

# The Role of School Infrastructure and Components in Effective Implementation of Educational Management Information System (EMIS) in Schools of Excellence in Nyarugenge District, Rwanda

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**Abstract:** The research objective was to find out the role and standing of existing school infrastructure and components for effective implementation of Educational Management Information System (EMIS) in Schools of excellence. Findings of this study revealed the high availability of EMIS infrastructure and its accessibility with limitations of low and slow internet. The study recommends that schools should avail strong internet, provide a support of EMIS experts to school, and organized follow-up activities.

**Key Terms:** School infrastructure and components, Educational Management Information System (EMIS), Schools of excellence

## I. INTRODUCTION

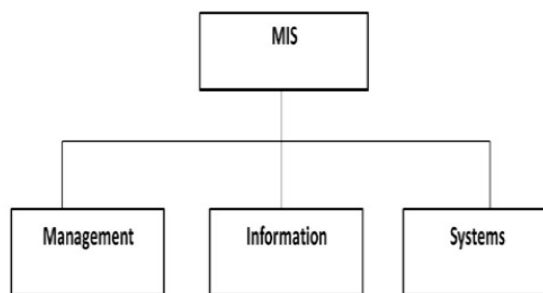
Every education system relies on accurate, timely and complete education data and information in order to function properly (RMSA-TCA, 2015). Schools and education institutions embraced the use of modern technological facilities based Educational management information systems (EMIS) for effective management of the educational information and data. EMIS plays an important role in effective school management. EMIS is crucial for the purposes of decision making, managing, planning and evaluating the education systems (Akaranga & Makau, 2016). A study demonstrates that there is a significant relationship between the usage of modern technological facilities and the effective management of educational institutions (Adeyemi, 2011). EMIS is demonstrated as a tool which impacts on every aspect of school management activity. EMIS leads to changes in work and changes in the organization of work (UNESCO, 2002). This proves the significant impact of the modern technological facilities and tools on effective school management.

## II. LITERATURE REVIEW

Literature review embraced the Concept of MIS and EMIS in Education, Components and Infrastructure Supporting EMIS, and Theoretical Framework based on Resource Orchestration theory.

### 2.1. Concept of MIS and EMIS in Education

The concept of EMIS is an adoption of Management Information System (MIS). EMIS is MIS applied to education management. Therefore, MIS mainly includes three important terms: Management, information, and systems. To understand the meaning of this term it is very crucial to understand the meaning of management, information, and systems (Al-Mamary & Aziati, 2014).

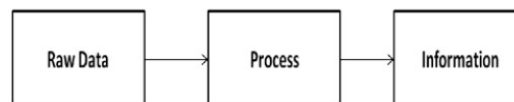


Source: Al-Mamary and Aziati( 2014)

Figure 1. The Meaning of Management Information System (MIS)

(i) *Management:* Management is an attempt to coordinate the effort of human and material input in order to achieve set objectives (Ahmed, 2007). It is also defined as a process to achieve organizational goals efficiently and effectively through planning, organizing, directing and controlling organizational resources (Al-Mamary & Aziati, 2014).

(ii) *Information:* Information is known as data that have been converted into a meaningful and useful context for specific end users. Thus, information is generated through the transformation of data (Al-Mamary&Aziati, 2014).



Source: (Al-Mamary&Aziati, 2014)

Figure 2. Conversion of data into information

(iii) *System*: A system is a set of interrelated components, with a clearly defined boundary, working together to achieve a common set of objectives by accepting inputs and producing outputs in an organized transformation process (Al-Mamary&Aziati, 2014). Systems have three basic functions: (i) Input which involves capturing and assembling elements that enter the system to be processed. (ii) Processing that involves transformation processes that convert input into output. (iii) Output which involves transferring elements that have been produced by a transformation process to their ultimate destination (O'Brien &Marakas, 2011).

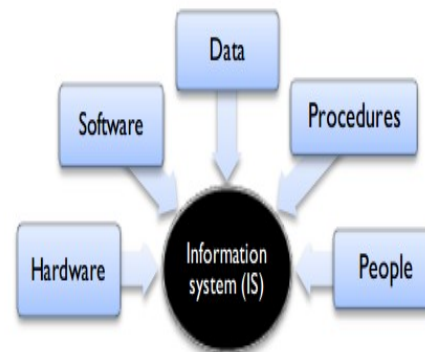
MIS is basically concerned with the process of collecting, processing, storing and transmitting relevant information to support the management operations in any organizations (Ajayi & Fadekemi, 2007). MIS makes management operations easier to collect, store and process the data and retrieve information easily when needed, which increases the efficiency of these companies (Al-Mamary&Aziati, 2014). In education, information is crucial for the purposes of managing, planning and even evaluating the education system. Therefore, MIS has been used in the field of education, adopted in all fields of knowledge and practice thus giving rise to EMIS (Akaranga, & Makau, 2016).

