

TERMS OF REFERENCE

Technical Assistance to Support the Integration of the Rwanda Education Management Information Systems

I. Purpose	The purpose of this consultancy is to support the improvement of the efficiency and effectiveness of the education management information systems (EMIS) in Rwanda.
II. Objectives	<ul style="list-style-type: none"> ✓ To develop and implement education metadata standards and an interoperability framework; ✓ To establish the education data service bus and data warehouse; ✓ To upgrade and integrate the main core systems of the EMIS; ✓ To deploy the integrated EMIS and build data producers and users' capacity to use the system and education data.
III. Background	<p>An Integrated Education Management Information System (IEMIS) is a critical tool for providing the education sector with accurate and relevant information to inform its policy decisions and implementation approaches. Although the Ministry of Education (MINEDUC) and its agencies¹ have data and information systems in place, inefficiencies in those systems reduce the effectiveness of planning, management and decision-making processes and, ultimately, compromise the quality, sustainability and equity in education. In 2017, an initial exploratory mapping on education data systems identified 12 unique education databases also in use by the Rwanda Education Board (REB), Workforce Development Authority (WDA), Higher Education Council (HEC), and MINEDUC, each managed by different departments and developed for different purposes. The twelve identified databases are not linked or coordinated, which creates limitations for collecting, storing, analyzing and using data. In addition, there are many data inconsistencies and duplication of efforts between the identified data systems, which lead to weak and inefficient reporting processes.</p> <p>In 2019, UNICEF, in partnership with MINEDUC, and through support from Mastercard Foundation, conducted an in-depth assessment of the EMIS, focusing on the education sector business structure and processes, data needs and utilization, information systems and the technology architectures currently in use.</p> <p>The key outcomes of this analysis highlight:</p> <ul style="list-style-type: none"> • the lack of clear EMIS policies, procedures and processes; • weak coordination with other sectors; • lack of harmonized metadata standards, and; • weak capacity to support: <ul style="list-style-type: none"> ○ statistics strategy and development, ○ information systems design and development; and, ○ trainings related to data production and utilization for education stakeholders.

¹ Rwanda Education Board (REB), Workforce Development Authority (WDA), Higher Education Council (HEC)

	<p>The 2019 baseline assessment also points at the existence of multiple systems that collect the same data multiple times from the same source (redundancy), which leads to the fact that current applications, systems and technologies are:</p> <ul style="list-style-type: none"> • only meeting some of the needs of various education institutions, but are inadequate to support the overall education business structure and processes; • implemented without regard to common standards and an interoperability framework. <p>Consequently, MINEDUC with support from UNICEF is aiming to improve the overall education management information system by addressing issues related to:</p> <ol style="list-style-type: none"> 1. Demand for and utilization of quantitative and qualitative education data at national and local levels with respect to the education sector strategic view. 2. Organizational framework that supports data collection, availability, and use. 3. Functional, technical and operational requirements of the systems that support the technical aspects of education data management. 4. Data analysis, information accessibility and use. <p>In this regard, UNICEF is partnering with MINEDUC to recruit an experienced firm to implement the key recommendations and roadmap of the Integrated EMIS architecture. This work shall allow to create a strengthened culture of evidence-based decision-making processes, and to ultimately improve efficiency in the education sector.</p>
<p>IV. Scope of work</p>	<p>This consultancy will proactively engage all relevant stakeholders to develop a comprehensive and integrated education management information system as per the recommendations of the EMIS assessment.</p> <p>The work will build on the implementation roadmap for the IEMIS enterprise architecture, the IEMIS policy and other existing education policies, the national strategy for the development of statistics, as well as ICT policies and the Rwanda Government-Wide Enterprise Architecture Framework.</p> <p>The metadata standards definition and implementation shall include the following key components:</p> <ul style="list-style-type: none"> • Data attributes, which identify technical specifications and parameters that inform how a piece of education data is designed and generated within an information system. It shall include field length, element type, permitted values, code sets, technical translations (formats), storage location, data source and target (technical), load time, privacy and security attributes in compliance with national and international regulations, and all other relevant aspects. • Metadata around data management, which conveys information about data meaning, availability, limitations, calculation, purpose, owner, steward, data source and target (operational), time parameter, treatment, history, retention, access, read and write permissions, and security, etc. • Metadata around data analysis, reporting and use, focusing on data quality. <p>Further, the implementation of the metadata standards shall be complemented by the adoption of an interoperability framework for the core systems of education sector. This</p>

framework will be jointly and mainly developed by the system integration architect and the metadata specialist.

