Management Information Systems Architecture in Universities in Southwestern Nigeria

OLADAPO Oludare Samuel, Ph.D
Oyo State College of Education, Lanlate
oladapooludaresamuel@gmail.com

ABSTRACT

This study investigated Data, Systems and Technology (DST) sub-architectures of Management Information Systems (MIS) in universities in Nigeria. Bertalanffy's systems theory guided this study; survey design of the correlation type was adopted. The study population comprised i) chairmen/directors of MIS/ICT units. ii) Top managements (strategic), mid-level managements (tactical). iii) Applications end-users in 6 universities selected in Southwestern Nigeria. Three federal and three private universities located in Southwestern Nigeria including i) University of Ibadan, Ibadan. ii) Obafemi Awolowo University, Ile-Ife. iii) Federal University of Technology, Akure. iv) Lead City University Ibadan. v) Adeleke University, Ede. v) Joseph Ayo Babalola University, Ikeji-Arakeji. A sample of 1681 respondents was selected. The analysis of the data involved measure of central tendency such as the mean rating and the cross-tabulations. The study revealed that universities in Southwestern Nigeria differ significantly in terms of capacity and application use of DST sub-architectures of MIS. The differences in MIS architecture in these universities make integration of data, systems and technology from Nigerian universities in Southwestern Nigeria difficult. This also had negative effect in developing National Educational Management Information Systems. Universities authorities and the National University Commission should endeavor to harmonise DST sub-sub-architectures of MIS in Nigerian universities.

Keywords: *Management Information Systems, Data Sub-architecture, Systems Sub-architecture, Technology Sub-architecture, Universities*

Background to the Study

At a stage the benefits derivable from deploying and adopting of Management Information Systems may become disadvantages. Such disadvantages are concomitant with using MIS in an organisation. Installing MIS can be expensive for an organization because of increased labour costs, additional training and ongoing education for maintenance crew. This assertion was supported by Vitez (2014). MIS also have the potential of becoming ineffective when it gather unimportant or non-essential information, this can delay decisions because managers must request for additional input. While another scholar, Acevedo (2013) added that the key to building effective MIS relates to understanding how an organisation operates and establishes systems that enhance the usability of data and streamline institution processes. Information Architecture (IA) enables users to quickly find pertinent information. This forestalls frustration and increases the chance that the applications end-users will return to the systems the next time

they require similar information.

The term, IA was first coined by Architect Richard Saul Wurman in 1976. Since then, IA has been defined as a skill, model or discipline. For instance, Crawford (2014) defined it as a specialised skill set that involves the categorisation of information into a coherent structure, which facilitates understanding and quick retrieval. As a model, Lynch & Horton (2011) described IA as the overall conceptual model and general design used to plan, structure and assemble a site. Crawford (2014) broadly defined IA as a model (or the practice of building the model) for an information space or a set of information organised and managed together. For any IA to work efficiently, attributes (physical, tangible and or abstract) should be applied consistently to packages and their contents. The IA might also include logic of how attributes relate to each other (Crawford 2014). Rosenfeld and Morville (2002) suggested that IA extends well beyond taxonomies and the Web. According to the writers, "there is a discipline, known as information architecture and there is a role, known as the information architect. They have developed more or less hand in hand and up to now any discussion of one has involved discussion of the other". From the foregoing, IA focuses on organising, structuring and labelling content in an effective and sustainable way. The chief goal of IS is to help applications end-users find information and complete tasks.

Information Systems Architecture (ISA) therefore is a unifying framework into which various stakeholders with different perspectives can organise and view the fundamental building blocks of IS (Whitten & Bentley, 2014). Stakeholders have different views of the systems and each has something "at stake" in determining its success. Stakeholders can be broadly grouped into four groups: i) systems owners, ii) systems users, iii) systems designers and iv) systems builders. The architecture of an IS encompasses the hardware and software used to deliver the solution to the applications end-users of services. The architecture is a description of the design and a content of a computerised IS such as MIS. The overall objective of MIS Architecture is to build systems and infrastructure that supports a harmonised and timely collection, processing, storage and dissemination of data and information for education planning and decision-making.

