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Investigative Study of Effective Information System Implementation in Nigerian Tertiary Institutions: A Case Study of Selected Tertiary Institutions in Edo State

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Abstract

Information Systems (IS) are embedded in the core of almost every business function in modern organizations; however, the field of education is not an exception to this phenomenon. Tertiary Institutions around the world are investing considerable amount of money to create and Implement Information Systems strategies that meet their students' and staff institutional needs. While Tertiary Institutions encourage their stakeholders to implement one or more of these new technologies for their planning and delivery of services, various other factors inhibit the effective implementation of Information System strategies. This paper, optimistically, will establish the availability of Information System resources in Nigeria Tertiary Institutions and explore the effective implementation of Information System in Nigeria Tertiary Institutions. Four (4) Tertiary Institutions were selected for the survey: these are Ambrose Alli University Ekpoma (AAU); Auchi Polytechnic (AP); Edo University Uzairue (EUU); and University of Benin, (UNIBEN) Benin City.

Keywords: *Information System (IS), Tertiary Institutions, Implementation, Resources*

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Background to the Study

These days, various tertiary Institutions work with large amounts of data, and data are basic facts or values which are organized in a database. Many people think of data as synonymous with information; According to the Cambridge International Advanced Subsidiary (CIAS) & Advance Level Information Technology - 9626 examination, a division of Cambridge assessment 2017; the concept of data as it is used in the computing syllabus is commonly referred to as 'raw' data, which is a collection of text, numbers and symbols with no meaning.

Introna, (1992). Viewed the meaning of information as a concept that is related to human communication and technological systems and concluded that Information usually implies data that is organized and meaningful to the person receiving it; it can also be defined in terms of its surprise value, however, it tells the recipient something he did not know.

Zorkoczy (1981) defines information as the meaning that a human expresses by, or extracts from representations of facts and ideas, by means of the known conventions of the representations used; Information actually consists of data that has been organized to help answers questions and to solve problems.

Stonecash, (1981) defines information by stating that "information is simply symbols (data, text, images, voices, etc.) that convey meaning through their relative ordering, timing, shape, context, etc. information is the raw material for making decisions for creating knowledge and fuelling the modern organization".

The Concept of Information System

According to Sebastian, (2015) Information systems (IS) involve a variety of information technology (IT) tools such as computers, software, databases, communication systems, the Internet, Mobile devices and much more, to perform specific tasks, interact with and inform various actors in different organizational or social contexts.

Jessup, Leonard, Joseph, & Valacich, (2008). Defined Information Systems as an academic study of systems with a specific reference to information and the complementary networks of hardware and software that people and organizations use to collect, filter, process, create and also distribute data, of general interest to the field of Information Systems (IS) are therefore all aspects of the development, deployment, implementation, uses and impact of IS in organizations and society.

Sebastian & Dubravka, (2015). Is of the opinion that Information Systems can be defined in terms of two perspectives: one relating to its function, and the other relating to its structure. From a functional perspective, an Information Systems is a technologically implemented medium for the purpose of recording, storing, and disseminating linguistic expressions as well as for the supporting of inference making. From a structural perspective, an information system consists of a collection of people, processes, data, models, technology and partly formalized language, forming a cohesive structure which serves some organizational purpose or function.

Laudon & Laudon, (2013). Termed information system as a set of interrelated components that collect, retrieve, process, store, and distribute information to support decision making and control in an organization. Information Systems can also be used to analyze problems, visualize complex subjects, and create new products. In the implementation of information system, three activities are required to produce the information the organizations need to make decisions, control operations, analyze problems, and create new products or services. These activities are input, processing, and output. Input captures or collects raw data from within the organization 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 organization to help them evaluate and refine the input or correct the input stage. Environmental actors, such as staff, students, stockholders, contractors, competitors, and regulatory agencies, interact with the institution and its Information Systems.

Types of Information System

O'Brien & Marakas, (2007). Expressed that the applications of information systems that are implemented in today's business world can be classified in several different ways. They stressed that, several types of information systems can be classified as either Operations Support System or Management Support System. While Operations Support System is the support of business operation such as Transaction Processing Systems, Process Control Systems and Enterprise Collaboration Systems; Management Support System is the support of managerial decision making such as Management Information System, Decision Support System and Executive Information Systems.