Building off the metadata standards, interoperability framework and the analysis of business processes and needs, the selected firm will develop an enterprise service bus and data warehouse to facilitate data integration.

The Enterprise Service Bus and the Data Warehouse shall be developed based on an iterative methodology, latest technologies and a service-oriented architecture. It shall provide a platform to integrate various data sources, create composite data views, host data services that make integrated data available as a service to internal and external end-users for easier reuse and to allow other external systems to interact with education data easily. It shall incorporate the “Extract, Transform and Load (ETL)” system to:

- Extract data from multiple source systems and other external sources
- Transform data in different formats to a unified form expected by the Education Data Warehouse as defined in the metadata standards.
- Load or store the transformed data in the Education Data Warehouse.

The Enterprise Service Bus and the Data Warehouse need to support, secure and manage data access, data transformation and validation and the ability to combine data from multiple sources in a single query or support nested queries across multiple data sources. Some of the key features to take into consideration in building the Enterprise Service Bus and Warehouse include:

- Ability to expose any data store as a web service or representational state transfer (REST) resource;
- Support for a wide range of data sources;
- Support for a wide range of databases;
- Support for a wide range of transport protocols;
- Ability to transform and validate data in order to provide quality assurance;
- Ability to combine data from multiple data sources in single response and to support nested queries across data sources;
- Comprehensive management & monitoring web console;
- Ability to ensure data security and provide post-attack forensics;
- Role-based access control of data read and write operations;
- Embedded monitoring and evaluation (M&E) tools to ensure IEMIS is meeting design goals.

The development of IEMIS shall be built with open standards and open system so that they align with the Rwanda Government Enterprise Architecture (RGEA) and principles of digital development. It will involve the upgrading of the School Data Management System (SDMS) and Teacher Management Information System (TMIS) as building blocks for an integrated EMIS with linkage to post-secondary education systems, including the Technical and Vocational Education Training Management Information System (TVET-MIS), Higher Education Council Management information System (HEC-MIS) and UR’s Integrated Electronic Business Management Information System (IEBMIS) via an Enterprise Service Bus. It will also entail building analytical and query tools to create data view dashboards, based on relevant statistical