The Architecture of Information Systems (MIS inclusive) is concerned with information systems that allow users access information. It describes the way information is grouped, the navigation methods and terminology used within the system, it enables applications end-users step logically through a system, confident they are getting close to the information they require. The architecture (as presented in this study) consists of three distinct yet interrelated parts managed within an overall organisational framework. They are as follows. i) Data sub-architecture: the major kinds of data (and the relationships between them). ii) Systems sub- architecture: the major systems applications and their interrelationships that manage the data and support the execution of business functions. iii) Technology sub-architecture: the technology environment needed to enable and support applications that manage the business data.

Data, Systems and Technology (DST) sub-architectures provide a map of these three components that form the foundation for information management planning efforts. However, certain information characteristics are fundamental to the architecture structure of MIS. They include the following. i) Organisation: how content is grouped or clustered; ii) Taxonomy: how content is referred to; iii) Navigation: how to move between content groups (functional flow and linking); iv) Writing and editing: message and meaning; readability, accuracy and style; v) Ease

of Retrieval: the ability to locate content for use; and vi) Meeting the need: effectiveness and efficiency of the IS to serve the needs of the applications end-users. It is simply not good enough for universities to build functionality or write content, put it on their MIS and expect users to be able to find it. Developing MIS Architecture is an essential step in the development of all computer systems. Users of MIS can only appreciate what they can actually find (Barker, 2005)**.** MIS Architecture allows organisations to react more quickly and efficiently to changes and respond more quickly to critical events (Hamlett, 2014). Therefore, the main thrust of this study is the examination of the extent to which MIS Data, Systems and Technology (DST) sub-structures of MIS differ in universities in Southwestern Nigeria.

Theoretical Framework for this Study

Bertalanffy's systems theory provided the framework for this study. Three activities (input, processing and outpt) in any IS produce the information that organisations need to make decisions, control operations and analyse problems. These activities are input, processing and output. Input captures or collects raw data within an organisation or from its external environment. Processing converts this raw input into a more meaningful form. Output transfers the processed information to the people who will use it or to the activities for which it will be used. Information systems also require feedback, which is output that is returned to appropriate members of the organisation to help evaluate or correct the input stage. (Magara, 2006) "The goal of a system is to receive input from the environment, process it, produce an output and feed it back to the environment".

In this study universities are regarded as systems. The sub-systems comprise resources- students, lecturers, the senate (management) and administrators. The universities as open systems consist of three essential elements. The institutions receive inputs from the society. These inputs include resources such as students, lecturers, administrators. The inputs called throughputs are transformed through the process of teaching, research and community services as well as funds and facilities. These throughputs then yielded products or services called outputs. These are when graduates were produced and solutions provided to problems through research and intervention services. These outputs were released into the environment. Feedback provides information to the universities by connecting the outputs to the inputs. A negative feedback loop indicates a problem that should be corrected. A positive feedback loop can identify outputs that have worked well. Thus, feedback loops are means of confirming success or signaling that corrections either on the input, the process or the output to the system need to be made. Figure 1 shows a typical MIS Architecture using the basic systems theory. The university management received and gave back to the society. Likewise, the MIS components received and gave back to the university management. The feedback loops also confirm appropriateness of using data/information for strategic and tactical decision-making. If not found adequate, the data/information may be modified or discarded.

