

PERFORMANCE AUDIT REPORT





State Audit Office of Georgia

"Approved"

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Education Management Information System

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DEFINITIONS OF TERMS

Ministry	Ministry of Education, Science, Culture and Sport of Georgia.				
Agency	LEPL Education Management Information System.				
SABER	Systems Approach for Better Education Results.				
EMIS	Education Management Information System.				
SABER-EMIS	The World Bank Framework Document defining the require- ments of the education management information system.				
eSchool	General Education Management Information System.				
eJournal	Module for recording student's academic performance. eJour- nal is one of the integral modules of the eSchool system.				
Management system	For the purposes of this report, the term management system is used in place of an education management information sys- tem.				
Best practice example	For the purposes of this report, this term includes SABER-EMIS assessment requirements unless otherwise stated in the report.				
Validation	Confirming information provided by schools with the third par- ties or through other control mechanisms.				
Data-driven culture	Data-driven decision-making culture.				
Information system	Any combination of information technology (IT) and actions carried out with the use of these technologies that facilitate management and/or decision-making process.				



EXECUTIVE SUMMARY AND RECOMMENDATIONS

Availability of reliable and timely information is critically important in the development of an education system tailored to the needs of the society. As a result of the development of technology, the use of big data and data analysis has enabled the development of data-driven culture. Through centralized information gathering, automated processing and easy-to-use visualizations, decision makers can timely identify gaps in the process and develop responsive policies.

In order to generate information in the education system, it is important to implement a relevant management information system and to operate it effectively.

The State Audit Office of Georgia conducted performance audit of the education management information system. The audit covered 2015-2018 years, and its objective was to evaluate the general education management information system, its governance and existing security measures.

It is noteworthy, that significant steps have been taken in Georgia since 2011 to develop a general education management information system. Since 2015, an eSchool electronic system has been in place that has greatly simplified several administrative processes and helped to minimize the risks associated with manually performed procedures.

Despite the above mentioned progress, there are still issues that **need to be improved by the Ministry of Education, Science, Culture and Sport of Georgia** (hereinafter – the Ministry) and **LEPL Education Management Information System** (hereinafter – the Agency). The audit identified shortcomings affecting the development of an effective general education management information system and the security of data produced in the system. In particular:

 eSchool system, unlike best practices, does not record such important data as student learning outcomes, health (such as immunization information, patient history, etc.) and other data. This is due to the inconsistent approach of the Ministry and the Agency within the eSchool creation process and the shortcomings in project management. In the eSchool system development process, requirements for information required in the system were not defined. In particular, the modules and the data that should be available to enable the evaluation of the general education sector.

As of today, the system does not have complete information/parameters and it is not possible to link different relevant information. This would allow the Ministry and other stakeholders to adequately assess the education sector and identify strategic directions.

The current state shows that, it is not possible to centrally generate critical data for education sector – the students' academic performance, and ensure timely access of stakeholders on them. In particular, one of the significant modules of eSchool – eJournal is developed only in 16% of public schools and since 2016 to date it has been used in a pilot mode. Accordingly, as in most of schools eJournal has not been developed, the Ministry cannot use the data for strategic purposes. In addition, the electronic journal, due to its incomplete functioning, fails to provide parental access to the student's academic performance on a regular basis.



Consequently, critically important stakeholders of the education system, parents, ministries and schools are deprived of the opportunity to receive information on their learning outcomes (at the level of an individual student, school or country).

- General education management information system does not have pre-built analytical functionality. In particular, so-called analytical dashboards, graphs and data visualizations that would make it easier for the ministry, school and parents to analyze current processes and assess required issues are not available for stakeholders.
- The Agency has made significant steps in establishing ISMS, however, given its scale, the scope of ISMS dissemination is inadequate. Governance and monitoring functions are also not appropriately separated. The audit identified shortcomings in human resource and change management and also in information security incident reporting processes. However, it is important that the Agency does not have a development policy/practice and that the information security manager/officer is not involved at any stage of the system development. The importance of a unified approach to development is also underlined by the fact that one of the primary functions of the Agency is the development of management information systems in the education sector.

All of this represents non-compliance with minimum information security requirements and increases the risk of unauthorized access to confidential information, which may affect the protection of the confidentiality and integrity of the Agency's information.¹

The identified circumstances and shortcomings have a significant impact on the development of an effective general education management information system. This, in turn, has a negative impact on informed and timely decision-making by schools, parents and the Ministry. The following recommendations were issued with regard to the identified shortcomings:

- In order to develop a data-driven culture and facilitate informed decision-making, the Agency, in agreement with the Ministry, should develop:
- eSchool system development plan specifying the appropriate time schedule. This plan, among other things, involves reviewing information in the eSchool system and identifying the minimum data required to achieve the above goals.
- Plan for improvement of system functionality and requirements towards it. This should enable the Ministry and other stakeholders to receive up-to-date information on current issues in the education sector in a timely and easy manner.
- In order to successfully implement the e-journal module in general education institutions and to access all relevant stakeholders, it is advisable that the Agency, in agreement with the Ministry, develop:



¹ The audit team conducted e-school system vulnerability testing, which revealed a number of shortcomings related to security. Due to the sensitivity of the test results, this section is not publicized, and a detailed report has been sent to the management of the auditee.

