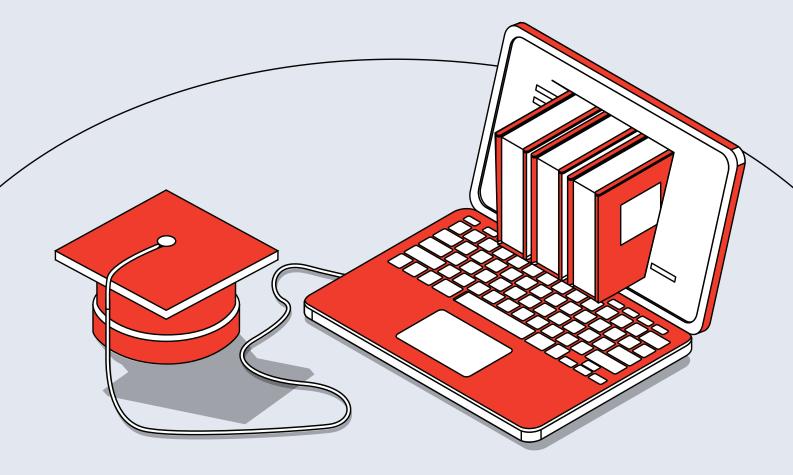Higher Education Management
Information System
FEASIBILITY STUDY

PRISHTINA, October 2021

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Information System

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CONTENT

TABLE OF ACRONYMS

MESTI
Ministry of Education, Science, Technology and Innovation

KAA
Kosovo Accreditation Agency

HEI
Higher Education Institution

AIS
Agency for Information Society

CRA
Civil Registration Agency

KAS
Kosovo Agency of Statistics

EARK
Employment Agency of the Republic of Kosovo

NARIC
National Centre for Diploma Recognition

HEMIS
Higher Education Management Information System

SEMS
Higher Education Management Information System

e-Accreditation
Informative System for Accreditation of Institutions and Programs

1. INTRODUCTION

In support of the Ministry of Education, Science, Technology and Innovation (MESTI), the Quality, Accountability, Integrity and Transparency in Higher Education (QAINT) Project aims to align the Kosovo higher education with the international standards for quality, transparency, integrity and accountability. The long-term impact of this project is to improve the quality and competitiveness of the higher education sector with the aim of contributing to social and economic development of the country.

The Ministry of Education, Science, Technology and Innovation (MESTI) uses the Higher Education Management Information System (HEMIS) to collect, store, secure and report statistical data that serve as the basis for drafting and monitoring higher education policies.

This document aims to identify technical problems of the Higher Education Management Information System (HEMIS) and to provide necessary information about the background and scope of system advancement or development, namely functional requirements and general technical requirements for future upgrade and application of Higher Education Management Information System (HEMIS) for the Ministry of Education, Science, Technology and Innovation (MESTI).

The scope of this document is as follows:

- Provides a description of the **existing management information system** in MESTI;

- Provides a general **concept of the system and its objectives;**

- Specifies **functional requirements** for the system modules;

- Specifies general **technical requirements** and directives for the future system.

2. DESCRIPTION OF EXISTING SYSTEM

The Higher Education Management Information System (HEMIS) was developed for the first time in 2018 and is used to collect and monitor higher education data, where the accredited and licensed Higher Education Institutions (HEI) in Kosovo register their students for Bachelor, Master and PhD studies in line with deadlines stipulated in the Administrative Instruction AI 13/2018.

Figure 1. HEMIS modules

The following data can be registered/modified in the existing system, within the Administration Module:

- ▶ Institutions
- ▶ Type of Institutions
- ▶ Study Programs
- ▶ Specializations
- ▶ Study Cycle
- ▶ Study Level
- ▶ Countries
- ▶ Municipalities
- ▶ Nationalities

- ▶ Student Type
- ▶ Student Enrolment Types
- ▶ Study Drop Outs
- ▶ Staff Type
- ▶ Academic Grades
- ▶ Academic Titles
- ▶ Positions
- ▶ Enrolment Deadlines