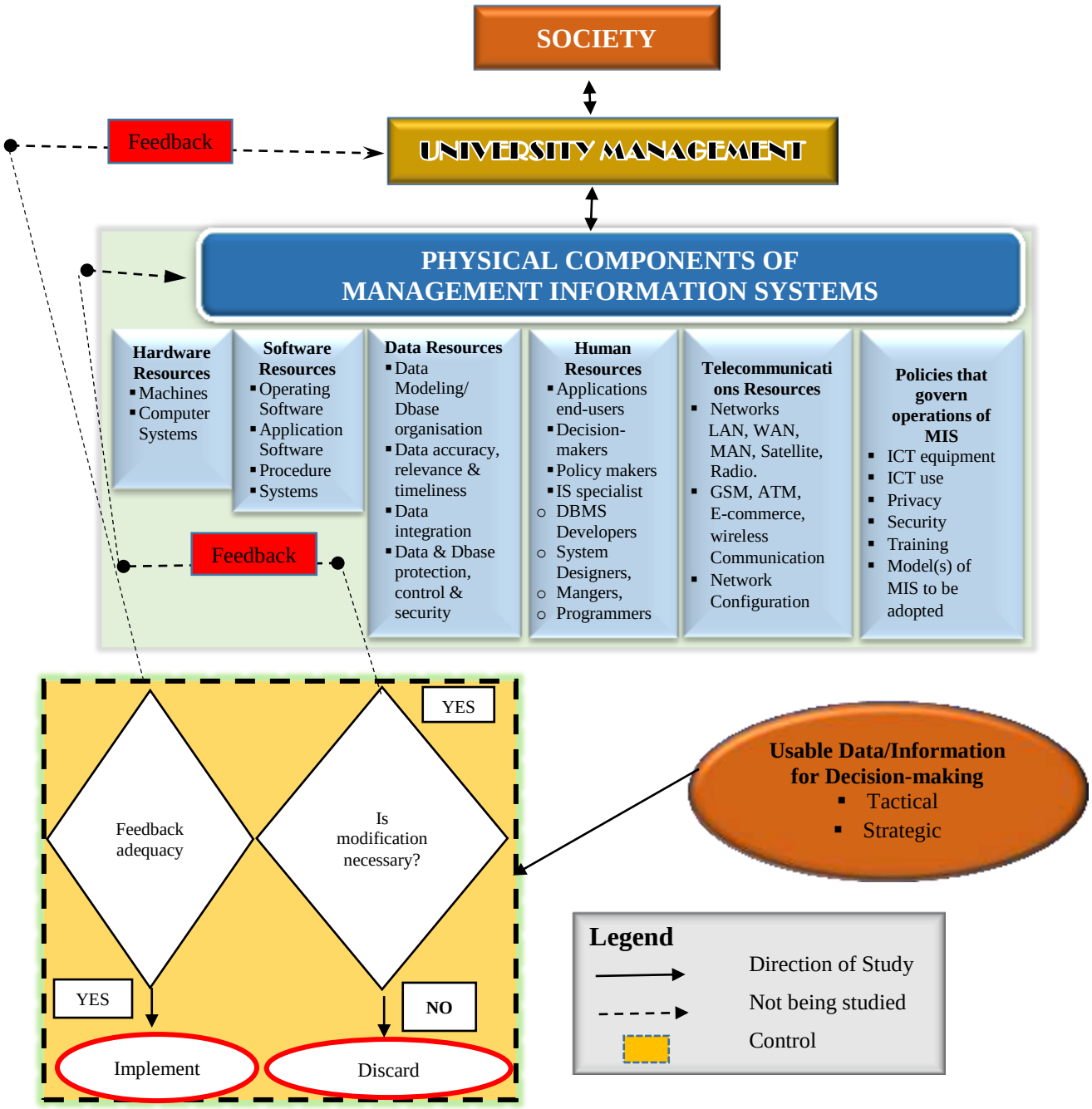

Figure 1. MIS Architecture in university setting using Systems Theory

Methodology

This study adopted the descriptive survey design of the correlation type. Data were collected using checklists and scales. The population for the study were defined at three levels: i) Chairmen/Directors of MIS/ICT units: ii) Top management (strategic), mid-level management (tactical): iii) Applications end-user in all the 35 universities in Southwestern Nigeria. However, a sample of six universities located in Southwestern Nigeria was selected; including: i) University of Ibadan, Ibadan: ii) Obafemi Awolowo University, Ile-Ife: iii) Federal University of Technology, Akure: iv) Lead City University Ibadan: v) Adeleke University, Ede: and vi) Joseph Ayo Babalola University, Ikeji-Arakeji. A total of 1681 respondents were selected. The analysis of the data in this study involved measures of central tendency such as the mean rating and cross-tabulations.