- The e-journal introduction plan, which, among other things, provides a timetable for the gradual inclusion of secondary education institutions, motivation and commitment mechanisms for schools, and the maximum duration of the pilot phase.
- For effective and efficient information security management system development, it is advisable that:
- The management of the Agency to review the scope of ISMS dissemination and ensure its compliance with organizational goals, stakeholder interests and legislative requirements.
- Separate the information technology governance function from information security oversight and subordinate the person(s) responsible for information security directly to the director of the Agency.
- The management of the Agency to determine the necessary and sufficient human resources. In addition, it is advisable to define the professional development plan of the above-mentioned employees and ensure systematic training.
- To reduce information security risks, develop adequate practice of change management in line with legislative requirements and international standards.

1.INTRODUCTION

1.1 AUDIT MOTIVATION

Human capital is one of the most important resources for the social and economic development of the country. Consequently, the formation of a quality and affordable education system is an important precondition for sustainable development of the country and one of the priorities for the Government of Georgia. The importance of the foregoing direction is stated in a number of strategic² and international documents of Georgia, such as the United Nations (UN) Sustainable Development Goals (SDGs).

The provision of quality general education, in turn, combines various complex issues such as:³

- Ensuring effective communication between a studentand a teacher;
- Providing equal opportunities and quality lessons for students living in different geographical areas;
- Determining the optimal number of teachers and students;
- Identifying teachers' promotion and required qualifications;
- Identifying the infrastructure required for the school and providing it adequately considering the available resources.

Timely and reliable information is an important prerequisite for effective management of these processes. In particular, the collection of quality data in the education sector and the analysis of this data enables to precisely determine the needs, future requirements and strategic directions of the sector. In addition, the above establishes a data-driven culture, ensures making informed decisions and receiving measurable results.

Moreover, technological development has a significant impact on the education sector, which ensures access to information (e-library, virtual classroom, teleconferencing technologies, etc.), simplifying administrative processes and forming better educational process.

In response to the existing challenges, in 2012 an Agency subordinated to the Ministry was established. According to the statute, the Agency is responsible for the following in the education system:

- Introduction of information and communication technologies;
- Development of management information systems;
- Providing information for the decision-making process.

In 2014, the World Bank conducted an assessment⁴ of the situation in the education system aimed at providing technical assistance in developing a strategy for the education sector. The report focuses on the following key issues:

4 Georgia: Technical Assistance to Support Preparation of Education Sector Strategy



² Socio-Economic Development Strategy "Georgia 2020" and four-point reform plan of the government of Georgia. 3 Data for Learning, Building a Smart Education Data System, Husein Abdul-Hamid, 2017 International Bank for Reconstruction and Development/the World Bank.

- Data in the education sector is not qualitative and comprehensive, which impedes the effective identification of strategic directions;
- There is no single agency, based on the information of which it might be possible to create an overall picture of all areas of education (preschool, general, higher education and vocational education) and gather relevant data;
- Strategic decision-making is not adequately utilized in the education system.

In addition, due to the importance of protected information in the education sector and education systems, according to the resolution⁵ of the Government of Georgia, the Ministry and the Agency are classified as critical information system entities.

Given the importance of the education management information system, considering its criticality and the shortcomings identified in the World Bank Assessment Report, the State Audit Office found it expedient to examine the education management information system and its current management practices.

However, as of today, no audit of the education management information system has been conducted in Georgia.

1.2 AUDIT OBJECTIVE

The audit objective is to evaluate the general education management information system, its governance and security practices. Accordingly, the audit answered the following questions:

- 1. How effective is the control environment for implementing and operating a general education management information system?
- 2. To what extent does the existing functionality and data of the system ensure informed and timely decision-making prerequisites?
- 3. How secure is information in the eSchool system?

Based on the audit results, appropriate recommendations were issued to help correct identified deficiencies.

1.3 ASSESSMENT CRITERIA

The World Bank Assessment Framework – SABER⁶- EMIS was selected as the criteria for evaluating the process of implementation of general education management information system, existing functionality and data integrity, which aims to evaluate the education management information system in the country. In particular, the aim of the above framework document is to help countries improve their education management information systems and subsequently make better use of these systems in the process of policy making.

⁶ Systems Approach for Better Education Results, SABER.



⁵ Resolution No. 312 of the Government of Georgia of April 29, 2014 "On the Approval of the List of Critical Information System Entities".

The following criteria were used when conducting audit procedures to evaluate general IT and application controls in the education management information system:

REGULATORY ACTS:

- Law of Georgia on Information Security;
- Law of Georgia on Personal Data Protection;
- Order No. 2 of the Chairman of the Data Exchange Agency of February 4, 2013 "On Approval of Minimum Information Security Requirements".

INTERNATIONAL STANDARDS AND BEST PRACTICE GUIDELINES:

- ISO/IEC 27001:2013 Information security management system requirements (Information technology – Security techniques – Information security management systems – Requirements);
- Standards developed by the National Institute of Standards and Technology (NIST);
- Framework document (COBIT 5) developed by the Information Systems Audit and Control Association (ISACA).

1.4 AUDIT SCOPE AND METHODOLOGY

The auditee is the Ministry of Education, Science, Culture and Sport of Georgia and LEPL – Education Management Information System. The audit covered 2015-2018 years.