Through this module, the Ministry of Education, Science, Technology and Innovation (MESTI) opens/closes the deadlines for student enrolment in HEIs by study level. After the enrolment period starts, HEIS proceed with registering students by filling in the following fields:

- ▶ Personal Number
- ▶ Name
- ▶ Parent Name
- ▶ Surname
- ▶ Date of Birth
- ▶ Gender
- ▶ Country of Birth
- ▶ Place of Birth

- ▶ Residential address
- ▶ Municipality
- ▶ Nationality
- ▶ Faculty
- ▶ Study Year
- ▶ Study Program
- ▶ Study level
- ▶ Study Language

In the existing system the study year registers as a calendar year, whilst there is no option to confirm whether the student has enrolled for the first time or whether the student has been transferred from another program/institution. In addition, the module contains no data about the student's current year of study; whether the student has graduated or has dropped out of studies.

One of the faults of this module is the possibility of importing student data via CSV file; the system does not include and list all of the students, since the fields within the system and database are not validated (required as mandatory).

There is a KAA module in the existing system, but the module is empty and non-operational. This module should have been integrated with the Kosovo Accreditation Agency (KAA) database, so the following information could be automatically transferred to HEMIS through web services:

▶ Accredited Institutions

▶ Accredited Programs

▶ Program Codifications

▶ Deadlines as per the drafted decisions

▶ Accreditation Decisions

▶ Accredited Institutions' academic staff

▶ Number of enrollments per study area

▶ Allowed number of student transfers

The User Administration Module currently provides the registration of students, but the same does not provide the option of assigning a user's role. At present, the module shows the whole list of institutions, instead of the user's institution only; this is not in compliance with the user role management within the system, which affects the protection of data access as well.

The Reports Module provides various filtering options, but reporting by study levels, student enrollment periods, levels and faculties is missing. The module is closely related to the diagrams in the dashboard, but the diagrams only display student data by study level, study type, gender and nationality for all the years and there is no option to disaggregate and filter diagrams by year.

TECHNICAL INFRASTRUCTURE

HEMIS was build based on Microsoft (.NET) technology and implemented in MS Windows Server 2012, MS SQL Server 2014 and MS IIS. The system is placed in the Government Data Centre. All licences are part of the Licensing Agreement of the Government of Kosovo with Microsoft.

CONCLUSION

Based on the requests to modify and upgrade the features of HEMIS and decisions of MESTI to implement these modifications and to ensure a unique and sustainable overview of higher education data, a new HEMIS system should be developed, using the latest technology and all the data from the existing HEMIS system should be migrated to the new database. To avoid manual data entry errors, the system should be integrated/linked to other relevant institutions' databases.

Such an integrated approach is crucial in order to have a system that will ensure interaction and integration with other institutions in the Republic of Kosovo. The implementation of the Higher Education Management Information System (HEMIS) will be achieved by:

1 Implementing the linkage between HEMIS and e-Accreditation for HEIs data transfer;

2 Implementing the linkage between HEMIS and Civil Registration Agency (CRA) to verify and transfer students' personal data;

3 Implementing the linkage between HEMIS and Ministry of Internal Affairs (MIA) database to verify and transfer international students' personal data;

4 Implementing the linkage between HEMIS and Electronic Students Management System (SEMS) to transfer student data of public universities;

5 Implementation of HEMIS connection with databases/systems of Higher Education Institutions (HEIs);

6 Implementing the linkage between HEMIS and the state Matura database in order to display the passing points.

With the completion of these tasks, a two-way communication between MESTI and HEIs will be applied, along with the synchronization of data with other relevant public registries for higher education data (KAA, CRA, MIA, etc.).

3. HIGHER EDUCATION MANAGEMENT INFORMATION SYSTEM - FUNCTIONAL REQUIREMENTS

Higher Education Management Information System should be built as a **new system**, closely related/linked to e-Accreditation, SEMS and Civil Register.