Extent to which MIS DST sub-architectures differ in the Nigerian universities

The overall mean score of each of the universities on a particular MIS sub-architecture was computed to establish the extent to which each university differ. In the same vein, the overall mean responses on MIS sub-architecture were calculated to check the difference in MIS architecture in Nigerian universities as shown in the Table 1.

Table 1: extent to which MIS sub-architecture differ in Nigerian universities

		OAU	**UI**	**FUTA**	**LCU**	**AU**	**JABU**
Data sub-architecture	X_1	3.03	2.80	2.97	1.95	3.09	2.53
	X_2	3.11	3.06	2.98	2.52	3.40	3.27
	X_3	3.25	3.24	3.16	2.60	3.51	2.67
	X_4	3.41	3.33	3.40	2.79	3.74	3.27
	X_5	3.21	3.20	3.11	2.95	3.59	3.20
	X_6	3.18	3.19	3.02	3.15	3.63	3.00
System sub-architecture	X_7	3.22	3.02	2.94	2.23	3.41	2.60
	X_8	3.20	3.17	3.18	2.56	3.63	3.07
	X_9	3.50	3.30	3.45	2.90	3.51	3.00
	X_{10}	3.30	3.20	3.03	2.74	3.54	3.20
	X_{11}	3.28	3.21	3.42	2.76	3.65	3.27
	X_{12}	3.41	3.25	3.21	2.98	3.56	2.80
	X_{13}	3.31	3.48	3.23	2.80	3.76	3.20
Technology sub-architecture	X_{14}	3.38	3.05	3.18	2.03	3.69	3.53
	X_{15}	3.41	3.38	3.27	2.66	3.74	3.20
	X_{16}	3.44	3.36	3.42	2.82	3.76	3.00
	X_{17}	3.34	3.25	3.40	2.58	3.59	2.80
	X_{18}	3.77	3.33	3.27	3.26	3.62	2.93
	X_{19}	3.47	3.22	3.18	2.79	3.62	2.87
	X_{20}	3.72	3.39	3.40	2.73	3.76	3.40
	X_{21}	3.51	3.51	3.35	3.05	3.81	2.80

Source: Field Work, July, 2015.

Decision Rule: *2.0 - 3.0 = Fair* *3.0 - 3.5 = Good* *> 3.5 = Very*

Good

The results presented in Table 1 indicate that universities in Southwestern Nigeria differ significantly in MIS sub-architectures. The data sub-architecture mean ranged between 2.99 and 3.49. MIS system sub-architecture ranged between 2.7 and 3.59. While, technology sub-architecture, ranged between 2.74 and 3.7. It is noteworthy that Nigerian universities differ significantly in terms of MIS Data, Systems and Technology sub-architectures.

Table 2. Overall Extent to which MIS DST Sub-architectures differ in Southwestern Nigeria

	OAU	UI	FUTA	LCU	AU	JABU
Data sub-architecture	3.20	3.14	3.11	2.66	3.49	2.99
Systems sub-architecture	3.32	3.23	3.21	2.71	3.58	3.02
Technology sub-architecture	3.51	3.31	3.31	2.74	3.70	3.07
Overall disposition to DST sub-architecture MIS	**3.34**	**3.22**	**3.21**	**2.70**	**3.59**	**3.02**

Decision Rule: *2.0 - 3.0 = Fair* *3.0 - 3.5 = Good* *> 3.5 = Very Good*

Table 2 indicates that universities in Southwestern Nigeria differ significantly in MIS DST sub-architectures of. It could be observed that in data sub-structure of MIS, the mean ranged between 2.66 and 3.58. The ranking of Data sub-architecture ranged between 2.66 and 3-2, Systems sub-architecture ranged between 2.71 and 3.59. As regards Technology sub-architecture, the rank ranged between 2.74 and 3.7. From the foregoing it is noteworthy that MIS Architecture differ significantly within and across universities located in the southwestern Nigeria.