According to the best practice, Education Management Information System covers all areas of the education sector: preschool, general, vocational and higher education. The subject of the audit is one of the key components of the education management information system, the general education management information system, eSchool and the general control environment where the aforementioned system is developed/managed. This system has been chosen for a number of reasons: first of all, general education in the education sector is a fundamental basis for the student to build the knowledge of the student on and his/her formation as a full-fledged citizen. In addition, general education is a fundamental right guaranteed by the Constitution of Georgia and the Convention on the Rights of the Child, by realizing which the student acquires basic skills for further life.

Consequently, the improvement of this sector is critically important for the establishment of adequately functioning higher and vocational education sectors. In addition, the general education management information system, eSchool is a state-of-the-art operating system successfully used by all general education institutions. Besides, during the audit, the old system of higher and vocational education was upgraded and a new one was developed. Consequently, given that these electronic systems were in the development and design phase during the audit, no detailed study was undertaken, in addition there is no electronic system for preschool education to generate the desired information.

Given that in addition to the Ministry and the Agency, schools have access to the eSchool system, the audit team studied the functionality available to different types of eSchool users in the



school and resource center. To achieve this goal, in case of 8 (eight) schools and 1 (one) resource center, different types of user assumptions about the system and relevant eSchool functionality were discussed.

In planning and implementing the audit procedures, the audit team was guided by the following audit standards and guidelines:

- International Standards of Supreme Audit Institutions (ISSAIs):
 - Guidelines on IT Audit ISSAI 5300;
 - Performance audit standard ISSAI 3000;
- Information technology audit guide for Supreme Audit Institutions⁷.

THE FOLLOWING METHODS WERE USED TO ANSWER THE QUESTIONS AUDIT:

- study and analysis of the regulatory norms;
- familiarizing with international practice;
- analysis of documentary information;
- eSchool system analysis;
- eSchool system security control testing;
- interviews with auditees;
- interviews with the representatives of schools.

Within the framework of the audit, the detailed evaluation of the education management information system in accordance with the SABER-EMIS framework was also carried out, which is a technical document and the summary results of the mentioned evaluation are attached to this report (see Annex Nº1). From the detailed technical evaluation document, several important components are used for audit purposes that are relevant proceeding from the scale of the audit (the environment required to implement and operate the system, generate comprehensive information in the management system and information security issues).

In turn, the results of the technical report may be used by the technical staff of the Agency and in the process of work on issues related to specific information technologies by the management of the Agency.

⁷ IDI – Handbook on IT Audit for Supreme Audit Institutions



2. GENERAL INFORMATION

2.1 THE IMPORTANCE OF EDUCATION MANAGEMENT INFORMATION SYSTEM

Education is an essential cornerstone of economic and social development of the country. The importance of this area is emphasized in the United Nations Worldwide Sustainable Development Goals (SDGs) plan developed in 2015. The fourth goal of the above plan (SDG 4) "quality education", within which it is important to provide inclusive and equitable education and to provide continuous learning opportunities for all. Figure 1 presents indicators defined under the 4th Sustainable Development Goal (SDGs).



Figure Nº1. The 4th Sustainable Development Goal (SDGs)-ensuring quality education

Quality education involves the development of the knowledge and skills necessary for an individual's social success and self-actualization. To achieve this, it is important to have equal access to education, provide students with necessary knowledge and respond to their needs in a timely manner. The education management information system plays a critical role in the formation of the quality education system, through which facilitates:

- simple communication between the parent and the school, and between the school and the Ministry;
- assessment by the stakeholders (parent, school staff and Ministry as policy maker) using less time and human resources students' academic performance, individual school progress and needs;
- the Ministry should efficiently analyze the current situation and make strategic decisions based on the actual data.

An important prerequisite for the creation of an effective information management system for education is the existence of a centralized, well-functioning and flexible **electronic system**.



2.2 GENERAL EDUCATION MANAGEMENT INFORMATION SYSTEM

In 2012, by establishment of the Agency, significant technological changes were introduced in the education sector and the administration processes were simplified. The purpose of the Agency is to:

- develop information and communication technologies and ensure their availability in the educational process;
- develop management information systems;
- provide information for decision-making processes;
- produce and disseminate educational statistics.

Due to the importance of the Education Management Information System, the Agency, in agreement with the Ministry, has started the establishment of a General Education Management Information System (eSchool) and its implementation in public schools throughout Georgia.

The main objective of the eSchool system is to implement effective management, which involves collection, processing, updating in an online mode and reporting of accurate data. eSchool Information System is a centralized electronic system. Consequently, the information reflected in the system by secondary education institutions is automatically reflected in a single database and available to all authorized persons. The system can only be accessed from devices connected to the Ministry's integrated education network.

The eSchool system includes personal data about students, their parents, teachers and the entire school staff, the total number of students and their socioeconomic status. Schools are required to update this information reflected in the system periodically. Table Nº1 presents the modules and functionality status of the eSchool.

Table Nº1. eSchool modules

FUNCTIONAL MODULES

DRAFTED IN 2015 Administration module Students module Textbook module Teacher professional development Persons manager

DRAFTED IN 2016 Register of secondary education institutions External studens registration

> DRAFTED IN 2018 Maintenance of schools

NON-FUNCTIONAL MODULES

DRAFTED IN 2015 Vehicles/vehicle park Electronic journal (in 335 schools)

> DRAFTED IN 2016 School transport School camps

DRAFTED IN 2017 School monitoring



The development of the above modules has greatly simplified a number of administrative processes. In particular, the automation of manual procedures has helped to reduce the time and risk required for administration.