The system should have the following features enabled:

1 Higher Education Institutions (HEI) Register
Initial data will be migrated from the existing HEMIs database and will adequately be compared to KAA. The module will contain all information about Higher Education Institutions (HEIs), including:
a) Accredited study programs, date of accreditation, end of accreditation date, study levels, ECTS and registration and transfer quotes;
b) Academic and non-academic staff register;
c) Infrastructure data register, including the facilities for theoretical study and practical activities, labs, administration offices, libraries, list of equipment;
d) The licence by MESTI for a HEI should be generated through HEMIS and committee members may digitally approve/decline the licence.

The KAA will notify HEMIS for any change in data via notification services.

Minimal data package: accreditation program, from (date), to (date), ECTS, quote.

2 Historical overview of changes in HEIs
Initial data will be migrated from the existing HEMIS database and will adequately be compared to KAA. The historical overview should show all the changes within a HEI, including current and expired accredited study programs, existing and past academic and administrative staff, existing and past campuses, existing and past licences.

3 Student data register
Initial data will be migrated from the existing HEMIS database and be adequately compared to KAA, MIA and SEMS. This module will contain all student information including: personal data, data of the HEI in which the student is enrolled, study program data, study mode, study cycle, study field, grading, study language, date of enrollment, graduation date, drop out date, transfer date, the HEI in which the student is transferred, the study program where the student is transferred, compatibility of study programs (in cases of transfer). This module should enable:

a) To register students by academic year;
b) Display of state Matura exam points;
c) To register transfers of students from a HEI to another;
d) To register transfers within a HEI, including information about the program from which the student is coming and the one where the student is transferred;
e) To register students in more than one program;
f) To register student grading/upgrading from one year to another and the end of studies (graduation or drop out/withdrawal of studies);
g) To register students with disabilities;
h) To create access for students (upon student registration in HEMIS, an automatic email is sent to the student with access information).

The CRA will notify HEMIS for any change in data via notification services.
Minimal data package: personal number, name, parent name, surname, gender, date of birth, country of birth, residential address, municipality.

4 Historical overview of changes in students' register

Initial data will be migrated from the existing HEMIS database and will be adequately compared to CRA. The historical overview should show all the changes in the student file, including personal data, data of the HEI in which the student is enrolled, study program data, study type, study cycle, study field, grading, study language, date of enrollment, graduation date, drop out date, transfer date, HEI in which the student is transferred, study program where the student is transferred.

5 Diploma validation

Initial data will be migrated from the existing HEMIS database and adequately compared to MEST and NARIC. NARIC to have the opportunity to validate diplomas through HEMIS online.

6 User management

Role-based access control should be used in the user management module. The module should contain forms of registering roles, privileges and users. These forms should be dynamically developed, where the User in the role of Admin is entitled to assign personalized privileges to roles and users, selecting the modules and forms that are allowed to be accessed by a user. System safety will be ensured by identifying users in the system and their username and password will determine the access to various system modules subject to user's role. None of the users should have access to a certain module if no privilege has been previously assigned by administrator. The administrator is the only person to control the privileges of different roles, such as:

▶ Data access
▶ Data entry
▶ Data modification
▶ Data deletion

As part of system safety, there should be options to apply restrictions, to register transactions and other features, such as:

▶ Password expiry
▶ Password complexity requirements
▶ 2FA authentication method
▶ Account lockout when identification fails several times in a row
▶ Full audit of system events (time, event, user, success/failure, user and computer)

7 System management

The Administrator module should be an advanced module and allow for the creation, modification/deletion of all configurable data within the system that are shown in various lists, including: countries, municipalities, HEIs, HEI types, study programs, specializations, study cycles, study levels, registration types, staff types, academic grades, academic titles, positions.

Enrollment deadlines can be registered for each academic year and the system should sent an automatic email to all Higher Education Institutions to inform them whenever enrolments are opened and closed.

8 System audit

The system should provide for full auditing capacity, evidencing any change done by users in the system. A vital part in any data safety strategy is the capability to detect who accessed the system or who attempted to access the system. This ensures the capability to detect unauthorised logins or, if needed, to get insights about activities by malicious insiders who misuse their legitimate access.

