the very beginning stages of policy design and formulation by including all possible relevant ICT strategies.

In quests to Embracing Capacity Building Opportunities in the Digital Era, participants cited emerging technologies such as the *Internet of Things (IoT)* and *Big Data Analytics* as increasingly becoming a critical Tech-development that will greatly influence the attainment of the Government's *Bottom-Up Economic Transformation Agenda* (BETA), and to a large extent the Sustainable Development Goals (SDGs).

6.2. Strategies for Capacity Building

Effective utilization of KEMIS Applications at various levels demands of enhanced Equipment and Trainings to the following groups:

- System Developers and System Support Team
- System users at Ministry Departments and Agencies, Counties
- Institution Users
- Public sensitization of parents and alumni
- Validation of Certificates users
- Data analysts

Strategic Capacity Building Interventions would thus scope around;

i. Develop five (5) training modules that would be used to equip all stakeholders in education with the requisite skills to handle data and the KEMIS system. Module one (1) shall be mandatory for all education technical officers across the ministry to create awareness but module 2 to 5 shall be pegged on responsibility accorded. The training shall be conducted by Institutions mandated to train Educators either through an online or in person interactions.

ii. **Conducting User-Needs Assessments**, to help bring out Specific skills gaps, special Training Interests and further device Training areas of relevance and sustainable effects.

iii. **Conducting e-Readiness Surveys** to help determine the quality of ICT infrastructure and the ability of its consumers, businesses and governments to use ICT Systems to their benefit

iv. **Provision of ICT Infrastructure**: While the Government shall ensure availing Connectivity Options; provision of the required Digital Equipment (*and Application Softwares*), enabling successful Implementation of KEMIS System is proposed to be actualized by the Implementation Agency.

v. **Sponsoring Training through workshops and seminars**: The Implementing Agency shall Train the KEMIS Implementation Team (at least the *System*

Developers and System Support Team) on the required Training Gaps/Needs across, then *Design, Develop, Deploy, Test* and *Rollout* the Developed KEMIS System.

These **Training Areas, (**executed across KEMIS Implementation phases) will focus on;

- Software Development (*Full Stack*)
- Big Data Analytics
- ICT Projects Management (*PMP, Prince2* or *Other*)

It is worth noting that the *KEMIS Implementation Team* and the Contactor shall journey together throughout the Development phases, thus equipping the Ministry of Education Technical Team with Knowledge and Required Technical Skills for effective Development and Implementation of KEMIS System.

vi. **Government Multi-Stake Approach**

KEMIS Development, Implementation and Sustainability rest with many Government Stakeholders, including;

- *Ministry of Education (Basic, TVET, HE, and SR&I)*
- *Ministry of Interior and Coordination of National Government*
- *Ministry of ICT and The Digital Economy*

These Government bodies, together with other Government Departments and State Agencies will be collectively tasked to share Data and thus measure successful KEMIS rollout and Implementations.

vii. **Partnerships:** Technology Partners (*Local & Global*), Private Practitioners and Corporate Organizations are encouraged to plug in with novel ICT Capacity Building Initiates that help bridge Technology Deficits among KEMIS Implementation Teams. A working matric of strategic benefits to Parties shall be agreed upon engagements.