Discussion of Major Findings

The implication of these differences in MIS architecture in Nigerian universities is that it makes integration of Data and Systems and Technology from each of the Nigerian universities difficult. This also has negative effect in deploying National Educational Management Information System (NEMIS). This finding was in agreement with Salako (2012) who found that the challenges of NEMIS in Nigeria include inadequate funding, inability to integrate data and data systems, inadequate development of skills in data use at all levels, inability to capture data in EMIS and inability to develop student-record base. This was in tandem with Al-Koofi (2007) who contended that the major factors needed to have effective implementation of an EMIS in the Ministry of Education in the Kingdom of Bahrain. The factors were: understanding the importance of data integration from different resources, understanding the importance of the collaborative work among directorates, and building an integrated application for data collection, processing and analysis. Accordingly, this study proposed a model for measuring MIS sub-architectures in institutions in general and universities in particular.

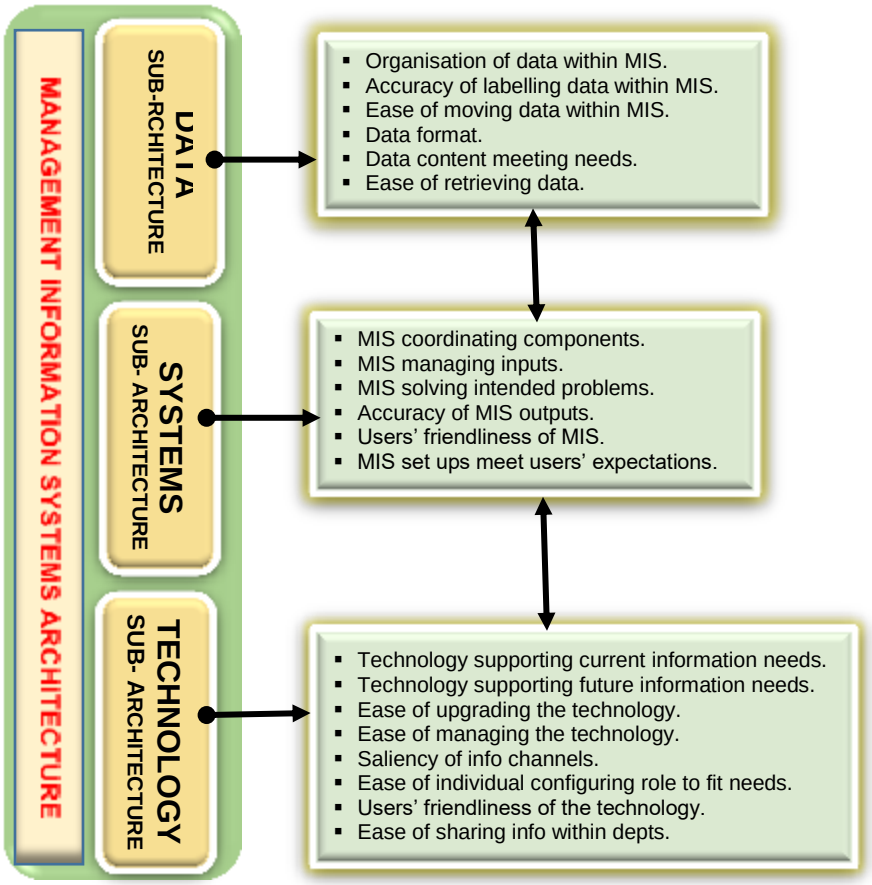

Figure 1: Model for measuring Data, Systems and Technology sub-architectures of Management Information Systems (as tested in this study)