For example, by developing/implementing a mobility module, school staff can easily manage student mobility issues. In addition, the Ministry can easily access general, administrative data, such as the total number of students and their distribution by regions.

It is noteworthy that prior to the creation of eSchool, the Ministry had to separately request information from each school and then process it. Accordingly, through the development of the system and its use in the day-to-day operations the Ministry managed to increase the efficiency of the above processes.

The eSchool system, in addition to modules related to the administration of the educational process, also includes an **eJournal module**, whose purpose is:

- to develop and manage an electronic timetable;
- electronic control of attendance and academic progress;
- automatic calculation of marks;
- automatic reporting.

The eJournal module made it possible to centrally reflect information on a student's academic performance in a single system across the country and then process it. It is noteworthy that the traditional, paper-based journal that is mandatory for all (private and public) schools fails to generate and unite in a centralized manner the academic performance (marks) of school students at the Ministry level. In case of journal in paper form:

- the legal representative of the student does not have an opportunity to be systematically informed about the academic performance of the child and his/her attendance;
- school management cannot use school-level generated information for school strategic planning purposes;
- it is not possible to process student academic performance data nationwide and use for program and strategic planning purposes.

Accordingly, the traditional process and approach is characterized by low efficiency and flexibility.

The adequate use of the information about the academic performance of the student reflected in a centralized manner in the eJournal module enables the Ministry and school management to provide individual/student-tailored educational processes.

In addition, all of this can be achieved in a more efficient way, which means collecting and processing data using less time resources.

It is noteworthy that in all 2085 public and 228 private schools⁸ of Georgia basic modules of the eSchool system are developed. However, **only 335 public schools use eJournal.**⁹



⁸ Data of the National Statistics Office of Georgia for 2018-2019 school year used to determine the number of schools.9 Data of September 2018.

2.2.1 BUDGET RELATED TO SYSTEM DEVELOPMENT

Despite the complexity of the eSchool system, the costs involved in developing and administering the system are not calculated. This system has been developed by the Agency staff. Accordingly, the budget determines only their payroll rate. Given that these employees are involved in other projects besides eSchool, it is difficult to determine the costs involved in developing the system and its technical maintenance.

AUDIT FINDINGS

International best practice and experience¹⁰ in various developed countries demonstrate that the education management information system and its data should ensure generation of information required for the Ministry, parents and school. Figure # 2 shows the components required for proper functioning of the education management information system.



Figure №2. Components of the education system

Depending on the geographic area, number of schools and users, the implementation of the eSchool system, which includes the eJournal module, is a complex project for successful implementation of which, it is important to consider project management principles.

According to numerous project management frameworks/methodologies¹¹ and SABER-EMIS evaluation, the following principles are important, among other things:

- identifying the persons responsible for the project;
- clearly formulating project objectives and system requirements;
- preparing project implementation plan (including timeframe and schedule);
- determining project-related costs and monitoring actual costs.

Incomplete consideration of the above principles has led to shortcomings, which are discussed in detail in the below chapters.



¹⁰ Estonia, which has started developing the Education Management Information System (EHIS) since 2005. 11 PRINC2, PMI/PMBOK et al. These principles are also important under the IT Governance Framework Document-COBIT5.

3. INCOMPLETE INFORMATION

According to the international best practice, eSchool should include comprehensive information required for the education sector assessment, which should be collected in a centralized manner from all educational institutions.

The information available at eSchool and its centralized management has brought significant benefits to the Ministry. In particular, a practical example of the effective use of the system and the data contained therein is the student mobility and accounting modules. Through the mobility module, after enrolling a student in the school, the Ministry will control in a centralized manner the status of that student (which school he/she goes to, which school he/she moved to, etc.). Accordingly, the system allows to avoid the risks of dual funding associated with student mobility, and the use of the mobility and student registration module has greatly simplified the process of voucher financing for schools. Thus, this process is centrally managed by the Agency and based on eSchool data it became possible to determine the required amount of vouchers for the school after simple analysis.

According to the best practice, SABER-EMIS, the system should contain the information/parameters required to administer processes, evaluate the education sector and determine strategic directions. Identifying the data required to improve processes in the education sector, in turn, should be a formalized and clearly defined process.

Table 2 provides the list of information required in the information management education system according to the best practices and the status of their availability in the eSchool system according to the current situation. The importance of the data has been determined by the World Bank over years in various countries. Accordingly, this information is the preferred practice for evaluating the education sector.

Data types	Description of data	eSchool/ status
	Student demographic data (age, gender, social status, etc.)	\checkmark
	Information about the student from preschool to higher education	×
	Health data (immunization information, disease history, etc.)	×
	Students with special needs	\checkmark
Administrative	Information about education (student enrollment, moving from class to class, leaving class, etc.)	\checkmark
uata	General information about the school	\checkmark
	Information about school efficiency and achievements (ratio of the number of students and teachers, <i>number of students finishing school, etc.</i>)	×
	School infrastructure needs	×
	Rating of schools	×
Financial data	School budget, income, expenses, subsidies	×
	General data of school personnel	\checkmark
Human Re-	School staff salaries	\checkmark
mation	Teacher assessments	\checkmark
	Teacher professional development	\checkmark
Learning out-	Academic performance of students	×
comes informa- tion	National Assessment/Examination Results	×

Table Nº2. Information generated in eSchool system

The table below shows that, unlike the best practice, only 50% of the desired information is reflected in the management information system. This is because the process of setting up an eSchool is ad hoc and does not envisage the basic principles of project management mentioned above.