An EMIS is an organised group of information, a centre or a unit that collects, stores, integrates, processes, organises, analyses, manages and distributes information for educational planning and management. It includes the concept of comprehensive data, which are accessible by computer and available for analysis, for processing and decision-making purposes. It is responsible for the promotion and use of information for policy planning and implementation, decision-making, and the monitoring and evaluation of an education system. It provides timely, cost effective and user appropriate information to support educational planning and management (Connal, 2005). He added that data systems are designed to collect, compile, collate and analyze school level data (variables include students, teachers, facilities, finance, and school locations). These systems are often called education management information systems (EMIS).

## 2.2. Components and Infrastructure Supporting EMIS

MIS is a set of components which interact to produce information, which include hardware, software, data, procedures, and people, whereas these components can be found in every information system (Kroenke, 2007). Additionally, MIS, EMIS applied to education, consists of hardware, software, data, procedures, and people. Hardware refers to computers, storage disks, keyboards, and communication devices while software is relevant to processing programs. Data or information is included texts, words, sentences, and paragraphs in reports. Furthermore, procedures refer to the methods for using the program and involved activities. The last element is people. The important role of the *five components* is that MIS is not only computers, programs, and communication devices, but it also focuses on

the assembly of hardware, software, data, procedures, and people; in other words, information system means a system of communication between people (Kroenke, 2007; Davies, 2009).

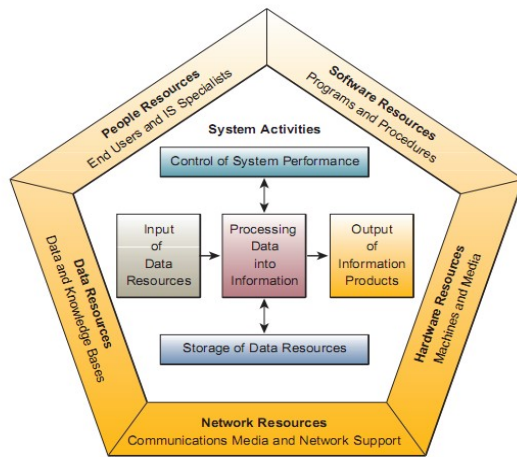


Five Components of an Information System (IS) (source: Kroenke, 2007: p. 5)

Figure 2. Components of MIS

According to Heidarkhani et al. (2013) indicated management information system is kind of organizational information computer systems, that take internal information from operating processing system and summaries them to Meaningful and useful forms as management reports to use in performing management duties. Advancements in computer software and web-based platforms in the past two decades have allowed for EMIS to be more accessible, affordable and efficient. EMIS tools are primarily open source for large systems, thus allowing multiple individuals to each individual school to contribute information. EMIS can be accessed through installed software or web-enabled tools, increasingly on laptops and smaller devices, such as netbooks and tablets that require less electricity and requirements for cooling and security (Bernbaum& Moses, 2011). Bernbaum and Moses added that Mobiles or smartphones, as support to EMIS are capable of transmitting data through SMS and specialized applications. Mobile phones are irreplaceable particularly for schools in rural areas without electrification. MIS contains infrastructure, application systems, and personnel who employ information technology to deliver information and communications services for transaction processing /operations and administration/management of an organisation” (Baskerville, Stage, & DeGross, 2000). Hence, the main EMIS components and infrastructures to properly function includes hardware devices, software programmes, procedures, supporting staff, internet, electricity, and data.

Additionally, Information systems (IS) are made up of interrelated components People, hardware, software, peripherals, and networks (O'Brien &Marakas, 2011)



Source: (O'Brien & Marakas, 2011)

Figure 4. The components of an information system

Figure 3.2.3 illustrates an information system model that expresses a fundamental conceptual framework for the major components and activities of information systems. An information system depends on the resources of people (end users and IS specialists), hardware (machines and media), software (programs and procedures), data (data and knowledge bases), and networks (communications media and network support) to perform input, processing, output, storage, and control activities that transform data resources into information products (O'Brien & Marakas, 2011). All information systems rely on people, hardware, software, data, and network resources to perform input, processing, output, storage, and control activities that transform data resources into information products. People, hardware, software, data, and networks are the five basic components and resources of a successful information systems.

### III. THEORETICAL FRAMEWORK

This research was based on Resource Orchestration theory.