The system should possess a mechanism to monitor a wide range of internal events in the database; it is used to detect any blockage, monitor system performance, for correction and many other development and administrative purposes. System audit is a very effective tool because it can pick out individual changes while being applied, including user ID.

9 Dashboard

Dashboard should be able to show the data from last year in numbers and percentages and diagrams should be dynamic and provide for filtering options. Dashboard should be customizable to different users.

10 "Reports

The System should be able to generate dynamic reports, with text and graphs. The system should provide the possibility to generate different statistical and administrative reports defined by the MESTI and the dynamic reporting tool should enable users to generate various reports by created them themselves.
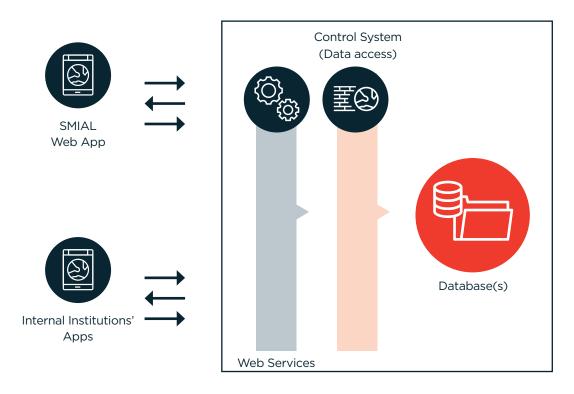
11 Document archiving

All documents issued by the System (licences, certifications) and accreditation decisions, lists of students signed and stamped by HEI should be able to be uploaded in the system and archived.

12 Help Desk Module

Apart from user manuals, the system should also have an interactive user guide. The interactive guide helps the user step by step, highlighting the steps they have to follow to reach a certain goal.

LOGICAL ARCHITECTURE OF THE SYSTEM
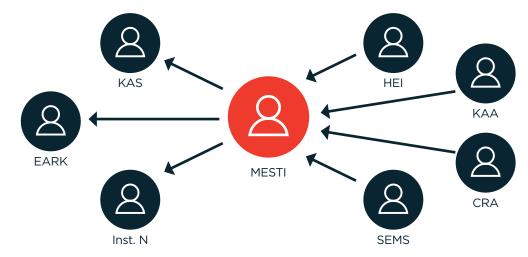
Figure 2. System architecture

As shown, the logical infrastructure is made of several layers and components, such as: system database, data entry layer / control system, Web services, HEMIS Web app and integrated apps.

SYSTEM ACTORS

The figure below presents the system actors and their relation in terms of information exchange:

Figure 3. System actors

● **MESTI**

The main actor in the system is the Ministry of Education, Science, Technology and Innovation (MESTI), whereas all the data and coordination go into in their institution.

● **HEI**

HEIs are another important actor in the system; all data will be periodically collected from them as specified by the MESTI.

● **KAA**

Kosovo Accreditation Agency is another important stakeholder in the system; all data will be automatically collected from them through web services.

● **CRA**

Civil Registration Agency is another important actor in the system; all data will be automatically collected from them through web services.

● **AIS**

Agency for Information Society is another important actor which enables the hosting of the system in the data center and enables the communication of HEMIS with other databases.

● **NARIC**

National Diploma Recognition Center is another important actor in HEMIS who will validate diplomas within HEMIS.

● **SEMS**

Electronic Students Management System is another important actor in the system; all data will be automatically collected from them through web services.
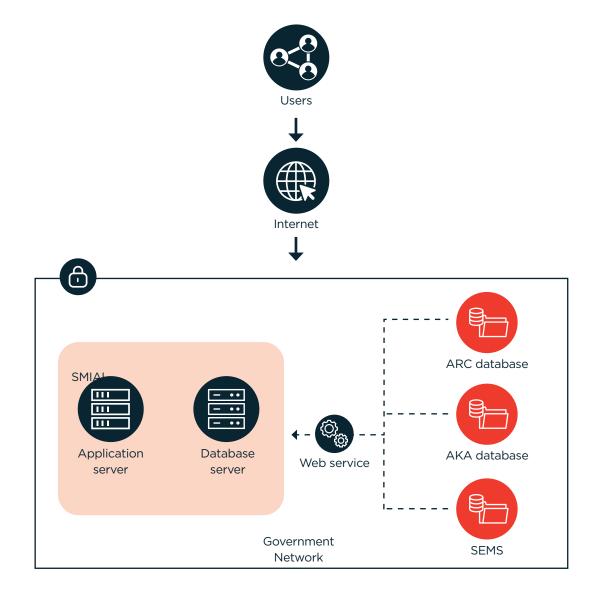
● **EARK**