The ad hoc approach to system development is emphasized by the lack of clearly defined requirements for system functionality and data. There are often cases where the module is developed at the request of stakeholders, but over time at the background of the staff changes they are not used (examples of such modules are presented in Chapter 2 of the report – General Information).

Improving information would enable the Ministry and other stakeholders to improve problem areas and facilitate their administration in relation to different data sets. Namely:

- By connecting the student's academic performance and teacher qualification, it would be possible to evaluate the teacher scheme, identify successful teachers, etc.;
- With regard to learning outcomes and general learning environment data, it would be possible to determine the optimal number of teachers and students, teacher promotion and required qualifications;
- Linking financial costs and learning outcomes;
- Identifying leading schools based on school ratings data and establishing healthy competition between schools.

As it stands, the Ministry and other stakeholders are deprived of the opportunity to conduct such analysis. In particular, only general statistical information is generated based on eSchool data.



4. SHORTCOMINGS RELATED TO THE EJOURNAL DEVELOPMENT

Generating information about a student's academic performance is critically important for evaluating the education sector and providing individualized learning processes. Reflecting this information in a centralized manner and its analysis will enable the stakeholders to identify problematic areas in a timely manner, at the level of an individual student, as well as country and region level. All of this is an important basis for achieving one of the main goals of public education policy – students should receive necessary knowledge.

At present, there is little progress in implementing electronic journals. Figure №3 illustrates the steps of developing an electronic journal.



As the Figure shows, from 2016 to date eJournal has been developed in pilot mode and this module has not been fully implemented in schools. As of now, the scope of eJournal use is limited and a small proportion (16%) of public schools are implementing it in the pilot mode.

Figure Nº4. The use of eJournal module at schools

Figure Nº3. eJournal module development steps





In addition, during the audit period, the eJournal module is used in pilot schools only by school teachers and administration. However, the system is not accessible to parents and cannot provide them with online access to student grades, assignments and other important information. Parental involvement is one of the main functions of the system and its main value.

This is due to deficiencies in project administration. It is worth noting that the development of eJournal is one of the activities in 2016 and 2017 years action plans of the Agency, however, the audit team did not obtain a detailed plan according to which the project would be managed, and schools incorporated into the pilot project.

It should be noted that participation in the pilot project is voluntary for schools. Accordingly, where maintenance of the paper journal is mandatory, undertaking the mentioned obligation by schools is associated with the additional resources for administration. Therefore, the Ministry and the Agency have not used appropriate mechanisms to increase the acceptance of eJournal module by schools.

In the pilot project schools outflow and failure to use this module is frequent. This relates to malfunctioning of eJournal module functionality and restricted access to it by schools.

The results of international assessments, in turn, indicate the need for a centralized and timely response to students' academic performance. Figure #5 shows the situation and relation of Georgia to the average of other countries according to PISA¹² and PIRLS¹³ international assessments.



Figure Nº5: International evaluation results

12 The International Organization for Economic and Cultural Development (OECD) conducted an international survey that examines the willingness of 15-year-old children to cope with daily challenges using the knowledge and skills they received at school. PISA examines knowledge in three areas: reading, mathematics and natural sciences.

13 PIRLS is an international literacy study designed to assess reading comprehension in 9-10-year-old children. It assesses whether the student can relate the facts and opinions in different parts of the text and draw conclusions, see causal links, and gain insight into the text.



Given the existence of an electronic journal, it would be possible for the Ministry to identify the problems in a timely manner and respond accordingly. In addition, these assessments are conducted on a periodic basis (PISA – once every 3 years, PIRLS – once every 5 years), which, unlike the electronic journal, does not allow for real-time observation of the progress of students.

The absence of an electronic journal has a significant impact on the timely management of processes and ultimately on the improvement of learning outcomes. Accordingly, the parties involved lack the following opportunities:

- Timely response to student problems individually by both parents and teachers;
- For the Ministry to have a centralized view of the improvement items/programs in the Ministry and provide appropriate response to them;
- For the school management to be able to continuously monitor the activities of teachers and students.



5. DRAWBACKS OF ESCHOOL SYSTEM ANALYTICS FUNCTIONALITY

One of the important advantages of a management system is the centralization and automation of processes. Consequently, the management system should allow the system user to achieve the business process goal by using less time and human resources.

Figure 6 presents the stakeholders of the learning process and their needs.

Figure Nº6. The main stakeholders of the learning process and their needs



Big Data + Small Children = Big Impact

One of the important prerequisites for monitoring the Ministry, school, parent and other stakeholders is the existence of the system's analytical functionality. In particular, by the functionality of the system, it should be possible to produce ready-made analytical information that will enable the stakeholders to easily receive information they need in understandable and in a timely manner. Figure N°7 illustrates the benefits of analytical functionality of management information system through the example of parents and the Ministry.