	<p>methods, for different stakeholders interested in education data as well as defining secure application program interfaces (APIs) for external system access and integration as well as promoting third-party application development.</p> <p>Further, the selected applicant will provide support to Ministry of Education and its agencies to deploy the IEMIS, engage and build stakeholders capacity at national, district, sector and school level to use the system and education data for planning and decision making. This includes both initial stakeholder training but also working with stakeholders to define user scenarios and ongoing programs and policies to maintain enough capacity for the purpose of ensuring sustainability.</p> <p>Quality assurance of deliverables will be undertaken through a taskforce composed by key stakeholders and academics specialized in education policy analysis, data science, statistics, machine learning, ICT, and education research. These will define system design goals and key performance indicators (both qualitative and quantitative) to measure progress in meeting these goals.</p> <p>The firm is expected to adopt a contextualized approach, define the set of processes, techniques and activities they will use to perform the tasks described below:</p> <p><u>I.- Development of Metadata Standards for Education in Rwanda</u></p> <p>Task 1: Stakeholders consultation to assess metadata needed in the education sector</p> <p>Task 2: Definition of a metadata model² that links metadata items to existing data elements and data sets.</p> <p>Task 3: Development of technical attributes, data management and data analysis, reporting and use metadata relevant to the Rwandan education system.</p> <p>Task 4: Definition of a comprehensive education data dictionary.</p> <p>Task 6: Implementation of the education metadata system as part of the Data Warehouse.</p> <p><u>II.- Development of an Enterprise Service Bus and Data Warehouse</u></p> <p>Task 1: Development of a detailed interoperability framework based on the metadata specification.</p> <p>Task 2: Installation and configuration of the data service bus and data warehouse, as well as the warehouse database as per the validated architecture</p> <p>Task 3: Extraction of data from the existing core education data management systems;</p> <p>Task 4: Transformation of data in different formats to a unified form expected by the Education Data Warehouse as defined in the metadata standards.</p> <p>Task 5: Loading and storage of the transformed data in the Education Data Warehouse.</p> <p>Task 6: Ensure MINEDUC has the technical IT capacity to maintain the Education Data Warehouse and procedures and policies for maintaining this capacity.</p> <p>Task 7: Develop, publish, and implement a multi-stakeholder security framework to ensure the privacy and integrity of education data.</p> <p>Task 8: Develop, publish, and implement secure APIs for external access.</p>
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² Mapping and illustration of how data elements (variables), metadata items, business rules, subsystems, data repositories, data flows, and information needs relate to one another.

	<p><u>III: Upgrading the core systems (SDMS and TMIS) and integration with TVET-MIS, HEC-MIS and UR-IEBMIS</u></p> <p>Task 1: Agree with MINEDUC and its agencies on all the proposed modules by the IEMIS architecture</p> <p>Task 2: Agree on metadata and data dictionary to be considered and refine data fields accordingly</p> <p>Task 3: Develop the agreed modules, including functionalities/interfaces that support school management and operations, sector plans indicators tracking, as well as the monitoring and evaluation of the IEMIS key performance indicators;</p> <p>Task 4: Integrate the core systems with TVET-MIS, HEC-MIS and UR IRBMIS and build query visualization, and analytical tools based on relevant statistical methods and strategies for data analysis and dissemination, as well as interactive users’ interfaces through consultation with and feedback from stakeholders regarding different user scenarios and display options.</p> <p><u>IV: IEMIS Deployment and capacity building</u></p> <p>Task 1: Testing of the new modules and the IEMIS as a whole at national, district, sector and school level</p> <p>Task 2: Refining the modules and all IEMIS functionalities</p> <p>Task 2: Developing the content of customized user guides for each category of stakeholder</p> <p>Task 3: Developing training tools relevant to trainers and education stakeholders</p> <p>Task 4: Setting up the helpdesk ticketing system for both technical and functional support.</p> <p>Task 5: Implementation of training for data producers and users including a minimum of 8,000 school leaders, 416 Sector Education Officers, 30 District Education Officials, and 30 staff at MINEDUC, as well as supporting all stakeholders to develop continuous training plans to maintain capacity.</p> <p>Task 6: Engagement of stakeholders on education data analysis and utilization for planning.</p>
<p>V. Deliverables</p>	<p>Under the supervision of MINEDUC and UNICEF, the following reports are required and must be validated with the participation of all key stakeholders at national and local levels:</p> <p><u>I. Development of Metadata Standards for Education in Rwanda</u></p> <ol style="list-style-type: none"> 1. Availability of the education metadata system 2. A report that documents the metadata standards, interoperability framework and the governance of the functionality of the education metadata system <p><u>II. Development of an Enterprise Service Bus and Data Warehouse</u></p> <ol style="list-style-type: none"> 3. Availability of a detailed interoperability framework and a functional Enterprise Service Bus and Data Warehouse 4. A report that documents the technical attributes and functionality of the Data Warehouse. 5. A report that documents the security framework for the Data Warehouse. 6. A report that documents the Data Warehouse API for external parties.

