

**EDUCATIONAL INFORMATION AND MANAGEMENT  
SYSTEMS (EMIS) IN LATIN AMERICA AND THE  
CARIBBEAN: GLOBAL MODELS, CHALLENGES AND  
PRACTICAL APPLICATIONS**

## About this report

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This working paper has been prepared within the framework of the KIX LAC Knowledge Mobilization Cycle and Community of Practice on the Use of Evidence in Education under the coordination of the Knowledge and Innovation Exchange Hub for Latin American and the Caribbean.

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## About KIX

The KIX initiative aims to connect the experience, innovation and expertise of Global Partnership for Education (GPE) partners to help developing countries build stronger education systems. Through the sharing and funding of proven solutions and innovations, KIX (a) ensures that evidence-based solutions get into the hands of national policymakers and directly feed into dialogue and planning processes; (b) builds and strengthens capacities to produce, integrate, and scale up knowledge and innovation in GPE partner countries.

To this end, KIX has created regional hubs in different regions, where partners come together to share information, innovation and best practices. KIX is also a funding mechanism that provides global and regional grants to invest in knowledge generation and innovation, and to scale up proven approaches. The International Development Research Centre (IDRC) is the grant-making agent for KIX.

Led by SUMMA in partnership with OECS, the KIX for Central Latin America and the Caribbean has been working since April 2020 to support the development of partner countries' education systems and contribute to guaranteeing the right to education in Dominica, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Saint Lucia, and Saint Vincent and the Grenadines. To achieve its purposes, KIX LAC has defined three pillars:

- (I) establishment of priorities of the educational policy agenda;
- (II) mobilization and exchange of knowledge;
- (III) regional and local capacity building.

## About SUMMA

SUMMA is the first Laboratory of Education Research and Innovation for Latin America and the Caribbean. It was created in 2016 by the Inter-American Development Bank (IDB), with the support of the ministries of education of Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Uruguay. Since 2018, the ministries of Guatemala, Honduras and Panama have also joined. Its mission is to contribute to and increase the quality, equity and inclusion of education systems in the region, improving the decision-making process of education policies and practices. To fulfill its mission, SUMMA organizes its actions in three strategic pillars to promote, develop and disseminate: (1) cutting-edge research aimed at diagnosing the region's main challenges and promoting shared work agendas, (2) innovation in educational policies and practices aimed at providing solutions to the region's main educational problems, and (3) spaces for

collaboration that allow for exchange among policymakers, researchers, innovators and the school community, based on a shared regional agenda.

## About the Organization of Eastern Caribbean States (OECS)

The Organization of Eastern Caribbean States (OECS) was created in 1981 as an intergovernmental organization to promote cooperation, harmonization and integration among its member states.

OECS has developed a considerable amount of valuable knowledge sharing and direct technical assistance between Ministries of Education. It has also been part of the Regional Education Strategy and has supported participatory planning and monitoring processes. In this regard, OECS plays a strong leadership role with the Caribbean States, and especially in supporting the countries that belong to this territory: Dominica, Grenada, St. Lucia, and St. Vincent and the Grenadines. As a current partner of the GPE, OECS has spearheaded the implementation of the Education Sector Plans in these states.

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## Executive Summary

This document analyzes the importance of Educational Information and Management Systems (EMIS) in the technological integration and administration of the educational system. These systems facilitate the collection, analysis and use of data to optimize management and decision-making. However, their development varies in the region as many countries still rely on manual systems. More than technological platforms, EMIS are part of a management system that involves processes, methodologies, standards and regulation. Their practical implementation is key to improving educational administration and maximizing their impact.

International organizations such as UNESCO, the World Bank, IDB, OEI and CAF highlight the need for an enabling environment, adequate technological infrastructure and capacity building. They also promote emerging technologies such as big data, artificial intelligence and blockchain to strengthen decision-making. UNESCO emphasizes the importance of accurate data to identify priority populations, while the World Bank, through SABER-EMIS, evaluates data quality.

EMIS have multiple applications: at the central level, they support strategic planning and resource allocation; at the intermediate level, they enable the monitoring of educational policies; and at the school level, they improve administrative and academic management, in addition to identifying students at risk of dropping out. Their ability to integrate administrative data, statistical records and evaluations allows the design of more inclusive and equitable policies.

The development of EMIS in Latin America and the Caribbean is heterogeneous. While some countries have advanced in digitization, others still face challenges such as lack of interoperability, data quality and insufficient infrastructure. To overcome these obstacles, it is recommended to improve technological infrastructure, develop human capacity, ensure political and regulatory support, and guarantee sustainable financing. Interoperability is key to integrating EMIS with other educational and governmental systems, allowing real-time data to strengthen decision-making.

The document presents cases of KIX LAC countries such as St. Lucia, St. Vincent and the Grenadines, Grenada, Guyana, Honduras and El Salvador, highlighting progress and challenges in the implementation of EMIS. Some countries are at the beginning of their development, while others, for example Honduras, have implemented advanced systems such as the Sistema de Administración de Centros Educativos (SACE) and the Sistema de Alerta y Respuesta Temprana (SART) to prevent school dropout.

Strengthening EMIS requires investment in infrastructure, continuous training, change management strategies and access to open data. Nominalization of information through unique identifiers facilitates individualized tracking and targeting of resources. Emerging technologies such as artificial intelligence and big data improve the identification of learning gaps and enable timely interventions.

In conclusion, strengthening EMIS in KIX LAC countries is essential for evidence-based planning, and promoting more efficient, equitable and social justice-oriented educational management.

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## I. Introduction

The integration of technologies in education has permeated different areas of the educational ecosystem. The use of digital tools for educational management, known as Educational Information and Management Systems (EMIS), has become increasingly relevant. EMIS are understood as the set of operational processes that, through digital technology, enable the collection, aggregation, analysis and use of data and information in education (Law et al., 2018; Broadband Commission, 2023). New definitions expand the view of EMIS and posit the need for it to be considered as a component in management systems, along with people, models, processes, procedures, methods, standards, and regulations. Together, all of these components work toward the proper integration of technology into educational management and the effective use of EMIS (GEM 2023).

The development of information systems and the incorporation of digital tools is not homogeneous in all countries. Much of the world lacks access to timely, quality and complete educational data. While most countries in the region have collected educational administrative data, many still rely on a manual system that plays a purely monitoring and statistical role through the collection of statistical reports and counts (Broadband Commission, 2023). Globally, educational information and management systems seek to transition from a rigid production of statistics to a dynamic analysis as a real-time system that translates data into meaningful and actionable evidence for decision-making through multilevel system actors and early warning mechanisms.

In this way, EMIS are also designed to ensure the right to education by collecting information on schools, teachers and students, making it possible to identify and address educational inequities and learning gaps, especially among the most disadvantaged and vulnerable groups. By making these groups visible without stigmatizing them, EMIS promote more inclusive and equitable education.

In addition, these systems integrate administrative data with statistical records and learning assessment results, facilitating the creation of fairer educational policies. Strengthening human capacities and improving data quality ensures that educational decisions are based on solid evidence, thus promoting social justice and guaranteeing that all students have an equal opportunity to succeed.

In summary, EMIS are key platforms for improving the management of the education system, optimizing investment, and promoting equity and inclusion. However, generating rigorous evidence of their impact remains a challenge. International organizations have not only generated conceptual frameworks to guide their development and use, but have also diagnosed their state of development in the region and provided recommendations for their strengthening.

This document compiles information on EMIS from the perspective of international organizations. It includes an analysis of the conceptual frameworks proposed by these organizations, as well as potential uses. Finally, some challenges are addressed and recommendations drawn from their reports and the state of development of these systems in the region and Eastern Caribbean countries are presented.

## II. Reference frameworks and guidelines of international organizations

For the development of a modern Educational Information and Management System (EMIS), it is essential, as a starting point, to assess the specific needs and capacities of such systems in each country, so that implementation can be gradual. By considering the capacities and demands of the education system as a whole, it is possible to design a robust EMIS that facilitates efficient management through the optimal use of digital technologies according to the reality of each country (UNESCO, 2022).

Reports published by international organizations propose conceptual frameworks that identify the main components of EMIS and, in some cases, present instruments to measure the level of development of these systems in a certain country. The following is an account of the guidelines by each organization.

### 1. The perspective of UNESCO

The **United Nations Educational, Scientific and Cultural Organization (UNESCO)** has published several reports with conceptual frameworks with the main components of a developed EMIS. In addition, it has generated documents on provider selection criteria, frameworks for inclusion in EMIS, and reports on the importance of data accuracy and validity.

The document *Re-imagining the Future of Education Management Information Systems: Ways Forward to Transform Education Data Systems to Support Inclusive, Quality Learning for All* (UNESCO, 2022) was prepared following the UNESCO Regional Forum on EMIS in 2021. This report identifies two key elements for the transformation of these systems: systemic considerations and technological considerations.