Figure №7. Analytical functionality results



In addition, one of the requirements of the SABER-EMIS evaluation framework for minimizing time and human resources is the existence of system analytical functionality. In particular, one component envisaged by the criterion, adequacy of the system, includes requirements, such as generating early warning about the activities¹⁴ of students, teachers and schools, and the availability of ready analytical data for stakeholders.

As it stands, the eSchool system functionality fails to ensure early detection of problems based on the existing data by means of pre-built analytical functionality. In addition, for timely response and monitoring, so-called analytical dashboards, graphs and data visualizations are not available for the parties.

The abovementioned circumstance is also due to shortcomings in the project management process. In particular, clearly defined requirements for the system and the lack of prioritization of such functionality for system users.

The drawback of system analytics functionality affects the timely processing of information. In particular, stakeholders for general and simple statistical information should contact the Statistics Office of the Agency. Whereas, ready-made analytical dashboards and statistics would enable the involved parties to obtain the statistical information they need without any assistance and with less time resources.

Considering the foregoing, the stakeholders have lack of opportunity to:

- the parent, through early warning, timely and easily receive information on the student's academic performance and compare the average situation at the school`;
- the management of general education institutions monitor teachers' activities on a timely basis and complete reflection of information;
- the Agency simply monitor the dynamics of information reflection by schools using less time resources;
- the Ministry has the opportunity, through early warnings, to receive timely, easily understandable information on school achievements across Georgia, compare it and respond promptly.

14 Component: System Adequacy: 2.2.1 "Data required for general administration", 2.3.1 "Data analysis directions".



A good example of the e-journal analytical capabilities and practical application is the Georgian software "Schoolbook" implemented in several public and private schools. Images: No. 1 and No. 2 provide an analytical functionality through the example of the schoolbook.

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Image Nº1. Analytical functionality of schoolbook

Image Nº2. Analytical functionality of schoolbook



It is noteworthy that some public schools, which realized the need for this information, purchased eJournal-schoolbook with their own resourses, from a local company operating in the market. Both the school and the parent are included in the schoolbook system. Consequently, the user can provide:

- easy communication between a parent and a teacher without parents going to school;
- parental access to the student's academic performance online;
- active involvement of the parent in the learning process;
- monitoring of teacher and student activity by the school management;
- analysis of current situation through simple visualization.



CONCLUSION

Given the above circumstances, the Ministry does not have data-driven and informed decisions. This is due to system functional deficiencies (lack of analytical functionality) and incomplete information. In terms of incomplete information, there are two major factors that hinder the process of providing information to the Ministry. Specifically, on the one hand, the system module – eJournal, which has been developed, but schools do not fully utilize it and modules whose need to exist has not yet been defined by the Ministry and other users of the system.



Figure Nº8. Incomplete information

Drawbacks related to incomplete information, the development of eJournal and system functionality, in turn, are due to shortcomings related to the eSchool system implementation process. In particular, the audit team did not obtain from the Agency a long-term plan and action plans for developing the system. Consequently, at the initial stage of system development, the following was not specified:

- Requirements for information and functionality required in the system;
- A detailed plan for implementing eJournal, including both the plan, as well as the project support mechanisms.

In view of the above, given the development status of the education management information system, the Ministry lacks the capacity to undertake in-depth analysis of the education sector. As it stands, the Ministry mostly relies on research, evaluation and assistance from international organizations.



RECOMMENDATION

In order to develop a data-based approach and facilitate informed decision-making, the Agency, in agreement with the Ministry, should develop:

- an eSchool system development plan with an indication of the appropriate time schedule. This plan, among other things, involves reviewing the information in the eSchool system and identifying the minimum data required to achieve the above goals;
- plan for improving the system functionality and requirements towards it. This should enable the Ministry and other stakeholders to receive up-to-date information on current issues in the education sector in a timely and easy manner.

In order to successfully implement the e-journal module in general education institutions and to access all relevant stakeholders, it is advisable for the Agency, in agreement with the Ministry, to develop:

• an e-journal introduction plan, which, among other things, provides a timetable for gradual inclusion of secondary education institutions, motivation and commitment mechanisms for schools, and a maximum duration for the pilot phase.

6. INFORMATION SECURITY

The eSchool system includes personal information about students, their parents and school staff. Accordingly, it is important that personal information be processed and stored in accordance with the law¹⁵. The confidentiality and integrity of such information shall be ensured. In addition, the Agency is designated as a critical information system entity¹⁶ and according to the Law of Georgia "On information security" is required to ensure meeting of minimum requirements of information security.

The Law of Georgia "On information security" defines information security as an activity that ensures availability, integrity, authentication, confidentiality and continuous work of information and information systems.

Information assets should be protected against unauthorized access or modification at the stage of their storage, processing, transfer and destruction. An organization that fails to ensure information security is exposed to risks such as unauthorized access and alteration of information, leakage of or unlawful access to confidential information, which leads to violation of regulatory laws, impairment of the reputation of the organization and impediment with the achievement of organizational goals.

The Agency, as a Critical Information System Entity¹⁷, is responsible¹⁸ for developing and implementing the Information Security Management System (hereinafter referred to as ISMS).



Figure Nº9. Information Security Management System Cycle (PDCA)

15 Law of Georgia "On Personal Data Protection".

16 Resolution No. 312 of the Government of Georgia of April 29, 2014 "On the Approval of the List of Critical Information System Entities".

17 Resolution No. 312 of the Government of Georgia of April 29, 2014 "On the Approval of the List of Critical Information System Entities".