III. Upgrading the core systems (SDMS and TMIS) and integration with TVET-MIS, HEC-MIS and UR-IEBMIS

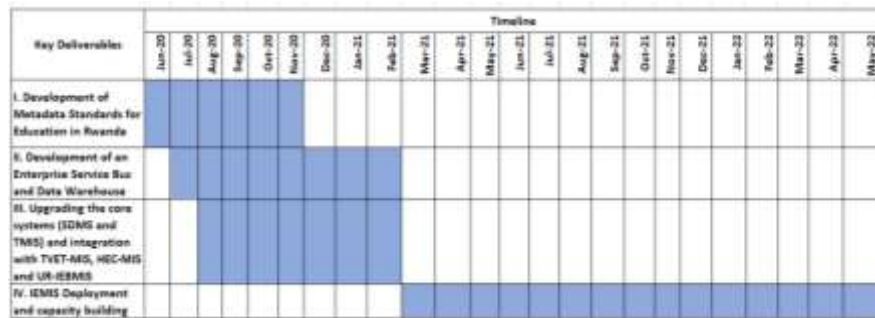
7. Availability of the Integrated Education Management Information System (IEMIS) building on SDMS and TMIS integrated with TVET, HEC and UR MISs;
8. Availability of interactive visualization, analytical tools based on appropriate statistical methods, and strategies for data analysis, dissemination and use;
9. A report that documents functionality of the IEMIS, as well as methodology for data analysis, dissemination and utilization framework.

IV: IEMIS Deployment and capacity building

10. The IEMIS is tested among the users and is fully functional;
11. Content for user guides are developed for all categories of stakeholders
12. Training tools on IEMIS functions and data analysis and use are developed targeting users’ needs for capacity building
13. On and off the job trainings are implemented for national users from MINEDUC, WDA, HEC, district and sector users from the education units, as well as school leaders
14. The helpdesk is in place and operational.

VI. Timing and duration

The consultancy work shall start on 1 June 2020 and last 24 months in total.



VII. Qualifications and Experience

Applying institutions must meet the following criteria:

- Minimum 8 years of working experience in integrated information management systems development, data science projects and demonstrated technical expertise in a relevant field.
- Capable of recruiting and building a team of national and international experts with a high level of relevant expertise in Business Analysis, Business Intelligence, Metadata Standards and interoperability framework, Information Systems Architecture, Information Security, Software Development, Database and Applications Administration, Data Science, Data Analyst or other relevant areas.
- Proven technical expertise and experience in stakeholders’ analysis, processes modelling and requirements specification.
- Proven experience in the development and implementation of integrated information system architecture plans.
- Proven expertise in capacity development at national level.

- Experience working in Rwanda on Information, Communication Technology is an asset.
- Must be a legally certified and registered institution.

The selected institution shall assign four international senior experts, respectively, in Metadata Standards and Interoperability Framework, System Integration Architecture and Data Service Bus and Warehouse Development, Software Development, and Data Science. Further, the selected applicant is expected to work closely with the MINEDUC's Chief Information Officer and EMIS and Education Statistics Specialist, two national software development officers, one Database Administrator, one Data Analyst, one Business Analyst and four training officers. **The experts shall be based at the Ministry of Education for the total duration of the technical assistance.**

1.-The **Metadata Specialist** must fulfil the following qualifications:

- Proven working experience with data lifecycle management and governance, metadata management, with enterprise data catalog, with ETL processes that include data profiling and data quality, data integration, education sector and/or with another relevant field.
- Advanced university degree and proven technical expertise in Information Technology, Computer Science and/or other relevant areas.
- Ability to develop Metadata and Data Lineage Solutions for multiple data sources across on-premise and cloud environments in accordance with Data Governance Standards, Policies and Procedures.
- Familiarity with conceptual, logical and physical data modelling and data dictionaries and semantics, syntax and taxonomies.
- Demonstrated interpersonal and consultative skills and capable of facilitating workshops with stakeholders with diverse backgrounds.
- Good oral and written communication skills.
- Good organizational, analytical, conceptualization and problem-solving skills.
- Fluency and excellent writing skills in English required.
- Good knowledge of the Rwanda public sector and the education system is an asset.