7. METHODOLOGY

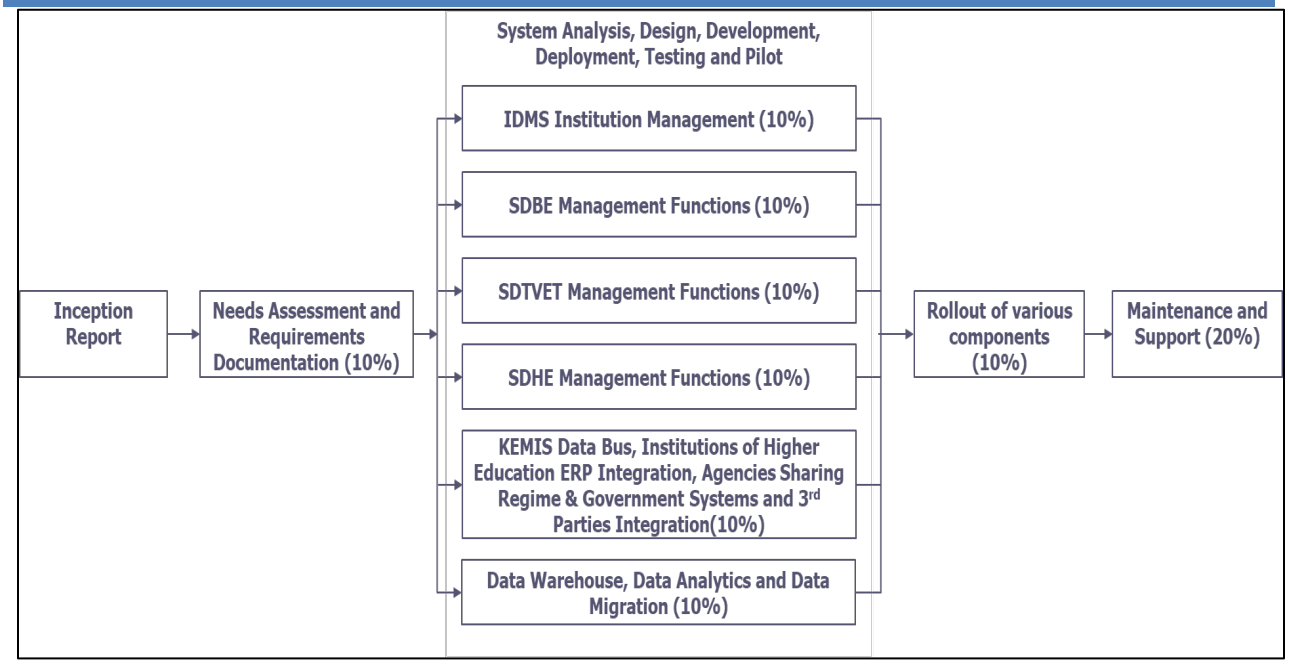


Figure 10: KEMIS System Development Life Cycle Stages

8. DELIVERABLES

Outputs	Deliverables	Timeline
Inception Report	Detailed plan with approach for carrying out the tasks outlined, including work-plan.	Within 2 weeks of contract signature
Needs Assessment and Requirements Documentation of KEMIS	a) Needs Assessment Report - detailed needs assessment based on modules in the legacy NEMIS system b) Detailed Requirements Documentation for KEMIS	Within 2 month of contract signature (2 Months)
KEMIS System Modules and Sub-Systems Developed (Multi-Team Front Implementation) – System Analysis, Design, Development, Deployment, Testing and Pilot of Developed Components	The firm will undertake System Development a. Institution Data Management System (for institution portals) b. State Department for Basic Education Functionality (as performed by NEMIS and extended new requirements) c. State Department for TVET Functionality (as performed by TVET-MIS and extended new requirements) d. State Department for Higher Education Functionality e. KEMIS Data Bus and Data Sharing Protocols for Institutions ERP Systems, Agencies, Government Systems and 3rd Parties as need arise (flexible expansion) f. Establishment of KEMIS Data Warehouse, Data Analytics and Data Migration Plan implementation. Each component is expected to have i. System Analysis and Design Documentation ii. System Development Documentation (inclusive of source codes and design artefacts) iii. Deployment Guidelines and Testing Documentation iv. Pilot Results and User Acceptance (Technical Committee shall designate the responsible user acceptance committees for each component)	Up to 6 months
KEMIS Implementation – Full rollout and going live, System implementation and training of users	Contracted firm shall prepare for implementation schedule: a. Training schedule targeting key users (departments, directorates, agencies etc.) as prescribed in capacity building guide under 6.	Estimated 3 months

Outputs	Deliverables	Timeline
	b. Working with Ministry's department responsible for KEMIS mount training of users (training attendance list, and facilitators' materials) c. Establish a support mechanism for handling and reported issues (including bugs, work-flow changes) d. Training done for a period not exceeding 2 month on full stack developer course (UX, Front End, Back-End, Database Management, Data Analytics and Reporting, Backup regimes – Business Continuity and Disaster Recovery). Officers' facilitation on the days involved to participate in workshop training (based on government approved rates). e. System development tools (laptops and assortment of software purchased for the assignment): procurement process require clarification. The firm engaged working with Government System Developers trained in above milestone, will be start the process of development of modules into new framework. Some of key documentations here include: i. User Documentation (docs). ii. Training Manuals (for various components) iii. user guides and training schedules (docs and videos)	
KEMIS Maintenance and Support – Hand-holding the KEMIS System Developers of Government undertake continuous development and continuous improvement work on various modules	It is expected that after rollout and going live, KEMIS will continue being improved and more functionality required. This therefore include documentation of support from the firm to the Government Developers. The following shall be used to gauge the deliverables here: i. New Module Implemented by GoK Developers – Documentation and integration to all components ii. Participant lists and minutes of meetings of engagement	2 Months

9. RESPECTIVE RESPONSIBILITIES

The Firm must ensure that the tasks identified are performed in a result-oriented manner with the sole objective of achieving outputs and outcomes expected from the assignment as described in the scope. A lot of collaboration is required as has been experience previous similar efforts in education sector. The environment is complex and require people-engagement skills and stakeholder participation for success.