Employment Agency of the Republic of Kosovo will collect data from the system for their needs regarding employment statistics. HEMIS will allow the Labour Market Barometer to get the data based on their requests through service integration.

● **KAS**

Kosovo Agency of Statistics will collect the data regarding higher education statistics from the system (to meet their needs) or to report to other counterpart statistical agencies, such as EUROSTAT or similar ones.

In the future, other institutions may be linked to the system to collect data/statistics based on the nature of their activity and agreements with the MESTI. Data exchange given below should be enabled using the SOA technology:
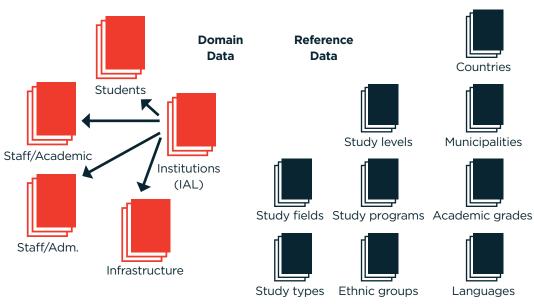
Figure 4. Network architecture

1 Transfer of data from CRA to HEMIS
    a. Information on personal data changes

2 Transfer of data from MIA to HEMIS
    a. Information on foreign students' personal data changes

3 Transfer of data from KAA to HEMIS
    a. Information on accredited institutions
    b. Information on accredited institutions' academic staff
    c. Information on accredited programs

4 Transfer of data from SEMS to HEMIS
    a. Information on students enrolled in public universities

5 Transfer of data from HEI's to HEMISL
    a. Information on students enrolled in private universities

6 Transfer of data from Matura exam to HEMIS
    a.Information for students who have passed the Matura test as well as passing points

DATA STRUCTURE AND FIELDS

The figure below shows the logical structure of system data. These schemes do not include the middle tables or connecting tables in terms of any technology or relationship.

Figura 5. Data structure

The final database structure should be in line with the scheme presented in here, but not necessarily the identical one, in line with the product development, technology used for data storage and the needs of the MESTI.

The structure should be divided in Reference Data and Domain Data.

Reference Data in some technical documents as code tables/reference tables are data used by system for standard reference to information in regards to code exchange or specific field values. These data are stored once in the system, they are configured by the MESTI in the initial phase and rarely or never change.

These tables will be read for HEIs only, but they have to be consumed by their internal systems to be in full compliance with the HEMIS in regards to data operation and delivery.

The data should be considered especially when the third tables are used. HEIs should get these data as a reference to standardize their internal systems. If so far, they have use (their) specific term for the study levels, study types, study programs or any other data presented in here, they can change them according to this information and they will be in full compliance with the MESTI in the future..
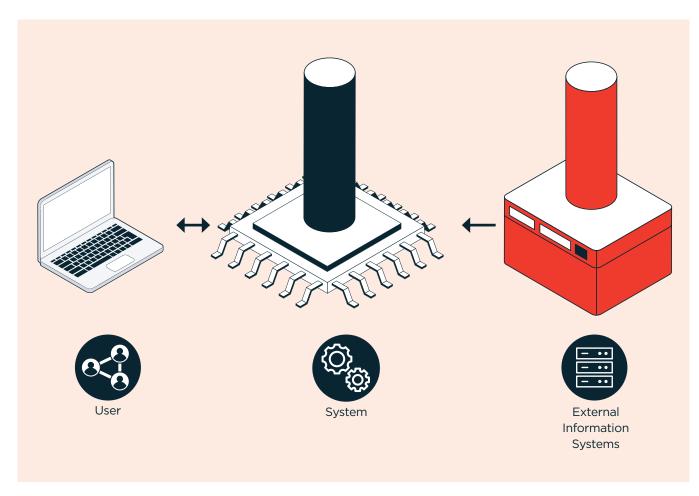
Domain data are data to be periodically collected from institutions.