Systemic considerations are those necessary to create an enabling environment for future EMIS. On the other hand, technological considerations are ways to take advantage of what new technologies can offer to overcome the difficulties of conventional EMIS. Systemic considerations include the following: legal, regulatory and institutional frameworks, data processes, technological infrastructure, and human and organizational capacity building. Technological considerations include recent innovations in technology such as Big Data, Artificial Intelligence and Blockchain.

In addition, this report proposes that a modern EMIS should contemplate the following considerations:

- **Integrated:** an EMIS is an integrated data system facilitated by interoperable data standards and software components.
- **Modular and flexible:** rather than a single monolithic solution, the EMIS architecture should be built through a collection of independent, interoperable units that provide services for a particular function. This approach allows the system to be adaptable and remain relevant as new needs arise.

- **Actionable and timely information services for all levels:** Big Data analytics should provide real-time actionable information based on large volumes of data to all educational stakeholders, including students, parents, teachers, and sector managers, at various levels of disaggregation, with comparisons over time and across units.
- **A tool to support administrative management:** EMIS are tools that support the digitized management of education at all levels, including both strategic and routine daily management, and both sector management and at the level of educational institutions. Areas such as educational planning and the identification of educationally vulnerable populations are key aspects.
- **A tool to support learning management, including hybrid learning:** EMIS should include Learning Management Systems that support the learning process and are tools to support the delivery of hybrid and distance education.
- **Focus on capacity building and leveraging local ecosystems:** Throughout the process, EMIS should focus on developing human and organizational capacity at all levels of education to collect, analyze, disseminate, and use data for decision-making. The EMIS process should also develop and leverage local ecosystems to provide technical services.

Additionally, **UNESCO** has published timely reports with relevant components for a modern EMIS. The paper *Eficiencia y efectividad en la elección y utilización de un EMIS* (Van Wyk & Crouch, 2020) lays out guidelines intended to help countries ensure efficiency in choosing and using an EMIS approach. Following the Unesco Institute for Statistics (UIS) conference, the document *Data for Education: A Guide for Policymakers to Leverage Education Data* (UNESCO, 2023) raises the importance of data and the interoperability of different data systems to improve decision-making. Additionally, the ED-DATA Quality Assessment Framework (Ed-DQAF), which is based on the International Monetary Fund model, assesses the strengths and weaknesses of the educational statistical system, based on the dimensions of data quality.

## 2. The perspective of the World Bank

The World Bank's **SABER-EMIS** (Systems Approach for Better Education Results - Education Management Information Systems) initiative focuses on improving EMIS in developing countries. This initiative seeks to collect and analyze data on education policies and institutions to help countries strengthen their education systems in a systematic way<sup>1</sup>.

The development model proposed by SABER-EMIS is based on a systemic approach that has the ultimate purpose of promoting learning for all, ensuring that all children and youth have

<sup>1</sup>

<https://www.worldbank.org/en/topic/education/brief/systems-approach-for-better-education-results-saber>

access to quality education that enables them to develop the skills necessary for life and work. The model includes several key components<sup>2</sup>:

- **Policy and Institutional Assessment:** analyzes the quality of educational policies and institutions and provides tools for dialogue. This allows countries to conduct a comprehensive inventory of their educational policies based on global best practices.
- **Improved management and accountability:** promotes the creation of strong learning environments and improved accountability in the education system. This includes aligning school governance, financing, and management policies to improve learning for all.
- **Skills development:** fosters skills development from early childhood through tertiary education and workforce development. It focuses on ensuring that students acquire the skills necessary for life and work in the 21st century.
- **Use of comparative data:** uses global comparative data to identify best practices and guide educational reforms. This includes collecting and analyzing data on educational performance and implementing evidence-based policies.
- **Stakeholder participation:** engages policymakers, educators, and other stakeholders in a structured and effective dialogue on education policy. This ensures that reforms are inclusive and responsive to local needs.

This initiative focuses on the policy level and the process of data collection, quality and use of data and indicators. It also defines key components and considerations for decision-makers to assess the policy-relevant areas of a country's EMIS. For this purpose, four areas are identified:

- **Enabling environment:** assessment of planned policies regarding sustainable infrastructure and human resources that can handle data collection, management, and access.
- **System robustness:** assessment of the degree to which the processes and structure support the components of a comprehensive information management system.
- **Data quality:** an assessment of the degree to which an EMIS accurately collects, securely stores, and produces high-quality, timely information.
- **Use for decision making:** evaluation of the reality of system implementation and the use of EMIS information in decision making.

For each educational data system examined, SABER-EMIS assesses progress in these areas using a four-level scale: latent (1), incipient (2), emerging (3), and established (4).

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<sup>2</sup>

<https://www.bancomundial.org/es/results/2014/04/28/world-bank-support-to-education-a-systems-a-approach-to-achieve-learning-for-all>

### 3. The perspective of the Inter-American Development Bank

The **Inter-American Development Bank (IDB)** created a conceptual framework that identifies and defines the main characteristics of a highly effective EMIS and constructed a comparative measurement tool. The conceptual framework delineates the management processes and systems that support it.

The report entitled *Los sistemas de información y gestión educativa de América Latina y el Caribe: la ruta hacia la transformación digital de la gestión educativa* (Arias et al., 2021a) presents the EMIS diagnostic instrument ([Annex A of the document](#)) designed to collect information, which is structured based on two structural conditions and six key educational processes.

- **Structural Conditions:**
  - *Technological infrastructure:* this condition refers to the technology base and digital systems necessary for effective educational management.
  - *Governance and Institutional Framework:* this condition is related to the regulatory and administrative structures that govern educational management.
- **Key Educational Management Processes:**
  - *Physical Infrastructure and Equipment:* this process involves the planning, construction, maintenance and utilization of physical facilities and resources in educational institutions.
  - *Schools:* this process focuses on the administration, management and operation of educational institutions at the school level.
  - *Students and Learning:* this process revolves around student enrollment, attendance, academic performance and learning outcomes.
  - *Human and Budgetary Resources:* this process involves the allocation, utilization and management of human resources (e.g., teachers and administrators) and financial resources (e.g., budgets and funding) within education systems.
  - *Digital Content for Student Learning and Teacher Training:* this process focuses on the development, distribution and use of digital resources to support student learning and teacher professional development.
  - *Strategic Management Tools:* this process involves the use of data, information systems and strategic planning tools for decision making and policy formulation in educational management.

As in the SABER-EMIS proposal, the development of each process and structural condition is classified into four levels: latent (1), incipient (2), emerging (3), and established (4).

### 4. The perspective of the Organization of Ibero-American States for Education, Science and Culture (OEI) and the Development Bank of Latin America and the Caribbean (CAF)

The document entitled *Transformación digital en las administraciones públicas educativas en América Latina y el Caribe: análisis y perspectivas* (Marés, et al., 2023) proposes a digital

development model for educational public administration that is structured in several key dimensions. These dimensions are fundamental to guide and evaluate the progress of digital transformation in education. The model considers the following main dimensions:

#### a) Organization

This dimension focuses on the existence of a planned digital transformation strategy that responds to political, technical and managerial demands, including:

- **Strategy and vision:** documented and shared strategic plans.
- **Actors and leadership:** responsible and capable teams to lead the transformation.
- **Legal and regulatory frameworks:** regulations governing the implementation of technologies.
- **Cultural management of change:** strategies to manage the resistance to change of the different stakeholders and continuous training plans.

#### b) Technological Infrastructure

It refers to the operability and interoperability of the technological infrastructure necessary for the integral functioning of the educational systems. This dimension considers aspects such as:

- **Administrative connectivity:** broadband access and quality of connectivity.
- **Access to devices:** availability of devices suitable for educational management.
- **Management and administration:** maintenance, updating and security of the technological infrastructure.

#### c) Management Processes

This dimension considers the consolidation of the purposes of improving digital transformation in the priority processes of educational management. Aspects that includes:

- **Student management:** nominalized management systems and their use for decision making.
- **Management of educational institutions:** integral systems for the administration of institutions.
- **Personnel management:** systems for the administration of teaching and non-teaching personnel.

- **Financial resource management:** systems for the administration of economic resources.
- **Infrastructure and equipment management:** school infrastructure management systems.
- **Learning management:** systems for the evaluation and certification of learning.
- **Management of articulation with the community:** systems that link the educational system with the community.
- **Content management:** curriculum, syllabus, and teacher training management.

#### d) Emerging Technologies

This dimension refers to the implementation of emerging technologies in the context of digital transformation strategies. Within this framework, it can be considered:

- **Blockchain:** use for the issuance of degrees and certifications.
- **Data science:** data analysis for decision-making and trend prediction.
- **Artificial intelligence:** applications for process automation and predictive analytics.
- **Cloud computing:** flexible and scalable infrastructure for data management.
- **Internet of Things (IoT):** connectivity of devices to improve educational management.
- **Other technologies:** 3D printing, robotic process automation, augmented reality, dockerization and advanced connectivity.