#### 3.1. Resource Orchestration Theory (ROT)

Etymologically, Orchestration is the use of various combined musical instruments to get a sonorous effect. An analogy for resource orchestration can be music orchestration, which is the art of composing for an orchestra. In the process of implementing an IS project, many kinds of resources exist and contribute toward attaining the project objectives. Nonetheless, resources have impacts on each other. The term resource orchestration is used to explain the outcome of all resources as a united concept. Resource orchestration simply means an arrangement of organizational resources which lead the organization to perform an EMIS project (Dwivedi, Wade, & Schneberger, 2012). Barney (1991) classified resources as being physical, human, and organizational. Resource orchestration theory (ROT) analyzes how selection and structuring of human, social, network, financial, and technological resources can be used to exploit opportunities

and gain competitive advantage, achieve growth, and create value (Sirmon et al., 2011).

Resource orchestration (ROT) involves structuring, bundling, and leveraging of resources as three broad processes. There are several sub-processes within each process. Structuring involves acquiring, accumulating, and divesting. Bundling involves stabilizing, enriching, and pioneering. Leveraging involves mobilizing, coordinating, and deploying (Sirmon et al., 2011). ROT extends this argument to assert that firms must know how to accumulate, bundle, and leverage resources in order to generate sustainable returns (Ahuja & Chan, 2017). Thus, EMIS successful implementation depends on combination five basic resources: People, hardware, software, data, and network resources. People resources include end users and EMIS specialists, hardware resources consist of machines and media, software resources include both programs and procedures, data resources include data and knowledge bases, and network resources include communications media and networks. EMIS uses resources of people, hardware, software, data, and networks to perform input, processing, output, storage, and control activities that convert data resources into information products (O'Brien & Marakas, 2011).

### IV. RESEARCH OBJECTIVE

The research objective was to find out the role and standing of existing school infrastructure and components ineffective implementation of Educational Management Information System (EMIS) in Schools of excellence;

### V. RESEARCH METHODOLOGY

The study adopted the positivism paradigm by collecting objective data and analyzing them using quantitative and empirical methods. Descriptive survey design was used to examine relationships between EMIS and school management. The sample of this study included four schools of excellence with 90 staff members. Triangulation technique of questionnaire, observation sheet, and documentary analysis was employed to collect data and make reliable conclusions.

### VI. RESULTS AND ANALYSIS

The findings were thematically presented to respond to the objective. The objective was to find out the standing of existing school infrastructure and components for EMIS in Schools of excellence.

#### 6.1. Standing of existing school infrastructure and components of EMIS

The standing of existing school infrastructure and components of EMIS presented and analysed included personal computers, school office computers, EMIS software, internet connectivity, modern, electricity, wireless internet, and EMIS user right. The scale had 10 items or statements. The analysis was done using the responses to the statements of questionnaire related to the respondent's position on the standing of existing school infrastructure and components of

EMIS. The responses were presented in a Likert scale of 1-5 (Strongly Agree; Agree; Neutral; Disagree; and Strongly Disagree). The respondents were asked to rate their level of

agreement or disagreement indicating strongly agree; agree; neutral; disagree; and strongly disagree. The results were as shown in table 1.

Table1.School infrastructure and components for EMIS

Statements	STRONGLY AGREE	AGREE	NEUTRAL	DISAGREE	STRONGLY DISAGREE	Mean	Standard Deviation
	Frequencies (F) and Percentage (%); N=90						
	F (%)	F (%)	F (%)	F (%)	F (%)		
1. I possess computer for my office work	56 (62.2)	14 (15.6)	11 (12.2)	1 (1.1)	8 (8.9)	1.79	1.250
2. I have access to EMIS	24 (26.7)	24 (26.7)	21 (23.3)	7 (7.8)	14 (15.6)	2.59	1.373
3. EMIS is installed and accessible in my computer	24 (26.7)	19 (21.1)	18 (20.0)	9 (10.0)	20 (22.2)	2.80	1.501
4. EMIS is installed in all school office computers	24 (26.7)	24 (26.7)	25 (27.8)	7 (7.8)	10 (11.1)	2.50	1.274
5. The school provides consistent internet connectivity	33 (36.7)	23 (25.6)	22 (24.4)	8 (8.9)	4 (4.4)	2.18	1.160
6. The school avails the modem for accessing the internet	20 (22.2)	29 (32.2)	16 (17.8)	13 (14.4)	12 (13.3)	2.64	1.335
7. School provides stable electricity during working hours	53 (58.9)	19 (21.1)	15 (16.7)	1 (1.1)	2 (2.2)	1.67	0.948
8. Mobile phones with access to wireless internet for EMIS	27 (30.0)	19 (21.1)	18 (20.0)	13 (14.4)	13 (14.4)	2.62	1.419
9. EMIS is installed in one computer used by all Staff	15 (16.7)	23 (25.6)	13 (14.4)	15 (16.7)	24 (26.7)	3.11	1.472
10. Each category of staff has a specific user right for EMIS	31 (34.4)	18 (20.0)	25 (27.8)	5 (5.6)	11 (12.2)	2.41	1.340
<b>Overall</b>						<b>2.431</b>	<b>1.307</b>