18 Law of Georgia "On Information Security".



Within the ISMS, the organization should develop information security policies and implement controls to ensure the confidentiality, accessibility and integrity of information. In addition, Critical Information System Entities are obliged to designate a person or persons responsible for implementing information security management.¹⁹

6.1 ISMS SCOPE AND RESPONSIBILITIES

According to the order²⁰ on approval of minimum information security requirements, the organization must identify and document the scope and boundaries of ISMS, in terms of activities, organizational structure, location, assets and technologies, and justify the reasons for the exceptions.²¹

In addition, it is important for information security responsibilities to be clearly separated.²² In line with the international best practice, it is advisable to separate information technology governance from information security oversight.

ISMS document approved by the Agency covers the scope of security policy spread, which includes the general education management system (eSchool) and the relevant data processing center, and the coverage is limited to geographic area. However, the same document states that the scope does not include other systems developed and/or managed by the Agency. For example, ISMS and relevant policies do not apply to the system for registration of first-graders developed by the Agency and information systems in the area of vocational education.

According to the Audit Office, the systems outlined above are critical information systems **to which the information security policies of the Agency should also apply.** In particular, restricting access to the system may have a negative impact on first-graders' registration process, which may ultimately have a negative impact on the reputation of the Agency and the Ministry.

It is also important that considering the complexity of the activities of the Agency, **the scope of ISMS coverage envisages not only the geographical area but also the requirements for activities, organizational structure, assets and technologies.** Given these criteria, the Agency will be able to develop a more efficient ISMS and thus better protect critical systems.

In addition, the audit identified shortcomings in the organizational structure, delimitation of roles and responsibilities of the ISMS. Specifically, according to the minimum information security requirements, the Agency has an Information Security Manager and an Information Security Board. During the audit, the deputy director of the Agency overseeing information technology was also responsible for monitoring information security. In particular, the information security manager was subordinated and accountable to the above-mentioned deputy.



¹⁹ For example, the Information Security Council, which consists of an information security manager and key, sectoral, or directional managers.

²⁰ Order No. 2 of the Chairman of the Data Exchange Agency of February 4, 2013 "On Approval of Minimum Information Security Requirements", Article N5.

²¹ Order No. 2 of the Chairman of the Data Exchange Agency of February 4, 2013 "On Approval of Minimum Information Security Requirements".

²² Attachment to DEA 27001:2011 controls (Control .6.1.3).

6.2 RESOURCES

In accordance with the minimum information security requirements, the management of the Agency is obliged to allocate²³ appropriate resources to implement the information security management system. In particular, one of the important areas is personal development and awareness raising and awareness raising (DEA 27001: 2011, 5.2.2.).

The organization shall ensure increasing qualification of staff with respect to ISMS by performing the following activities:

- define the necessary knowledge of ISMS staff;
- conduct training and other activities (e.g. recruitment of qualified personnel) to meet needs;
- evaluate the effectiveness of the actions taken;
- accumulate information on teaching, training, knowledge, experience and qualifications.

Based on the information provided by the Agency, no training was conducted for the persons involved in the implementation of ISMS (Information Security Manager, Information Security Council members) in 2016-2018. However, despite the number, complexity and large geographic area of the information systems of the Agency, the Agency has only 1 (one) information security employee (manager).

Given the complexity and scope of work of the Agency, these human resources are not sufficient to implement the information security management system. In particular, since the adoption²⁴ of the minimum information security requirements up to the audit period, the implementation of ISMS policies and relevant procedures has not been completed. It should be noted that the fulfillment of these requirements was to take place within maximum of 3 (three) years after the above regulation was adopted. It is important that the Agency understands the importance of ISMS and is working to implement it, but the resources and efforts are not sufficient to meet the legislative requirements.

6.3 CHANGE MANAGEMENT

In accordance with the minimum information security requirements, the Agency is required to manage the implementation of changes in accordance with change control procedures (DEA 27001:2011, a.12.5.1.).

The audit revealed that the Agency lacks proper change management practices and does not produce documentation on critical infrastructure. For example, during the audit, the Agency did not have an up-to-date/current logical topology for infrastructure arrangement.

²⁴ Order №2 of February 4, 2013 of the Chairman of the Data Exchange Agency "On approving the minimum information security requirements".



²³ DEA 27001:2011, 5.2 resources.



Figure Nº10. Arrangement of Agency infrastructure

Given the complexity and extent of the infrastructure of the Agency, which is clearly seen from the topology shown in Figure 10, the above-represented shortcoming is an important circumstance. In particular, this increases the risk of unauthorized alteration/access, which may affect the protection of confidentiality and integrity of the Agency information.

6.4 INFORMATION SECURITY INCIDENT MANAGEMENT

In line with the minimum information security requirements, the organization is required to implement information security incident management controls. This, among other things, implies that there should be a mechanism to record and oversee information security incidents by their type, extent and value (DEA 27001:2011, a.13.2.2.).

The audit revealed that the Agency does not maintain an Information Security Incident Registry and prepare relevant documentation. For example, the Internet (IP) address of schools is registered in several so-called "black lists" and is blacklisted. This is an information security incident, and the "black list" points to cyber security shortcomings. It is noteworthy that the above factual circumstance is important for the management of information security incidents and, like any other information security incident, the Agency needs to respond promptly.