In addition to the aforementioned dimensions, the document identifies other conditions that are essential for digital transformation at the level of public educational administration:

- **Governance and institutional:** clear definition of roles and responsibilities, and legal frameworks that support the transformation.
- **Human capital and organizational models:** continuous training and flexible organizational models that can adapt to technological changes.

## 5. An integrated look at the perspectives reviewed

As can be seen from the perspectives reviewed, there are specific purposes promoted by each international organization within the framework of EMIS development. Thus, in the case of

**UNESCO**, the purpose is focused on promoting the transformation and use of EMIS to support inclusive and quality learning; the **World Bank**, with its SABER-EMIS, seeks to improve educational management information systems in developing countries through their evaluation; the **IDB** focuses on identifying and defining the characteristics of a highly effective EMIS; and finally, the **OEI** and the **CAF** mainly promote a digital development model for public educational administration.

Despite this differentiated focus, all organizations agree on the importance of **data quality**. UNESCO, for example, stresses the need for accurate and valid data for educational decision-making. Similarly, the World Bank, through its SABER-EMIS initiative, evaluates data quality as an essential component for improving education systems. The IDB also includes data quality in its education management processes, and the IEO and CAF consider interoperability and data science as fundamental for digital transformation.

Another area where these perspectives converge is in **the progressive use of advanced technologies**. UNESCO promotes the use of big data, artificial intelligence and blockchain to overcome the limitations of traditional EMIS. The World Bank uses global comparative data and technology tools to guide education reforms. The IDB focuses on technological infrastructure and the use of digital tools, while the OEI and CAF implement emerging technologies such as blockchain, artificial intelligence and cloud computing to improve educational management.

In addition, all organizations stress the importance of **capacity building**. UNESCO emphasizes the development of human and organizational capacities to manage and use data effectively. The World Bank highlights the need for an enabling environment for EMIS deployment where human resources that can handle data collection, management and access are key. The IDB includes human resource development and teacher training as part of its key processes, and OEI and CAF propose strategies for change management and continuous training.

All organizations explicitly mention **data governance** and **interoperability** in their approaches to EMIS. Data governance is addressed through legal, regulatory and institutional frameworks that ensure information quality and security. Interoperability is promoted through the use of data standards and technologies that enable efficient communication and exchange of information between different systems and platforms.

On the other hand, there are also some differences in the key dimensions of the **evaluation and diagnosis** of EMIS between organizations. UNESCO assesses the technological infrastructure, data processes, and the uses of EMIS; while the World Bank uses a four-level scale to assess progress in areas such as the enabling environment, system robustness, provision of quality data, and its use for decision making. The IDB conducts a diagnosis of EMIS based on structural conditions and key processes, and the OEI and CAF consider dimensions such as organization, technological infrastructure, and management processes.

Finally, the **approach to educational management** differs among organizations. UNESCO supports both administrative and learning management, including hybrid and distance education. The World Bank focuses on improving management and accountability in the education system. The IDB covers educational management processes such as physical

infrastructure, schools and students, while the OEI and CAF include the management of students, educational institutions, personnel and financial resources.

### III. Uses and practical applications in EMIS

Educational Information and Management Systems (EMIS) have multiple definitions and functionalities that cover diverse development areas. A recent study conducted by UNESCO's International Institute for Educational Planning (IIEP) reports on various uses of EMIS (Montes, 2022):

#### 1. Types of EMIS uses

##### a) Administrative or institutionalized uses

- **For school management:** enrollment of students, assignment of vacancies, registration of attendance, grades, promotion and issuance of certificates.
- **For the allocation of resources:** distribution of scholarships, student tickets, food services and didactic materials.
- **For the follow-up of trajectories:** identification of students at risk of dropping out and management of professional internships in technical schools.

##### b) Specific uses for policy design and management

- **For strategic planning:** preparation of national and strategic plans, generation of indicators and diagnostics for the design and monitoring of educational policies.
- **For the identification of target populations:** determination of territories and groups requiring priority attention.
- **For the evaluation of educational policies:** impact and implementation evaluations of educational policies.

##### c) Emerging uses

- **In response to the COVID-19 pandemic:** monitoring of the health situation of students and teachers, organization of the return to school, identification of students who require support to sustain their schooling and management of technological resources for educational continuity.

#### 2. Uses at different levels of the educational system

The use of EMIS for the development of educational tasks and their uses in the management of the school system vary according to different levels of the educational system.

## a) Central level

At the central level, the use of technology for administrative data management and interoperability with other information systems has the potential to provide various benefits. Some of the proposed uses are the planning, distribution and monitoring of the implementation of public policies, and the management of the provision of educational services. EMIS, among others, seek to have timely information that has the potential to optimize the management of enrollment, human resources, and complementary services such as food and transportation (Arias et al., 2019; 2021b). The systematization of information is also identified for the preparation of regular statistics and indicators that, in turn, are inputs for carrying out diagnoses that collaborate with the design, definition and monitoring of social and educational policies, programs and goals; as well as with the identification of target populations or territories that require priority attention.

Thus, at this level EMIS is used for a variety of critical functions, including:

### Strategic planning and decision-making

- **Development of strategic plans:** EMIS provides the information necessary for the formulation of strategic plans at the national level. For example, in Peru, the Ministry of Education uses EMIS data to develop the Multi-Year Sectoral Strategic Plan, which includes purposes and targets based on accurate data.
- **Design of educational policies:** the data collected by EMIS allow the design of informed educational policies for early childhood protection, teacher training, and support for school retention.

### Monitoring and Evaluation

- **Monitoring indicators and goals:** EMIS is used to generate national indicators and reports to monitor progress towards established purposes, such as the Sustainable Development Goals (SDG). In the Dominican Republic, EMIS is used to align and monitor SDG 4 targets in the Ministry of Education's institutional strategic plans.
- **Impact evaluations:** EMIS facilitate the evaluation and implementation of educational policies. This includes the identification of territorial gaps and the evaluation of the effectiveness of specific educational programs.

### Resource management and allocation of funds

- **Resource allocation:** EMIS data allows for efficient allocation of financial and material resources. This includes the distribution of scholarships, grants and teaching materials to the schools and students that need them most. In Argentina, the Sistema Integral de Información Digital Educativa (SINIDE) is used for the distribution of scholarships and grants to students. In addition, it allows the estimation of the costs of new policies and programs, ensuring an efficient use of available resources (Pinkasz, 2022).

- **Cost estimation:** EMIS help to estimate costs of new policies and programs, ensuring that resources are used effectively and efficiently.

### Identification of needs and target populations

- **Identification of specific populations:** EMIS allow for the identification of specific populations and groups that require priority attention. This includes the identification of students at risk of dropping out of school and the implementation of interventions aimed at keeping these students in the education system. For example, in Ecuador, the [Archivo Maestro de Instituciones Educativas \(AMIE\)](#) interacts with other government databases to identify students who require priority attention. This includes the identification of students at risk of dropping out and the implementation of early warning systems.
- **Territorial gap analysis:** data allows for the analysis of disparities between different regions and the design of specific interventions to address these gaps.
- **Monitoring in coordination with other sectors:** EMIS facilitate coordination between different government sectors. For example, in Chile, the Sistema de Alerta Temprana (SAT) is developed in collaboration with the Ministry of Social Development and Family, which allows for a more integrated and effective response to the educational and social needs of students.

These uses enable ministries of education and other central government entities to make informed decisions, design effective policies, and continually monitor their implementation.

### b) Intermediate level

At the intermediate level, EMIS are mainly used for the **management and monitoring** of educational policies. This level includes regional and local administrations, which play a crucial role in the implementation and monitoring of centrally designed policies. Some specific uses stand out at this level:

#### Allocation of resources

- **Resource distribution:** EMIS allows regional administrations to manage the distribution of financial and material resources to schools. For example, in Brazil, the Educacenso system facilitates the allocation of resources from the Bolsa Familia program and the Benefício de Prestação Continuada (BPC) to schools, ensuring that funds reach the students who need them most (Siqueira da Cunha, 2022).

#### Supervision and monitoring

- **Enrollment and attendance monitoring:** In Colombia, regional offices use the [Sistema de Información de Matrícula \(SIMAT\)](#) to monitor student enrollment and attendance.

This helps ensure that school retention policies are properly implemented and that students remain in the education system.

- **Monitoring education programs:** Intermediate administrations also use EMIS to monitor the implementation of specific education programs and evaluate their effectiveness. This includes tracking key performance indicators and identifying areas requiring intervention.

### Support for school management

- **School management support:** regional administrations use EMIS to support schools in day-to-day management and informed decision-making. This includes the provision of data and analysis that help schools improve their educational and administrative practices.