The Ministry of Education shall provide the following to the best of their ability:

1. System Developers to work with the firm's experts
2. Working office within the Ministry
3. Host environment for implementation of solution at each stage of development
4. Data, studies and literature (previous (N)EMIS system design and development documentations) considered relevant for accomplishing identified tasks;
5. Access to key officials within the relevant Ministry and other relevant official entities and/or any others as applicable;
6. Full Access to NEMIS, TVET-MIS, HEMIS and all education platforms aimed at this assignment to achieve a single platform from preschool to higher education levels;
7. Help convene key stakeholders and support cooperation with the Government of Kenya and other organizations whose activities and programs may be considered relevant to this project, to enable the consultants to have access to the information necessary to carry out their work program;
8. Provide timely feedback on deliverables.

10. FIRM'S EXPERTISE

Engagement of Stakeholders & Management Strategy

Due to the scope and complexity of this project, various stakeholder groups and levels will be involved. The vendor's methodology should describe how, by whom, and to what extent stakeholder interaction will be handled throughout the project. The response should cover the following topics:

- Methodology for identifying, analyzing, and evaluating the types, expectations, and involvement of stakeholders
- The formation and management of governance, boards, committees, and teams - Workshops, meetings, get-togethers, or sessions with various stakeholder groups
- Any other forms of communication that will be sent to the stakeholder, such as reports, consultations, informed/announcements, etc.
- Some parts of the project require multi-team and it is critical that firm should demonstrate how the multi-team will be setup to drive the development of various components.

Organization and project team structure:

The bidder is expected to provide the proposed organization and project team structure including

1. The Key Personnel, for appropriateness for the successful performance of the Work required to deliver the Project.

The Lead Key Personnel team should include the following experts, who should be Kenyan Citizens.

- **Project manager** – project Manager lead with 5 years of experience and Project management professional certifications eg. Prince2, PMP, Scrum Master
- **Program manager** - Program Manager lead with 5 years of experience in programs & product management and professional certifications in product design, program management and professional certifications eg. ITIL v3, project Management, Software Development.
- **Software Architect** – with at least 8 years of experience and expertise in Programming languages, API integration, customization, software development, database management. Relevant programming or development certifications.
- **Network Security Architect** - Network architect with at least 8 years of experience and Network Security professional certifications. E.g. CISSP, CCNP-Security
- **Network Architect**: Network architect with at least 8 years of experience and Network professional certifications. E.g. CCNP, ACE-7, or HCSP
- **Cloud Architect** - Cloud Architect with at least 5 years of experience, expert certifications in Azure/Google/AWS Cloud Architecture and Cloud Security and VM ware professional certification

- **Datacenter & Electrical Engineer** - Electrical Engineer with an Electrical Engineering degree and more than 10 years' of experience, Registered Electrical Engineer registered with Engineers Board of Kenya (EBK) and accredited with Uptime Institute Accredited Tier Designer (ATD).
- **Compute Infrastructure Architect** – Compute Infrastructure architect with at least 5 years of experience in enterprise compute systems, storage systems and professional certifications in compute and storage systems.
- **Virtualization and Containerization Architect** - Virtualization and Containerization architect with at least 5 years of experience in Virtualization and Containerization and holding Professional certifications in Enterprise Linux OS, Containerization/Micro-services Technology and Virtualization.
- **Service Delivery Manager** – Service Delivery Manager lead with 5 years of experience Service Delivery with professional certifications in IT service delivery eg. ITIL v3

11. PROCUREMENT METHOD

KEMIS Critical Information Infrastructure

Due to the security nature of student and parent bio information kept in the platform, it is recommended that the procurement takes security nature of system procurement. It is also recommended that firm develop and handover the maintenance and management of KEMIS to Government System Developers once onboard.

With funding already identified through **KDEAP World Bank**, it is recommended that we go the International Tender way so that skilled firms are engaged to help establish the KEMIS Platform. The tender can be **Request for Bids (RFB)** since sector have been documenting the requirements and system features, hence no need for EOI and later RFP.