6.5 SECURE DEVELOPMENT

In line with the minimum information security requirements, the organization is committed to integrating information security into all key processes. The Agency information systems (applications, websites, portals) are in-house developed. Accordingly, the Agency is obliged to ensure the implementation of security controls during the development process (DEA 27001:2011, a.12.2).



The audit revealed that **the Agency did not have any development policies and practices.** In addition, the information security manager/officer is not involved in any stage of system development. It is also noteworthy that during the audit, neither external nor internal security assessment of the eSchool system was performed.

It is advisable to periodically perform both static and dynamic testing of the system for the reliable, sustainable and continuous operation of Agency systems, as well as for the protection of confidential information within the system. This should be done regularly by both external (for example, audits) and internal reviewer (e.g., information security officer, internal audit).

6.6 VULNERABILITY ASSESSMENT

To test the cyber security controls of the Agency, the audit team conducted a vulnerability assessments of the eSchool system. Specifically, under a predefined scenario, vulnerability testing was performed on the eSchool application and the infrastructure where the information system is located.

In addition to the vulnerability analysis, the internet access practices of the Agency were discussed. As a result, it was revealed that the practice of the internet access of the Agency requires improvement. The Agency has the appropriate infrastructure and resources to control internet access. Existing practices filter and block some internet resources containing inappropriate content, though internet access and traffic filtering is not fully implemented on the school network. In particular, a number of websites and portals containing inappropriate content are not filtered and blocked.

A detailed technical report was drafted based on weaknesses and shortcomings identified as a result of vulnerability assessment and was forwarded to the Information Security Manager and management of the Agency.

CONCLUSION

The Agency, as a critical information system owner entity, should ensure the development of the information security management system and compliance with applicable legislation. Adequate ISMS, in turn, affects the confidentiality and integrity of personal data in the eSchool system. The Agency has made significant steps over the years in meeting the minimum requirements for information security and its implementation in practice. Nevertheless, there are significant drawbacks that may have an impact on the development of effective ISMS. Namely:

- the scope of ISMS is inconsistent with the complexity of the Agency and its projects;
- information technologies are not delineated from the functions of governance and information security oversight;
- given the complexity and scalability of the Agency, adequate human resources are not provided for the implementation of ISMS;
- no adequate practice of change management;
- no information security incident reporting;
- a unified development approach and practice is not developed.



All of this has a significant impact on the confidentiality, integrity and reliability of the information generated. This practice increases the risk of unauthorized access to information, affecting compliance with minimum information security requirements.

RECOMMENDATION

To develop and implement an effective and efficient information security management system it is advisable:

- The management of the Agency to review the scope of ISMS coverage and ensure its compliance with organizational goals, stakeholder interests and legislative requirements;
- Delimit the information technology governance function from information security oversight and subordinate the person(s) responsible for information security directly to the director of the Agency;
- The management of the Agency to determine the necessary and sufficient human resources. In addition, it is advisable to define the above-mentioned PDP and provide systematic training;
- In order to reduce information security risks, develop adequate change management practices in line with legislative requirements and international standards.



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ANNEX N1 – SABER-EMIS EVALUATION RESULTS

The audit assessed the education management information system according to the World Bank framework, SABER-EMIS.

The four key components of SABER-EMIS have been assessed that have an impact on the development of an effective education management information system. For each direction, there are predefined criteria whose performance determines the weighted average score of the direction/ component.

The audit revealed that Georgian education management information system, in view of the above evaluation criteria²⁵, is in the development stage. The results of the evaluation (the indicator in percentage of criteria performance of SABER-EMIS Framework) are presented in Figure 1.



Figure Nº1. SABER-EMIS evaluation summary results

The below table presents the evaluation criteria and evaluation results for each component and subcomponent.

²⁵ Guidelines for the Evaluation of the Education Management Information System developed by the World Bank – SABER-EMIS



Component	Subcomponent	Score	Weight	Subcomponent evaluation	Component evaluation
	1.1 Legal framework	2.30	17%	Established	
	1.2 Organizational structure and institutionalized processes	1.78	17%	Emerging	
1. Enabling	1.3 Human resources	1.89	17%	Emerging	Emerging
Environment	1.4 Infrastructural capacity	2.31	17%	Established	
	1.5 Budget	1.25	17%	Emerging	
	1.6 Data-driven culture	2.00	15%	Established	
	2.1. Data Architecture	1.23	20%	Emerging	Emerging
	2.2. Data coverage	1.40	30%	Emerging	
2. System	2.3. Data analytics	0.80	15%	Latent	
Journaliess	2.4. Dynamic system	1.43	15%	Emerging	
	2.5. Serviceability	2.15	20%	Established	
	3.1 Methodological Soundness	2.77	25%	Established	
3. Quality	3.2 Accuracy and reliability	1.93	25%	Emerging	E L.P
Data	3.3 Integrity	2.36	25%	Established	Established
	3.4 Periodicity and timeliness	1.6	25%	Emerging	
	4.1 Openness	1.80	15%	Emerging	
4. Utilization	4.2 Operational Use	1.35	50%	Emerging	
for Decision	4.3 Acceptability	1.81	20%	Emerging	Emerging
Making	4.4 Effectiveness in disseminating findings	1.71	15%	Emerging	

Table Nº1. SABER-EMIS evaluation results according to components



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