### Identification of needs

- **Identification of specific needs:** EMIS allow intermediate administrations to identify the specific needs of schools and students in their jurisdictions. This includes the identification of students at risk of dropping out of school and the implementation of interventions aimed at keeping these students in the educational system.

The use of EMIS at the intermediate level of the educational system faces challenges related to the availability of resources, connectivity, accessibility and technical capabilities. Likewise, the lack of reports adapted to the specific management needs at this level may limit its full implementation. In this context, the strengthening of technical support and advice to schools represents a key opportunity to improve their effectiveness.

### c) School level

EMIS at the school level allows for a more efficient and effective management of various educational processes, from student enrollment to the monitoring of their academic performance. Some identified uses are:

**Enrollment and vacancy allocation:** used to manage student enrollment and the allocation of vacancies in schools. This includes the projection of quotas and the organization of enrollment. For example, in Chile, the Sistema de Admisión Escolar (SAE) allows the management of vacancies and the assignment of students to schools, facilitating enrollment and improving transparency in the allocation of places. This system helps families find available vacancies in the schools of their choice.

**Attendance registration:** systems allow recording and monitoring student attendance, which is crucial to identify patterns of absenteeism and take corrective measures. Thus, in Peru, the Sistema de Información de Apoyo a la Gestión de la Institución Educativa (SIAGIE) is used to record student attendance, allowing teachers and administrators to make informed decisions

about school management. This record is fundamental to identify students who need additional support to improve their attendance (Peñaloza, 2023).

**Recording grades and promotion:** Another use of EMIS is to facilitate the recording of grades, the promotion of students, and the issuance of certificates and diplomas. In Argentina, the "Mis Alumnos" system allows schools to manage student enrollment, record attendance and grades, and issue certificates. This system improves the operational efficiency of schools and ensures that academic records are accurate and accessible (Pinkasz, 2022).

**Communicating with families:** EMIS can also be used to communicate with families about students' academic performance and attendance through newsletters and other reports. For example, in Brazil, the Rio Grande do Sul State Education Secretariat's Computerization System allows schools to communicate with families about students' academic progress and attendance, encouraging greater parental involvement in their children's education. This communication is essential to keep families informed and engaged in the educational process (Siqueira da Cunha, 2022).

**Identification of students at risk:** These systems also help identify students at risk of dropping out of school or requiring additional support, allowing for early interventions. Thus, for example, in Colombia the Sistema de Información para el Monitoreo, la Prevención y el Análisis de la Deserción Escolar (SIMPADE) is used to identify students at risk of dropping out and coordinate interventions to keep them in school. This system analyzes risk factors such as academic performance and socioeconomic conditions to provide adequate support (Quintero, 2022).

**Registration of participation in professional internships:** in technical schools, these systems can register the participation of students in professional internships, facilitating the follow-up of their practical training. In Brazil, the Federal School Census includes information on students' participation in internships, which allows for a detailed follow-up of their technical training. This record is crucial to ensure that students acquire the practical skills necessary for their professional future.

EMIS plays a crucial role in educational management at the school level, facilitating a wide range of administrative and academic processes, improving operational efficiency, supporting at-risk students and encouraging greater family involvement in education.

When countries better understand the level or state of development of their educational information and management systems, as well as their data collection and enabling factors, they are more likely to make informed decisions to design and implement an effective EMIS.

To this end, designing a management information system requires understanding the information needs of the various end users, and incorporating this understanding in a way that allows them to obtain an accurate and intuitive view of the data. Thus, in order to make efficient use of EMIS, reports must be generated with appropriate levels of access to different stakeholders.

### 3. Data quality and reportability

Data reporting in an educational management information system refers to the system's ability to create, maintain, and disseminate accurate, relevant, and timely reports to various stakeholders.

Data reporting depends on several factors, including the type of software used by a country, data collection methods, interoperability with other information systems, data availability and quality, and the intended purpose of the data. In addition, reporting and visualization tools, as well as security and standards, are important considerations. Finally, it is essential to consider the target audience to ensure that the information is used effectively.

Educational information systems are moving toward a more dynamic rather than static view of data, including student experiences and outcomes (Vincent-Lancrin & Gonzalez-Sancho, 2023).

Some of the data reporting components of an EMIS based on the literature review are:

COMPONENTS	PROCESS	DESCRIPTION
<b>Integrated data management</b>	<b>Quality and precision</b>	Ensure that data meets quality assurance, standardize data collection, ensure relevance, accuracy, consistency and validity.  Data should answer specific questions aligned with well-defined educational purposes, methodology and objectives.
	<b>Compilation</b>	Tools for systematic data collection. Examples: online forms, surveys, questionnaires, and automated data capture.
	<b>Integral capture</b>	The system must be capable of capturing a wide range of data. Government data collection capacity and skills. Examples: administrative, statistical, financial, learning assessment, SDG 4.
	<b>Centralization</b>	A centralized database that consolidates data from various sources for a comprehensive report.
	<b>Integration</b>	Mechanisms to integrate data from different educational software and databases. Avoid duplication and fragmentation of data.
<b>EMIS Stakeholders</b>	Data must be organized and presented according to different purposes and interests. To be useful, they must be adapted and made accessible to all levels of decision-making within the education system: government, schools, students, parents, clients, and communities.	

Reporting and data visualization tools	Static display	Useful for providing an overview of an intervention and for disseminating summative data.  <b>Operational reporting:</b> automation of regular reporting (e.g., monthly, quarterly, annual) to ensure timely availability of information. Reports are run on a scheduled basis and distributed directly to relevant users.  <b>Customizable report templates:</b> defined templates that can be adjusted to meet specific reporting needs.
	Dynamic display	It can take the form of control panels that allow real-time manipulation by users and help visualize real-time data.  <b>Interactive panels:</b> control panels should be properly designed with the intended user in mind. Consideration should be given to clarity, accessibility and ease of use.  <b>Ad-Hoc Reports:</b> tools that allow users to create on-demand reports based on specific queries or requirements.
	Dissemination and Accessibility	Education statistics should be disseminated beyond the Ministry of Education and/or the education statistics-producing agency to other stakeholders.
Security	Data privacy and data security policies and measures	Data privacy policies and regulations. Confidentiality regulations.
	Access policies	The reporting mechanism and information dissemination must adhere to data standards and regulatory requirements.
User support and training	User support	Manuals and guides to help users understand how to generate and interpret reports.
	User training	Providing training and support ensures that users can effectively use the system's reports.
Policy or strategy to disseminate data	Data dissemination strategy	There must be a data dissemination strategy that: <ul style="list-style-type: none"> <li>Identify the information requirements of the target audience.</li> </ul>

		<ul style="list-style-type: none"><li>• Determine the medium in which the different types of documents should be produced (paper or electronic).</li><li>• Propose the period of hard copy and electronic data releases.</li><li>• Identify the officer or unit responsible for data release.</li><li>• Determine what will be released (e.g., enrollment, repetition, any relevant topics) (Van Wyk &amp; Crouch, 2020).</li></ul>
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#### IV. Status of EMIS development in the region

The development and use of Educational Management and Information Systems (EMIS) in the region requires countries to address a variety of key issues. Needs and capacities vary widely depending on the national context, which is reflected in the options available: from advanced technological solutions to pre-designed systems that include support materials, telephone technical support and the use of open-source technologies. In Latin America and the Caribbean, 83% of the countries reported using their own software, while 21% use integrated software (such as OpenEMIS). The data show that 53% of countries in all regions primarily use paper for data collection, 51% use an online interface, and 36% use a stand-alone electronic medium (Sigdel, 2022).

In the report that analyzes the uses of EMIS in Latin America and the Caribbean (Montes, 2022), it is observed that they are highly heterogeneous in terms of development, type of information produced, level of automation and interoperability. Thus, some countries have had nominal systems that have been consolidated for a decade, while others have statistical systems that are lagging behind. In any case, it is recognized that the incorporation of digital technologies and the greater availability of databases of individuals have made it possible to generate and process large volumes of strategic information for decision-making in the education sector.

A survey conducted in 2020 by the UNESCO Institute for Statistics, in which 24 countries in Latin America and the Caribbean participated, identified some relevant characteristics regarding the development of EMIS in the region (Vera, Scasso and Tham, 2022):

- **Purpose of data collection:** in Latin America and the Caribbean, most EMIS are oriented to statistical purposes rather than to support educational administration and management.
- **Mode of data collection:** 42% of Latin American and Caribbean countries collect information for their EMIS in physical (paper) format. This approach presents challenges to meeting real-time information needs and effectively adopting digital modalities.
- **Capacity to individualize information:** most countries in the region have a unique identifier (ID) for primary and general secondary schools, but this percentage is lower for pre-primary and technical secondary. Recent definitions of EMIS require systems that can describe in a timely and pertinent manner the reality of the different educational levels and modalities.
- **Nominal registry or unique student identifier:** 80% of the countries in Latin America and the Caribbean report having a nominal registry or being in the process of implementing one, which shows progress in the region.