Note. Strongly Agree= [1.0-2.0]= **Very high mean**; Agree= [2.0-3.0]=**High mean**; Neutral = [3.0-4.0]= **Moderated**; Disagree = [4.0-5.0]= **Low mean**; Strongly Disagree = [5.0-5.0]=**Very low mean**.

Source: Researcher (2018)

As indicated in Table1 most of the respondents fell in the category of those who agreed and strongly agreed with the constructs that were used to determine the level of existing school infrastructure and components for EMIS. Many of the respondents (62.2%:  $\mu =1.79$ ) strongly agreed with the statement “I possess computer for the office work”. The most notable components of infrastructure which respondents strongly agreed and agreed with included: the accessibility to EMIS ( 53.4%), the installation of EMIS in accessible computers (53.4%), EMIS is installed and accessible in my computer (47.8%); The school provides consistent internet connectivity (62.3%); The school avails the modem for accessing the internet ( 54.4%); School provides stable electricity during working hours ( 70.0%); The possession of mobile phones with access to wireless internet for EMIS (51.1%). Each category of staff has a specific user right for EMIS (54.4%).

On the other hand, some respondents strongly disagreed and disagreed with the constructs that were used to determine the standing of existing school infrastructure and components for

EMIS. The most prominent responses with moderated percentages of those who strongly disagreed and disagreed included: EMIS is installed and accessible in my computer (32.2%); The school avails the modem for accessing the internet (27.7%); Mobile phones with access to wireless internet for EMIS (28.8%), EMIS is installed in one computer used by all Staff (43.4%).

As a result, the overall average mean of responses was 2.431 (SD=1.307) on the constructs that were used to find out the standing of existing school infrastructure and components for EMIS operations. The overall average mean fell in the range of high mean. This indicated that many of the respondents agreed with the most constructs used to find out the standing of existing school infrastructure and components for EMIS operations. This was an indication that schools are ready for EMIS operations and EMIS infrastructure and components existed in the schools of excellence in Nyarugenge District, Rwanda. Although, some respondents gave a moderated level of responses in terms of EMIS installation and accessibility in



my computer, modem availability for accessing the internet, and mobile phones with access to wireless internet.

Findings made by the researcher from observation showed that EMIS software is accessible online through school computers when connected to internet. EMIS software used by schools is named The School Data Management System (SDMS). SDMS is a web-based application designed by the Ministry of Finance and Economic Planning (MINECOFIN) and Ministry of Education. It was observed that all the schools were also connected to internet including computer laboratories. It was also observed that some schools were concurrently using more than one types of EMIS software in the schools depending on the task they perform. For instance, all schools visited they run SDMS, School data management system (SDMS), Teacher Management Information System (TMIS), school management information system (SMIS) and Computerized System for school management (COSYM). It was observed that there was duplication of information in those different EMIS software used, yet one can capture all the information. Further findings from observations indicated that the Ministry of Education through Rwanda Education Board provided 105 laptops to schools of excellent to support the implementation of ICT. This meant that 100 laptops for Computer laboratory and five (5) laptops for teachers to support teaching and learning. Teachers could borrow the computers at their wish when needed. However, there were challenges related to slow internet connectivity to access SDMS web-based application online. During the day, the internet was slow due to the high number of SDMS users. The user right was shared among the staff to allow the entry of data which does not constitute a secured practice in the use of EMIS.

## VII. DISCUSSION OF FINDINGS

The objective of this study sought to find out the standing of existing school infrastructure and components for EMIS in schools of excellence in Nyarugenge District, Rwanda. The findings showed that schools were ready for EMIS operations with the support of infrastructure and components existed in the schools of excellence in Nyarugenge District, Rwanda. The overall average mean of responses on the constructs that were used to find out the standing of existing school infrastructure and components for EMIS operations was 2.431 (SD=1.307). The overall average mean fell in the range of high mean. This indicated that many of the respondents agreed with the most constructs used to find out the standing of existing school infrastructure and components for EMIS operations. This was an indication that schools were ready for EMIS operations with the support in place of EMIS infrastructure and components existed in the schools.