The model as shown in Figure 1 attempt to combine criteria from other several available sources in order to have a more general and holistic model for measuring MIS architecture. MIS architecture in the Nigerian universities were harmonized, into the three MIS sub-architectures (data, system and technology sub-architectures). Data sub-architecture consists of six indicators, system sub-architecture seven indicators and technology sub-architecture eight indicators.

Recommendation

The differences in MIS architecture in Nigerian universities make integration of Data and Systems and Technology from each of the Nigerian universities difficult. In order to reap benefits offered by MIS Architecture, this study recommends that Universities managements, National University Commission, Federal, State and Local Government Ministries of Education should endeavor to harmonise differences in Data, Systems and Technology Sub-architectures of Management Information Systems.

Conclusion

It should be emphasized that the overall objective of MIS Architecture is to build systems and

infrastructure that support a harmonised and timely collection, processing, dissemination of data and information for education planning and decision-making. MIS Architecture also enables applications end-users to quickly find pertinent information. This forestalls frustration and increases the chance that the applications end-users will return to the systems the next time they require similar information. However, it is noteworthy that Nigerian universities differ significantly in terms of data, systems and technology sub-architectures MIS. The implication of these differences in MIS architecture in Nigerian universities is that it makes integration of data, systems and technology from each of the Nigerian universities difficult. This also has negative effect in deploying National Educational Management Information System (NEMIS).

References

Acevedo, L. 2013. How to build management information systems. Retrieved 25 May, 2013 http://www.ehow.com/how_6331269_build-management-information-system.html#ixzz2TduakYAg

Al-Koofi, A. A. 2007. A Study of How an Education Management Information System (EMIS) can be Effectively Implemented in the Ministry of Education in the Kingdom Of Bahrain available online at ict.bh@hotmail.co.uk

Baker, I. 2005. What is information architecture? Retrieved 24 August, 2015 http://www.steptwo.com.au/papers/kmc_whatisinfoarch

Crawford, S. 2014. How information architecture works. Retrieved 12 November, 2014 http://computer.howstuffworks.com/information-architecture3.htm

Hamlett, K. 2014. Definition of Management Information Systems. Retrieved 20 November, 2014 http://smallbusiness.chron.com/definition-management-information-systems-2142.html

Lynch, P. J. and Horton, S. 2011. Information architecture. Retrieved 20 November, 2014 http://webstyleguide.com/wsg3/3-information-architecture/index.html

Magara, E. 2006. A Framework for Integrated Student Information Management System for Higher Education in Uganda. A published Doctor of Literature and Philosophy Thesis in Information Science at the University of South Africa.

Morville, P. 2006. Information Architecture 3.0. Retrieved 12 November, 2014 http://computer.howstuffworks.com/information-architecture3.htm

Oladapo, O. S. (2017). Structure of Management Information Systems and Decision-making in universities in southwestern Nigeria. An unpublished Ph.D. Thesis submitted to the Department of Educational Management, University of Ibadan, Ibadan, Nigeria.

Vitez, O. 2014. The disadvantages of a management information system. Retrieved 19 November, 2014 http://www.ehow.com/list_6856619_disadvantages-management-information-system.htmlLimitations on Management Information Systems

Whitten, J. L. and Bentley, L. D. 2014. A framework for information systems architecture.

About the Author: Oladapo. O. S. holds a B. Sc. (Geography) 1996, M. Sc. (Geography) 2002, M. Ed. (Educational Management) 2004, Master of Information Science 2006, PGD (Education) 2010 and Doctor of Philosophy (Management Information Systems) 2017. He is presently a Chief Lecturer at Oyo State College of Education, Lanlate.