After reviewing the general characteristics of EMIS in Latin America and the Caribbean, it is also important to detail the main strengths and opportunities for improvement of these systems, both in general in the region and specifically in some countries. For this purpose, three



sources of information will be considered: the report *Los Sistemas de información y gestión educativa (SIGED) de América Latina y el Caribe: la ruta hacia la transformación digital de la gestión educativa* of the Inter-American Development Bank (Arias et al., 2021a)<sup>3</sup>; the report *Transformación digital en las Administraciones Públicas Educativas en América Latina y el Caribe: análisis y perspectivas* (Marés et al., 2023)<sup>4</sup>; and the report *Usos de los sistemas de información en el planeamiento y gestión de políticas educativas en América Latina* (Montes, 2022).

## 1. Key strengths and case studies

According to the model proposed by Arias et al. (2021a), on the one hand, countries such as Peru, Uruguay, the city of Bogota (Colombia) and the province of Santa Fe (Argentina) have implemented outstanding strategies that place them at an emerging level of EMIS development. This level reflects significant progress towards the preparation for a digital transformation in educational management.

Peru has made significant progress in the implementation of EMIS by having a modern and updated technological infrastructure. Its main features include a single student registry and a digital notebook for individualized monitoring. It also has a comprehensive teacher training plan supported by digital tools, which includes specific resources for monitoring and continuous improvement of educational processes.

Uruguay has prioritized technological integration through unique identifiers for students, positions and educational centers. It uses platforms such as GURÍ, which facilitates the comprehensive management of students and teachers, and the Ceibal Plan, which offers digital content and teacher training. It also incorporates advanced tools to monitor learning and foster communication with families through GURÍ Familia.

The City of Bogota (Colombia) has a resolution-approved system that optimizes educational management and monitoring. This system includes an in-house data center and specialized off-site storage, as well as a human resources management system that automates key processes such as hiring validation and leave management.

In the province of Santa Fe (Argentina), an innovative model of interoperability between systems has been developed. Its human resources administration system integrates complete information on settlements, tasks and bonuses, in addition to advanced backup and information recovery protocols that include unique authentication mechanisms.

The study by Marés et al. (2023) identifies that in Brazil, Colombia and Peru there are significant advances in the creation of legal and regulatory frameworks and strategic plans that support the development of EMIS, as well as a growing awareness of the importance of cultural

<sup>3</sup> The countries participating in this study were: Argentina (provinces of Cordoba, Mendoza and Santa Fe), Brazil (state of Espírito Santo and municipality of Florianópolis), Colombia (city of Bogota), Costa Rica, Dominican Republic, El Salvador, Honduras, Jamaica, Panama, Paraguay, Peru, Suriname and Uruguay.

<sup>4</sup> The countries participating in this analysis were: Argentina, Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Honduras, Panama, Peru and Uruguay.

change and ongoing training to continue advancing in this area. In addition, this study recognizes some successful cases around the use of emerging technologies such as blockchain, artificial intelligence and cloud computing. For example, in Brazil and Argentina, blockchain is used for the issuance of academic degrees; while in Uruguay and Mendoza (Argentina), artificial intelligence is applied to predict and prevent school dropout.

On the other hand, the **Central American and Caribbean countries** that participated in the aforementioned studies, although they still face significant challenges in moving towards a more complete and automated integration, have made significant progress in the development of their EMIS, adapting to the particularities of their contexts and overcoming challenges associated with the initial stages of implementation. Among the main achievements identified, the following stand out:

- **Development of regulatory frameworks:** Legal and regulatory frameworks for digital transformation have been developed in countries such as El Salvador and the Dominican Republic. These frameworks provide a solid basis for the implementation of emerging technologies and the protection of personal data, together with their respective strategic plans. The latter includes clear purposes and a shared vision between policy and technical decision-makers.
- **Use of unique identifiers and nominal records:** countries such as Costa Rica and Panama have implemented unique identifiers to manage student information, which facilitates data consolidation and analysis.
- **Technological infrastructure:** notable efforts have been made to improve connectivity and technological equipment in administrative bodies (especially central offices) as well as at the school level. For example, in the first case, Panama and the Dominican Republic have a good level of connectivity and considerable availability of technological devices in their administrative offices, which facilitates management and access to information. In the second case, Jamaica and Panama have shown significant progress in connectivity and equipment in educational institutions, although challenges persist in rural and hard-to-reach areas.
- **Human resources management:** some countries, such as the Dominican Republic and Suriname, have developed systems for personnel and payroll administration, achieving different levels of automation and optimization in these processes. Likewise, in El Salvador, Honduras, Panama and the Dominican Republic there are continuous training plans for the actors involved in the digital transformation, which ensures that personnel are trained to use the new technologies and adapt to the changes.
- **Development of digital content and teacher training:** digital content repositories have been created and online teacher training programs have been implemented. Jamaica and Panama have led outstanding initiatives in this area, promoting the use of digital tools for teaching and learning.

In general terms, these initiatives reflect the commitment of each country and region to advance in the digitalization and integration of educational systems. These efforts make it possible to manage administrative and academic processes more efficiently, contributing to the strengthening of educational quality in their specific contexts.

## 2. Main opportunities for improvement

According to the report by Arias et al. (2021a), EMIS in the region are mostly in an incipient level of development. This means that the systems only partially cover educational management processes and need to strengthen their strategic orientation. Along the same lines, the report by Marés et al. (2023) recognizes that the level of digital development in public educational administrations in the region is in its early stages, with many countries still in the initial processes of digitization. Finally, Montes (2022) mentions that factors still present in countries of the region such as the lack of regulatory frameworks, interoperability limitations, difficulties in accessing information, and the lack of connectivity and equipment in some localities continue to affect the use of EMIS for educational planning.

For example, the **Central American and Caribbean countries** that participated in the aforementioned studies share aspects that require priority attention to strengthen their EMIS. These include:

- **Interoperability and fragmentation of systems:** in some cases, systems have been developed independently, which generates challenges related to data fragmentation and duplication. There are limitations in the integration of information, making it difficult to use it more intensively and autonomously at intermediate levels of the educational system. This is a critical aspect for optimizing educational management and making the most of the available tools. For example, in El Salvador, although progress has been made in the nominalization of students, personnel and financial resource management systems still operate in a fragmented manner.
- **Data quality and availability:** ensuring that information is up-to-date and accurate remains a major challenge. This limits the ability of systems to generate reliable reports and support decision-making.
- **Management of physical infrastructure and connectivity:** the maintenance and updating of school equipment and physical infrastructure are areas that require greater systematization. In terms of connectivity, although administrative offices are usually well-connected, many schools still face limitations in this regard. This is a particularly relevant challenge in Honduras and some areas of Panama, where school connectivity is still insufficient. Likewise, the maintenance and updating of technological infrastructure are priority areas for improvement. In Panama, for example, the need to strengthen technological equipment maintenance processes has been identified.
- **Tools for strategic management and data protection:** the adoption of emerging technologies such as dashboards, blockchain, data science, cloud computing, artificial intelligence and business intelligence is still in its initial stages in several countries, limiting the generation of key indicators for decision making. Although there are some advances, as in the Dominican Republic with the use of data science for educational management, in general, the implementation of these technologies is incipient. Likewise, although there are legal frameworks for data protection, the implementation of computer security measures is insufficient. This is critical to ensure the privacy and security of educational information.

In summary, in the countries of Central America and the Caribbean, although there are significant advances in the adoption of technologies and the management of human resources and digital content, important challenges persist in the interoperability of systems, data quality, management of physical infrastructure and the use of emerging technologies to make strategic decisions. Systems integration and updating are critical areas that require attention to improve the efficiency and effectiveness of EMIS in these countries. Similarly, coordination between public educational administration and schools represents a key challenge, and strengthening this coordination would allow the implementation of effective strategies in which the available technologies respond adequately to the needs of the different levels of the educational system.

## V. EMIS development experiences in KIX countries

Educational Management and Information Systems (EMIS) projects in Latin America and the Caribbean have emerged as key tools for modernizing educational management. In a context of growing demand for quality and equitable education, EMIS have facilitated evidence-based decision-making. These systems have significantly improved the collection, processing and analysis of educational data, allowing decision-makers to access accurate and timely information on various aspects of the education system. As a result, they have enabled a more efficient allocation of resources, better monitoring of educational policies and greater transparency in the sector. The implementation of EMIS has been fundamental to promote a more systematic and results-oriented educational management, thus contributing to face the region's educational challenges.

To broaden the use of evidence and share experiences and lessons learned in the implementation of EMIS in the region, the following report, in collaboration with the KIX countries<sup>5</sup>, presents different types of developments in KIX LAC countries, which show the efforts they are making in this area. This report allows visualizing their main advances, challenges and lessons learned, which are undoubtedly useful to promote collaboration at the regional level.