As a result, the most notable components of infrastructure which respondents strongly agreed and agreed with included the accessibility to EMIS, the installation of EMIS software in accessible computers, EMIS software is installed and accessible in my computer, the school provides consistent

internet connectivity, the school avails the modem for accessing the internet, school provides stable electricity during working hours, the possession of mobile phones with access to wireless internet for EMIS, and staff has a specific user right for EMIS. Further findings from observations indicated that the Ministry of Education through Rwanda Education Board provided 105 laptops to schools of excellent to support the implementation of ICT. This meant that 100 laptops for Computer laboratory and five (5) laptops for teachers to support teaching and learning. Teachers could borrow the computers at their wish when needed.

This current study found that EMIS through SDMS web-based application was using computers and mobile phones with access to the internet connectivity. The schools also availed electricity to enable the EMIS appropriate operations. These findings corroborate the findings of a study conducted by Bernbaum and Moses on EMIS components. Bernbaum and Moses (2011) stipulated that EMIS was accessed through installed software or web-enabled tools. The study added that EMIS increasingly was on laptops and smaller devices, such as netbooks and tablets that require less electricity and requirements for cooling and security. Bernbaum and Moses added that Mobiles or smartphones, as support to EMIS were capable of transmitting data through SMS and EMIS specialized applications. Mobile phones were irreplaceable particularly for schools in rural areas without electrification.

The current findings also were consistent with those of the study that was conducted to determine the extent of effectiveness on the implementation of EMIS as part of effective educational management functions in public elementary schools of Surigao Del Sur Philippines. The study revealed that EMIS employs ICT facilities namely computers, mobile phones, and internet connection to effectively and appropriately package EMIS as data bank of the school which address the urgent need of data and information (Cuartero & Role, 2018). The reason for determining accessibility to ICT is that the influence of technology on school management is largely dependent upon the accessibility of ICT resources to the end users since the frequency of use would be higher for those who have access to those facilities (Kiptalam & Rodrigues, 2010). This is a view shared by Tearle (2004) who asserts that access to ICT infrastructure is one of the practical factors that affects the use of technology in the school management processes. These current findings were in consonance with the findings made by Odhiambo (2017) in his study on influence of the use of EMIS on management of secondary school in Nairobi City, Kenya. His findings showed that schools with basic ICT infrastructure had good access to EMIS and were therefore in a good position to use EMIS to facilitate the effective management processes.

Despite the high level of agreement of respondents with the most constructs, it was also found that some respondents gave a moderated level of agreement of responses in terms of EMIS installation and accessibility, modem availability for accessing the internet, and mobile phones with access to wireless

internet. It was observed the internet connection was low and slow in schools of excellence during the day. This can constitute a limited access to EMIS. Odhiambo (2017) revealed that among the challenges that school managers faced were accessing EMIS facilities which resulted into competition for use that can limit effective EMIS operations. This finding also agrees with a study conducted by Sicilia (2005) who found that limited access to ICT facilities would limit EMIS operations. This is an indication that limited access to EMIS infrastructure and components can result into ineffectiveness in use of EMIS in secondary schools of excellence in Nyarugenge District, Rwanda.

## VIII. CONCLUSION

This study sought to find out the standing of existing school infrastructure and components for EMIS in schools of excellence in Nyarugenge District, Rwanda. The findings showed that schools were ready with the support of basic required infrastructure and components existed for EMIS operations in the schools of excellence in Nyarugenge District, Rwanda. This was an indication that schools were ready for EMIS operations with the support in place of EMIS infrastructure and components existed in the schools. The most notable components of infrastructure that were found available and accessible for EMIS operations included the installation of EMIS software in computers, provision of consistent internet connectivity and stable electricity during working hours. Staff possessed mobile phones with access to wireless internet and were able to access EMIS, and They have specific user right for EMIS depending on their responsibilities. However, it was also revealed that internet network was low and slow which made them work over night when internet network is not overloaded. This can constitute a limited access to EMIS at wish. This resulted into ineffectiveness for use that can limit effective EMIS operations in secondary schools of excellence in Nyarugenge District, Rwanda.

### 8.1. Recommendations for Action

The findings showed that schools were ready with the support of basic required infrastructure and components existed for EMIS operations in the schools of excellence in Nyarugenge District, Rwanda. However, it was also revealed that internet network was slow which made them work over night when internet network is not overloaded. This can constitute a limited access to EMIS at wish. This resulted into ineffectiveness for use that can limit effective EMIS operations in schools of excellence. It is therefore recommended that school managers should acquire and look for alternative internet providers with high speed to allow staff to use EMIS at wish in their respective office during the working day.

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