2.-The **System Integration Architect** must meet the following criteria:

- Proven experience developing and implementing strategic system architecture plans, enterprise resource planning system, including development of data service bus and data warehouse.
- Advanced university degree and proven technical expertise in system architecture development, Computer Science, Computer Engineering, Systems Engineering, information technology, information systems or other relevant areas.
- Proven technical expertise in integration architecture, application to application integrations, services, internal and external API, file transfer, information security, role-based data access, and electronic data interchange (EDI).
- Good knowledge of requirements analysis and decomposition, of design, development, internal testing, and the documentation of same for the application to

application integrations, of troubleshooting existing integrations and providing technical support to the application development team.

- Familiarity with computer operating systems, applications and software development processes and tools (design and engineering procedures).
- In-depth knowledge and experience with XML, PHP, Python, Java, JavaScript, SSL, Apache, MySQL SQL, PostgreSQL, Linux, Nginx, Windows server 2012 or newer.
- Experience writing Web Services, RESTFUL, or SOAP APIs, as well as experience writing fault-tolerant and secure code.
- Experience in structured release and deployment best practices.
- Good organizational, analytical, conceptualization and problem-solving skills.
- Fluency and excellent writing skills in English required.
- Good knowledge of the Rwanda public sector and the education system is an asset.

3.-The **Senior Software Developer** must meet the following criteria:

- Proven experience with information systems, applications and software development.
- Advanced university degree and proven technical expertise in Computer Science, Software Engineering, Systems Engineering, information technology, information systems or other relevant areas.
- Proven technical expertise in designing, developing software and interfaces.
- Familiarity with computer operating systems, applications and software development processes (design and engineering procedures).
- Familiarity with PHP, Java, JavaScript and SQL
- Good organizational, analytical, conceptualization and problem-solving skills.
- Ability to oversee and manage a team of software development officers.
- Fluency and excellent writing skills in English required.

4.-The **Senior Data Scientist** must meet the following criteria:

- Proven experience with the development of data analytics features and tools, programming languages (R, Python, etc.) and application of machine learning principles.
- Advanced university degree and proven technical expertise in Statistics, Applied Mathematics, Computer Science, Data Science, or similar.
- Track record of designing and developing dashboards
- Ability to devise and oversee data-driven projects.
- Familiarity with data querying languages, and statistical or mathematical software.
- Good organizational, analytical, conceptualization and problem-solving skills.
- Fluency and excellent writing skills in English required.

VIII. Payment Schedule

Deliverables/Reports	Timing	Payment Schedule
1.- Development of Metadata Standards for Education in Rwanda	6 months	10%
2.- Development of a Data Service Bus and Data Warehouse	8 months	20%
3.- Upgrading the core systems (SDMS and TMIS) and integration with TVET-MIS, HEC-MIS and UR-IEBMIS	7 months	40%
4.- IEMIS Deployment and capacity building	15 months	30%

The payment schedule will be based on the delivery of quality final products. The timeframe for each stage of the consultancy should be presented in the technical proposal and the payment schedule in the financial proposal. Payments will be made only based on the quality completion of deliverables, as approved by MINEDUC and UNICEF.

UNICEF reserves the right to withhold all or a portion of payment if performance is unsatisfactory, if work/outputs is incomplete, not delivered or for failure to meet deadlines.

The products and deliverables of this consultancy are not the property of the consultancy firm. No deliverables may be shared or published without written permission from MINEDUC/UNICEF. MINEDUC/UNICEF will be free to adapt and modify them.

IX.- Reporting Requirements

For all contractual issues, the consulting firm will report to UNICEF. For technical issues, the consulting firm will work directly with the technical team, led by MINEDUC and UNICEF. All deliverables must be approved by MINEDUC and UNICEF in order to be considered final.

The consultancy firm is expected to use his or her own equipment, including computers. UNICEF premises will be available for meetings and collecting inputs from other partners.