### 1. Initial developments and the challenge of establishing an EMIS policy

#### a) Saint Lucia

##### Brief description of the initiative

Although initial attempts to implement an EMIS in the country at the beginning of the millennium failed to consolidate, the recent Education Sector Plan has renewed the commitment to develop a sustainable and strategic system. This effort seeks to strengthen key elements such as infrastructure, security and system functionalities, with the purpose of supporting the monitoring and evaluation of progress in the education sector. To achieve this purpose, the importance of a favorable political environment that facilitates the coordination of roles and responsibilities at all levels of the education system is highlighted.

In terms of human resources, significant efforts have been made to involve teachers in the EMIS implementation process, adjusting their workload to allow them to actively contribute. However, the consolidation of a robust institutional framework for EMIS and the development of clear guidelines are necessary steps to align the roles and responsibilities of the actors involved, which will contribute to overcoming operational challenges.

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<sup>5</sup> The case studies presented below were the result of a collaborative co-construction process with the country representatives of the KIX LAC initiative. These cases were developed specifically in response to a formal request sent by the KIX LAC team to the national representatives, with the purpose of documenting and analyzing significant experiences in the regional educational context. In addition, the information was complemented and enriched with inputs from webinars, workshops, learning visits and KIX conversations and internal documents developed during the knowledge mobilization cycle. Based on this information, cases were developed from the experiences of: Dominica, El Salvador, Grenada, Guyana, Honduras, St. Lucia, and St. Vincent and the Grenadines.

In general, it is recognized that an EMIS is not only a technological tool, but an engine for organizational transformation. This process implies a paradigm shift in the dynamics of educational management and requires a sustained commitment on the part of the authorities to build a strategic vision that integrates all organizational and technological components.

## b) Saint Vincent and the Grenadines

### Brief description of the initiative

St. Vincent and the Grenadines launched its EMIS system in April 2023, which was developed by the SmartTerm organization. Initially, this system was piloted in six schools in the country (three primary and three secondary schools) and, during July and August 2023, data from all 104 schools across the country were successfully imported into this new system, with 102 schools now actively working with the system.

At present, the system is still under development and one of the main priorities is to achieve the commitment of all the schools, as well as of the different actors of the educational system.

### Main challenges identified during the implementation

1. **Connectivity in remote areas**
  - The lack of internet access in some regions of the country, coupled with limited high-speed internet coverage and problems with wireless connectivity, represents a significant challenge.
2. **Stakeholder commitment and familiarity**
  - Variable participation of staff, students and families was observed, influenced by initial resistance to change and different levels of digital literacy.
3. **Technical challenges**
  - The validation of data before uploading to the system and the provision of adequate computer support for all schools, especially in a geographically dispersed context, were key areas to be addressed.
4. **Compliance with the implementation schedule**
  - Ensuring that key actions for the EMIS mass configuration are completed within the established timelines continues to be an operational priority.

### Next steps in the implementation process

- Short term (2024-2025)
  - Participation of all schools (104).
  - Increased interaction and commitment of the different educational actors.
  - Integration of more administrative processes in the offices of the Ministry of Education to digitize and capture essential data.
  - Creation of an EMIS policy that supports these processes.
- Medium term (2025-2027)
  - A fully functional EMIS within the educational centers.

- Conclusion of attendance, grading, reporting, learning management system and other data capture functionalities.
  - Education law update.
  - Availability of data download for further analysis.
- Long term
    - EMIS as a crucial element to see the overall educational landscape of the country.
    - Delivery of accurate and real-time data, which will allow the development of educational policies and the improvement of school management.
    - EMIS provides a comprehensive view of the country's educational performance.

### c) Grenada

#### Brief description of the initiative

Grenada has been making significant efforts to implement EMIS. Although this is not the first time the country has attempted to introduce this system, this time the first stage of implementation is being carried out with OpenEMIS, to deploy the system in its entirety during the year 2024.

A key aspect of the process has been the need to establish solid policies to support implementation, emphasizing that this effort transcends the technological sphere. The importance of carrying out an organizational transformation from ministerial authorities to teachers in schools, promoting a comprehensive change in the way education is managed, is underlined. In addition, it highlights the need for a robust team that includes not only IT and planning specialists but also personnel trained to lead, plan and accompany implementation at the national level. In this regard, the figure of a leader to promote these initiatives at each level of the education system has been identified as a determining factor for the success of the project.

In terms of data collection, Grenada has opted to centralize this process in the ministries, considering that this measure reduces errors that may arise when records are made directly by the schools. At the same time, priority has been given to simplifying workflows, ensuring that information reaches teachers and other key actors promptly.

Grenada is currently developing a pilot in nine selected schools, which have internet access and technological devices provided by the government. The main purpose of this pilot is to collect data on students and their attendance, allowing the effectiveness of the system to be evaluated and adjustments to be made before nationwide implementation.

In general, it is recognized that the implementation of EMIS in Grenada represents not only a technological challenge but also a profound change in educational organization and

management. This process, although complex, marks an important step towards modernizing the education system and improving data-driven decision-making.

## 2. Intermediate developments and the challenges of keeping an EMIS structure in motion

### a) Guyana

#### Brief description of the initiative

For nearly two decades, efforts have been underway in the Caribbean region to establish an EMIS. However, it was in 2018 that these efforts began to come to fruition in Guyana, thanks to the collaboration of the Ministry of Education's Planning, Communications and IT units, along with support from UNESCO and the Community Systems Foundation (CSF). Through the OpenEMIS platform, the first national EMIS pilot was conducted, which was finally fully implemented in 2023.

The purpose of the system is to become a key tool for educational management, facilitating the generation of reliable and timely data. This data is essential for the planning, monitoring and evaluation of projects, policies and ministerial programs. This development represents a significant change from traditional paper-based processes, such as the use of admissions books and physical attendance records. With the introduction of the new digital platform, administrative processes in schools are expected to be optimized, freeing up time for teachers to focus more on academic activities.

The country is currently conducting an intensive training program for school staff to familiarize them with both the central online system and survey tools that can be used offline. EMIS is already in active use in schools, including modules for Personnel, Students, Academics and Attendance, which allow the Ministry of Education immediate access to relevant statistical data. In addition, there are plans to expand the system's functionality with new modules for the management of report cards, exams and risks, which will further increase its efficiency and capacity.

#### Challenges faced in the development and/or implementation of EMIS

- **Connectivity and technological access:** some schools, especially in remote areas, face connectivity problems, which are crucial for the effective operation of EMIS.
- **Teacher training and awareness:** teachers and administrative staff require training and awareness to adopt and effectively use EMIS.
- **Human resources and technical support:** additional personnel, such as data entry managers and EMIS coordinators, are needed to manage and maintain the system.
- **System integration and interoperability:** challenges related to integrating EMIS with other existing systems and improving offline functionality.
- **Political and regulatory support:** the importance of political and regulatory support for the successful implementation of EMIS, including the review of relevant legislation.
- **Change management:** resistance to change and the need for a strategy to facilitate the transition to EMIS.
- **Financing and costs:** challenges related to the financing of EMIS implementation and maintenance, including software and hardware development costs.

- **Data security and privacy:** concern for the security and privacy of data collected and stored in EMIS.
- **System planning and design:** EMIS needs to be carefully planned and designed to meet the specific needs of each school and regional context.
- **Scalability and sustainability:** challenges in expanding the system to cover all schools and its long-term sustainability.

#### Next steps in the implementation process

- **Strengthening of the work team:** by reinforcing the capacities of the existing team, plus the incorporation of new personnel for the proper deployment of EMIS.
- **Raising awareness of EMIS:** by working hard in the districts and regions to develop a data culture.
- **Incorporation of a module with Report Cards:** to standardize grade reporting at the national level. This will ensure consistency and accuracy of student performance records, as well as facilitate better tracking and comparison of academic achievement.
- **Early Warning System:** a dashboard is being developed to identify students at risk of falling behind and generate alerts about it, to make timely interventions.
- **Integration of Learning Management System:** in order to integrate or streamline the management of educational content, assignments and assessments, and create a more coherent and efficient educational environment.

#### b) Dominica

##### Brief description of the initiative

Dominica's EMIS, implemented in 2011, is based on the OpenSIS (Student Information System) platform for managing educational data. Since its introduction, the system has achieved widespread adoption, currently operating in 75 of the country's 78 schools, while three private institutions prefer to use their own systems.

One of EMIS's outstanding functionalities is its gradebook, designed to adapt to different assessment methodologies. This tool allows teachers to combine grading periods and customize assessment strategies, facilitating a more flexible and efficient calculation of final grades.