4. HIGHER EDUCATION MANAGEMENT INFORMATION SYSTEM - TECHNICAL REQUIREMENTS
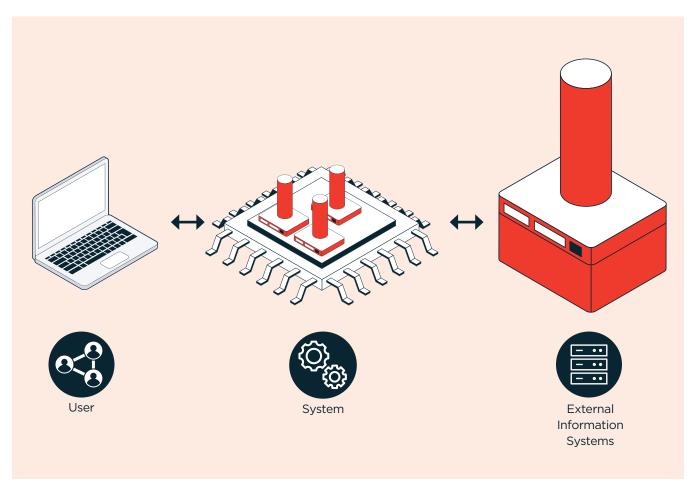
SOA – SERVICE ORIENTED ARCHITECTURE

Since institutions, such as CRA, KAA, HEIs, MIA, already have their information systems in place to support them in their daily activities, and existing contractual obligations with third parties in regards to system maintenance and improvement, the best way to build HEMIS is to create the possibility of having it linked to other systems such as e-Accreditation and SEMS using web services.

HEMIS system architecture in principle will be based on ISO/IEC reference Model of RM-ODP Open Data processing and Service Oriented Architecture (SOA). SOA principles are illustrated in the following three graphs:
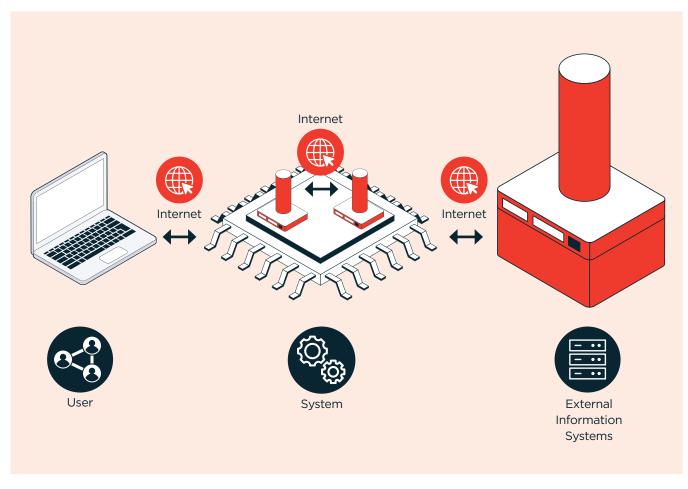
Figura 6. System experience

▶ User will experience a user-friendly system

▶ User will experience a unified system

▶ Web-based User Interface

▶ User will have access to a central system with a shared central database.

▶ User will have access to information in external systems.

Figura 7. Modules

▶ The System will consist of essential, autonomous modules (subsystems)

▶ Each module will be exclusively responsible to manage a part of the total quantity of data in the system

Figura 8. Interaction

▶ The entire communication in the system is based on http/https (Internet) communication protocol.

▶ Data exchange between modules will be implemented using Web services.

5. NEXT STEPS

▶ Procurement procedure for HEMIS development, integration and maintenance, including practical training for system users.

▶ Amendment of existing agreements and signing of new ones (if necessary) in regards to data exchange between public and private institutions.