The consultancy firm shall not make use of any unpublished or confidential information, made known to him in the course of performing his duties under the terms of this agreement, without written authorization from MINEDUC and UNICEF. The products of this consultancy are not the property of the consulting firm and cannot be shared without the permission of MINEDUC and UNICEF.

The consulting firm shall abide by and be governed by **UNICEF Procedure on Ethical Standards in Research, Evaluation and Data Collection and Analysis which can be accessed here:** https://www.unicef.org/supply/files/ATTACHMENT_IV-UNICEF_Procedure_for_Ethical_Standards.PDF

X.- Evaluation Criteria of Technical and Financial Proposals

Separate Technical and Financial proposals should be submitted in sealed envelopes. Evaluation will be done based on a 70 % technical and 30% financial criteria for each component. Bidders must score a minimum of 49 points on the Technical Proposal and meet the mandatory qualifications listed below to be considered technically compliant for the component, and in order to be contacted for the financial proposal submission:

1. **Technical proposal:** The technical proposal shall include the firm’s overall understanding of the terms of reference, relevant expertise and experience for this assignment, the proposed approach to the consultancy, a workplan and a realistic implementation timeline and relevant documentation of previous assignments to demonstrate level of expertise. The proposal must include CVs of individual experts, as well as contact references from three clients for which similar work has been carried out in the last 8 years.
2. **Financial proposal:** The applicants should also submit a financial proposal outlining the total costs for this consultancy with payment linked to the 4 main deliverables outlined above.

Technical Evaluation		Max	Min
1.- Overall Response & Methodology	Max Score		
Understanding of scope, objectives and completeness of response	10	20	14
Quality of the proposed approach, methodology and implementation plan	10		
2.- Proposed Team and Organisational Capacity	Max Score		
Institution and Team Members experience	20	50	35
Technical expertise of the proposed team members	20		
Technical expertise of the bidder	10		
Total Marks For Technical Component		70	49
3.- Financial Proposal			
Full points are allocated to the lowest priced proposal that meets the minimum score on the technical proposal. The financial scores of the other proposals will be in inverse proportion to the lowest price.		30	N/A
Total Marks		100	

Please note that this consultancy is contingent on availability of funding.

XI.- Confidentiality

Unless otherwise specified, the selected institution shall keep confidential all information and documentation being shared by UNICEF, MINEDUC and its agencies.

XII.- Contract Management and Administrative Matters

In support of MINEDUC, UNICEF-Rwanda will be responsible for the selection of the firm to conduct the work described herein and will ensure administrative supervision. UNICEF will issue the contract and pay the selected firm, based on the terms agreed in the contract and after the approval of the deliverables by MINEDUC. UNICEF's Education Specialist - in collaboration with MINEDUC - will manage the contract and be the focal point for all contractual matters.

The institution will be responsible for all logistical arrangements associated with this contract. Other expenses such as travels, visas, banking/cash services, or office space and equipment (including computers and photocopiers) shall be under the responsibility of the selected firm.

XIII. Mandatory Administrative Documents required

1. Legal Registration Documents
2. All BIDDERS are expected to share FINANCIAL AUDITED REPORTS for the LAST THREE YEARS (2018/2017) – 2019 IF AVAILABLE.

XIV.- How to Apply

Applicants must submit their proposal to rwasupply@unicef.org by 18 June 2020 before 23:59 pm (Kigali Time). Qualified firms whose technical proposal meets the selection criteria will be contacted for financial proposal submission.

Financial and Technical Proposals must be separated and mailed differently, only suppliers' whose technical proposal meets the minimum score will be financially evaluated

Please submit applications to UNICEF-Rwanda at: rwasupply@unicef.org with the following subject,

1. **Email 1: "Technical Proposal - Assistance to Support the Integration of the Rwanda Education Management Information System."**
2. **Email 2: "Financial Proposal - Assistance to Support the Integration of the Rwanda Education Management Information System."**