The implementation of EMIS reflects a commitment by the government of Dominica to the modernization and standardization of educational management. Throughout its development, the system has proven to be adaptable to the specific needs of the country's education sector. This flexibility makes it a valuable resource for the administration and monitoring of educational processes, marking a significant advance in the digitalization of the educational system.

##### Challenges faced in the development and implementation of EMIS

- **Insufficient equipment in schools:** many schools lacked the necessary technological resources, which hindered the effective integration of the system.

- **Limited Internet access:** stakeholders, including teachers and administrators, faced difficulties due to inadequate connectivity, especially in remote areas.
- **Resistance to change:** some school and Ministry of Education officials showed reluctance to adopt the new system, underscoring the need for awareness-raising and change management strategies.

Concerning this last point, the implementation of EMIS faced some initial resistance from teachers, who perceived the system as an additional workload not foreseen in their current responsibilities. This challenge highlighted the importance of providing adequate technical support to facilitate the transition to the use of the new system, especially during periods of high demand, such as academic closure.

The habit of concentrating computerized registration at the end of the school year generated an overload in administrative procedures, which increased the complexity of technological adoption. This experience showed the need for a comprehensive approach that addresses not only the technical aspects of the system, but also the organizational dynamics and perceptions of the teaching staff, ensuring that their concerns and challenges are taken into account in the transformation of their administrative practices.

### Lessons learned and recommendations for EMIS development and/or implementation

- It is essential to ensure the adequacy of infrastructure, equipment and training for all stakeholders. These factors serve as motivation for rapid adoption, particularly by schools.
- It is important to use different types of incentives to attract early adopters and those who resist process change.
- It is important to have the right people and processes in place to ensure data integrity. Otherwise, the reports generated may lose their value and the system will not achieve the expected results.
- Adequate load testing must be performed to ensure that the system can support the weight of the users who will be using it simultaneously.

### 3. Advanced developments and the challenges of a state policy for the interoperability and sustainability of EMIS

#### a) Honduras

#### Brief description of the initiative

The Sistema de Administración de Centros Educativos (SACE) was created to respond to the need for accurate and updated administrative data on the Honduran educational system. Prior to its implementation, there were significant inconsistencies, such as the underestimation of the number of teachers, students and schools, which was evidenced in previous audits.

The SACE is currently the main tool for the management of educational information at the national level and the main source of statistics related to coverage, performance, enrollment and attendance. This system integrates qualitative and quantitative data from pre-basic,

elementary and secondary education levels, generated from educational centers and processed at the national level.

The development of the SACE began in 2007, culminating in a first pilot test in 2013 and achieving full implementation in 2014. In 2015, the Sistema Estadístico de Reinserción Escolar (SERE) was introduced, evolving in 2020 to the Sistema de Alerta y Respuesta Temprana (SART). The latter aims to identify children at risk of dropping out of school, based on conditions and vulnerability profiles. The SART uses the information generated by the SACE to issue alerts, identify at-risk cases and provide intervention tools to mitigate school dropout.

In addition, the SART reflects a comprehensive approach to educational management, not only providing data, but also complementing it with direct attention strategies for students in vulnerable situations, such as the allocation of bonuses, scholarships and other incentives. This has been possible thanks to the interoperability of the country's educational systems, allowing the connection with other institutions to carry out complex processes, such as the targeting of benefits.

Both SACE and SART stand out for their operational flexibility. These systems are available throughout the year, allowing processes such as student enrollment at any time. Their interoperability with other systems has facilitated the implementation of more comprehensive strategies, such as the calculation and allocation of scholarships, vouchers and school feeding programs.

### Challenges faced in the development and implementation of SACE and SART systems

- **Financing and long-term sustainability:** both systems were initially developed without formal economic investment, which created challenges to ensure their sustainability in the initial stages.
- **End-user resistance to change:** The existing organizational culture required a strategic approach to empowering end-users and fostering acceptance of the system. This included developing specific awareness and training programs.
- **Equitable digital access:** although the country faces a significant digital divide, it was possible to ensure that all teachers have access to SACE and SART, although Internet access is still unequal in some regions.
- **Information security:** some nominal records are not yet publicly accessible, which poses challenges related to privacy and secure access to data.

### Lessons learned and recommendations on SACE and SART development and implementation

- **Educational management processes for decision-making:** it is crucial to design systems that not only record data, but also generate strategic information to support decision-making at all levels of the educational system.
- **Sound legal, institutional, and technological infrastructure:** having a clear regulatory and institutional framework, accompanied by an adequate technological infrastructure, is essential to ensure the functionality and sustainability of the systems.
- **Systems integration and interoperability:** Although it is not necessary to centralize all data in a single system, it is recommended to ensure that all systems used are interoperable and can communicate effectively with each other.

- **Economic and functional sustainability:**
  - **Economic:** prioritizing widely accepted and secure open-source tools that do not involve significant additional licensing or costs can be an effective strategy for maintaining long-term economic viability.
  - **Functional:** empowering teachers and end users, and promoting their appropriation of the system, is fundamental to guarantee its continuous and effective use.

## b) El Salvador

### Brief description of the initiative

The Ministry of Education, Science and Technology (MINEDUCYT) used to carry out the "School Census" process at the national level with the collection method through physical forms addressed to school principals and teachers, for the generation of educational statistics. However, this mechanism generated a certain delay in the timely production of strategic information for decision-making related to the different levels and modalities of educational services, resource allocation, management of social programs, among others. Likewise, the management of the academic registry was done through physical books, which generated delays attending requests for academic documents, as well as the management of cases of protection of rights in the educational system.

To overcome these limitations, in 2019 it was decided to develop a proprietary system for the management of education in El Salvador. It was an arduous process due to the difficulties in the registration and standardization of the information collected for the country's different educational modalities. There were many failed attempts at unification and they opted for a contextualized solution due to the particular characteristics of the Salvadoran educational system. In joint work between the different actors of the educational system and the support of the Millennium Challenge Corporation, a design adapted to the needs of the country was achieved. A market study and a survey of requirements were carried out, which were an essential part of the cost projection. Subsequently, they worked with the consulting firm to determine costs and needs to project the financial requirements for maintenance, which are assigned to the Directorate of Innovation and Technology through the funds of the institutional budget.

Support is currently being provided through the management of partnerships and cooperation such as UNICEF, UNDP-SIGOB, IDB, GPE, among others, to continue developing new functionalities of the platform and interoperability with other internal and external systems. This new EMIS is expected to strengthen decision-making and resource management for the educational community, as well as the interrelation and standardization of the joint needs of the educational modalities and levels. Additionally, they want to transform the management of educational centers through technology, interoperation between the different modules, with an architecture based on microservices, seeking that all reports, dashboards, documents and

queries work on unique repositories of information, incorporating key elements for data management: unique identifiers of people with their different roles for the improvement in the generation of data from schools, teachers and students.

### **Challenges faced in the development and/or implementation of EMIS**

- Development and strengthening of institutional capacities for the management, sustainability and development of the platform.
- Strengthening of the technological infrastructure for the operation and sustainability of the system.
- Limited internet coverage in some areas of the country.
- Low availability of technological resources for recording information in educational centers.
- Resistance to change.

To overcome these challenges some measures that continue to be implemented are:

- Provision of computer equipment for faculty and students nationwide.
- Design of support materials (procedures, instructions, tutorials, etc.) for the use of the system, published through web portals: <https://www.mined.gob.sv/gestioneducativa/>.
- Integration of platforms for the management of online procedures related to the management of teaching personnel.
- Training of teaching staff on the proper use of the system through an asynchronous virtual course.
- Ongoing monitoring of the registration of information through the Monitoring System (SIMON), in coordination with the Departmental Education Directorates and Education Managers at the national level.
- Integration of new technologies and cybersecurity mechanisms for data protection.

### **Lessons learned and recommendations for EMIS development and/or implementation**

- Conduct a broad analysis of the internal and external context to define the scope, the related processes and the needs of the different stakeholders according to the reality of each territory.
- Implement in parallel to ensure data reliability, quality and integrity.
- Consider the provision of technological resources for teachers.
- Establish permanent training programs in the use and design of the system.
- Implement permanent monitoring mechanisms to verify the quality of the data, with the support of teams directly related to the educational community.
- Integrate mechanisms for the return of results to school principals and teachers so that the resulting information can be useful in decision-making to improve the quality of education.

## VI. Challenges and recommendations for strengthening EMIS in the region

Education Information and Management Systems (EMIS) present significant challenges in their implementation and operation, according to recent studies by UNESCO (2022) and Adam & Mitchell (2024). These systems suffer from multiple challenges, including a lack of data integration, a lack of clear policies, obsolete technologies, and designs that do not respond to the real needs of all users. The main criticism focuses on their reduced usefulness for decision making, duplication of information and low levels of utilization of the data collected. In addition, it is pointed out that the technical and training requirements for a comprehensive implementation are not sufficiently understood and supported, which compromises their effectiveness as educational management tools.

Based on the models analyzed, the state of development of EMIS in the Latin American and Caribbean region, and the particular cases of the countries reviewed, a series of challenges can be identified that need to be addressed to strengthen the deployment of these systems in the region. This section presents them together with some relevant recommendations.

Latin American and Caribbean countries vary in the levels of development of their systems. In recent years, Global Partnership for Education (GPE) partner countries generally face several issues that hinder the potential realization of EMIS 2.0, including a lack of resources and technical capacity, difficulties competing with private organizations for technical staff, low data literacy and fragmented data sources, and low confidence in the quality and timeliness of data, resulting in inconsistent use of information at all levels of the education system (GPE KIX 2023).

The following table summarizes the main findings of IDB, CAF, OEI and IIEP UNESCO documents on the challenges of digital transformation in the region's education systems.

Dimension	Challenges	Recommendations
<b>Infrastructure and Connectivity</b>	<ul style="list-style-type: none"> <li>• Unequal access to technology, especially in rural areas.</li> <li>• Poor maintenance and updating.</li> <li>• Lack of investment in technological equipment and personnel training.</li> </ul>	<ul style="list-style-type: none"> <li>• Increase investment in technological infrastructure and ensure broadband connectivity in all schools.</li> <li>• Establish ongoing maintenance and support programs.</li> <li>• Increase investment in technology and continually train personnel in the use and analysis of information.</li> </ul>
<b>Governance and Institutional</b>	<ul style="list-style-type: none"> <li>• Fragmentation of non-interoperable systems that makes management difficult.</li> <li>• Cultural and organizational resistance to change.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop clear regulatory frameworks to govern the implementation of emerging technologies.</li> <li>• Promote transparency and efficiency in governance</li> </ul>

<b>Human Capital and Organizational Models</b>	<ul style="list-style-type: none"> <li>Lack of continuous training for administrative and teaching staff, and specialized technology personnel.</li> </ul>	<ul style="list-style-type: none"> <li>Implement continuous training programs in the use of digital technologies for educational and administrative personnel.</li> <li>Attract and retain talent specialized in educational technology.</li> </ul>
<b>Management Processes</b>	<ul style="list-style-type: none"> <li>Many administrative processes are not yet automated.</li> <li>Data not integrated between systems, making it difficult to make informed decisions.</li> </ul>	<ul style="list-style-type: none"> <li>Promote the automation of administrative and educational processes.</li> <li>Implement integrated data management systems to improve evidence-based decision-making.</li> </ul>
<b>Emerging Technologies</b>	<ul style="list-style-type: none"> <li>Low utilization of advanced tools such as artificial intelligence and blockchain.</li> </ul>	<ul style="list-style-type: none"> <li>Using data science and artificial intelligence to improve educational management.</li> <li>Implement blockchain technologies for the issuance of academic degrees and certifications.</li> </ul>
<b>Interoperability and Data Access</b>	<ul style="list-style-type: none"> <li>Low interoperability between educational systems and limited access to data</li> </ul>	<ul style="list-style-type: none"> <li>Improve interoperability and facilitate access to open data and online consultation platforms.</li> </ul>
<b>Development of Regulatory Frameworks</b>	<ul style="list-style-type: none"> <li>Lack of clear regulatory frameworks governing EMIS, which affects responsible data management.</li> <li>Lack of protocols for the use and protection of personal data.</li> </ul>	<ul style="list-style-type: none"> <li>Create and strengthen regulatory frameworks that regulate the collection and use of educational data, guaranteeing the protection of personal data.</li> <li>Develop clear protocols for the responsible use and management of information.</li> </ul>
<b>Strategic Plans and Coordination</b>	<ul style="list-style-type: none"> <li>Lack of comprehensive strategic plans for EMIS and lack of inter-institutional coordination.</li> </ul>	<ul style="list-style-type: none"> <li>Develop strategic plans for the digitalization of educational processes.</li> <li>Strengthen governance and inter-agency collaboration.</li> </ul>
<b>Promotion of Digital Culture</b>	<ul style="list-style-type: none"> <li>Little integration of digital culture in educational policies.</li> <li>Lack of participation of key stakeholders in the design of the systems.</li> </ul>	<ul style="list-style-type: none"> <li>Foster a digital culture that values the use of data for decision-making.</li> <li>Promote the participation of all educational stakeholders in the design and development of EMIS.</li> </ul>
<b>Identification of Vulnerable Populations</b>	<ul style="list-style-type: none"> <li>Difficulty in identifying students at risk of dropping out of school due to lack of early warning tools.</li> </ul>	<ul style="list-style-type: none"> <li>Implement early warning systems to identify students at risk of dropping out of school.</li> <li>Develop intervention protocols that avoid stigmatization and promote equity in access to education.</li> </ul>
<b>Harmonization of Indicators</b>	<ul style="list-style-type: none"> <li>Lack of harmonization of indicators at global, national and local levels.</li> <li>Difficulties in comparing and evaluating information at different levels of the educational system.</li> </ul>	<ul style="list-style-type: none"> <li>Harmonize indicators at global, national and local levels to ensure comparability and consistency of data.</li> </ul>

		<ul style="list-style-type: none"> <li>• Establish common frameworks for data collection and strengthen international collaboration and coordination.</li> </ul>
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Finally, Butcher and Zimmermann's (2023) paper on EMIS in the Caribbean mentions, additionally, the following recommendations:

- Use a diagnostic tool to evaluate, update and monitor the current performance of EMIS.
- Articulate an ICT (Information and Communication Technologies) policy in education linked to national purposes.
- Adopt and apply a theory of change to drive EMIS policy development.
- Articulate the strategic vision of EMIS and design a change management plan.
- Develop an EMIS policy driven by purposes.
- Reflect the characteristics of a high-impact EMIS in policy.
- Develop capabilities.
- Work closely with regional bodies such as the Caribbean Examinations Council (CXC).
- Ensure that countries comply with enabling requirements such as nationwide connection of educational centers.

## VII. Conclusions

The development of Education Management and Information Systems (EMIS) in Latin America and the Caribbean is a story of contrasts and challenges. In some places, these systems have evolved into sophisticated tools that facilitate informed decision-making and improve educational management. In others, EMIS implementation still faces significant obstacles, from lack of technological infrastructure to resistance to change.

One of the most striking aspects is the diversity in the development of EMIS. While some countries have made remarkable progress in digitization and systems integration, others still rely on manual methods and fragmented systems. This diversity is due to factors such as the availability of resources, technological infrastructure, and political and regulatory support.

The existence of clear regulatory frameworks and policies is crucial for the effective development of EMIS. Countries with well-defined legal frameworks and digital transformation strategies show greater progress in the implementation and use of these systems. These frameworks provide a solid foundation for the implementation of emerging technologies and the protection of personal data.

Continuous training and capacity building of educational and administrative staff are essential for the adoption and effective use of EMIS. Resistance to change and lack of digital skills are common challenges that must be addressed through the implementation of continuous training programs for administrative and teaching staff in the use of digital technologies and the generation of digital content.

Interoperability between different systems and long-term sustainability are critical challenges for EMIS in the region. They must be able to integrate with other educational and governmental systems to provide accurate, real-time data to support informed decision-making. Lack of interoperability and data fragmentation impede efficient management and limit the ability of EMIS to generate useful reports and analyses.

Technological infrastructure and connectivity are critical to the effective operation of EMIS. Lack of connectivity in remote areas and insufficient technological devices are significant barriers that must be overcome to ensure equitable access to digital education. Investment in technological infrastructure and ensuring broadband connectivity in all schools, especially in rural areas, must be made.

Concerning social justice, it is concluded that EMIS are essential for their promotion in the region since they provide accurate, updated and detailed data that make it possible to identify and address educational and learning gaps, especially among the most disadvantaged and vulnerable groups. By collecting nominalized information on schools, teachers and students, these systems facilitate the creation of more inclusive, relevant and equitable education policies. Some experiences illustrate this focus of use, such as the case of Honduras, with the Sistema de Administración de Centros Educativos (SACE) and the Sistema de Alerta y Respuesta Temprana (SART), which identify students at risk of dropping out of school and support them such as scholarships and school vouchers, ensuring that the most vulnerable continue their education. Or like Colombia's with its Sistema de Información para el Monitoreo, la Prevención y el Análisis de la Deserción Escolar (SIMPADE), which detects students at risk of dropping out and coordinates interventions based on risk factors such as

academic performance and socioeconomic conditions, helping to keep these students in the education system.

In summary, the development and strengthening of EMIS in Latin America and the Caribbean requires a comprehensive approach that includes improving technological infrastructure, staff training, policy and regulatory support, and securing sustainable funding. Addressing these challenges is essential to ensure that EMIS can fulfill their potential to improve educational management and support evidence-based decision-making throughout the region and thereby promote higher quality education focused on social justice.

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