According to Patterson, (2005) there are several categories of Information Systems, Data Processing System is a type of Management Support System and therefore Data Processing System, Management Information System, Decision Support Systems and Executive Information System are in the same classification.

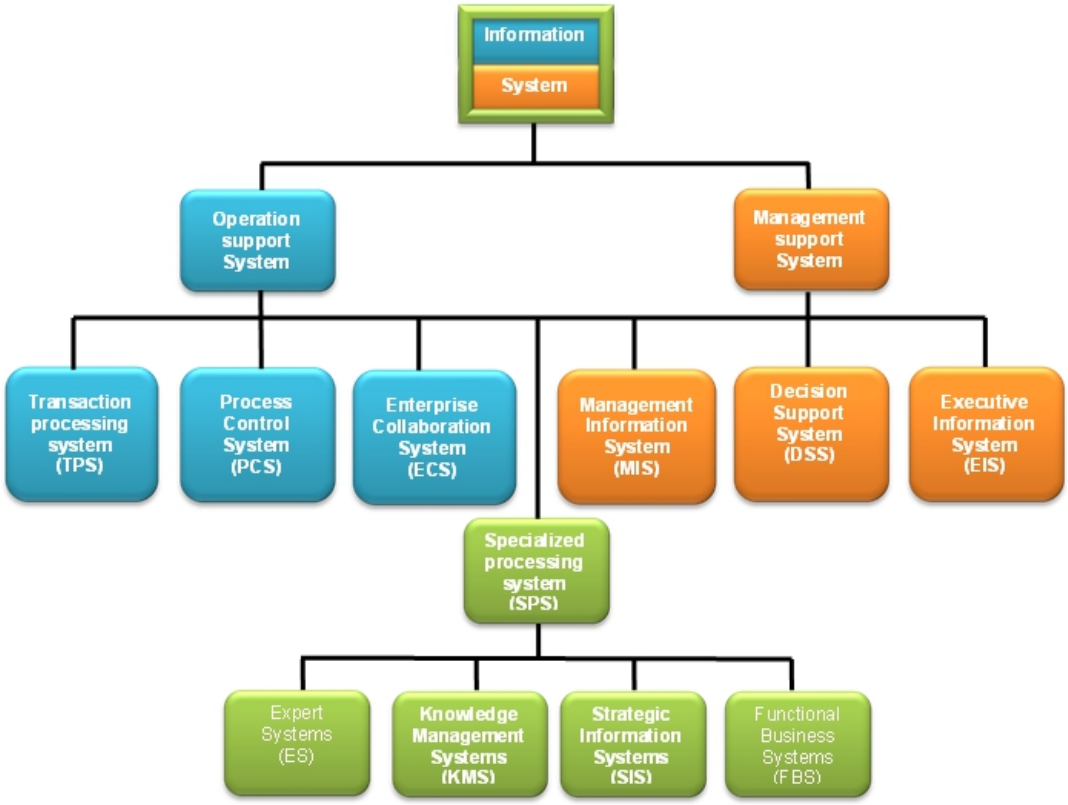

Figure 1: Types of information system
Source: Updated from O'Brien & Marakas (2007)

Information System is divided into two major categories namely:

A. Operation Support System.
B. Management Support System.

(A) Operation Support System

The operations support systems focus on the operations of the enterprise. The basic objective of these systems is to improve the operational efficiency of the enterprise. As these systems are concerned primarily with operations, they use internal data primarily for managers at the lower levels. Similarly, operation support system also helps to efficiently process business transaction, control industrial process support enterprise communication and update corporate database. The operations support systems may be further classified into the following categories:

i. Transaction Processing System (TPS)
ii. Process Control System (PCS)
iii. Enterprise Collaboration System (ECS)

Transaction Processing Systems

According to Laudon & Laudon, (2013). Transaction processing systems (TPS) are the basic business systems that serve the operational level of the organization. A transaction processing

system is a computerized system that performs and records the daily routine transactions necessary to the conduct of the business. And at the lowest level of the organizational hierarchy, we find the transaction processing systems that support the day-to-day activities of the business.

Transaction Processing Systems (TPS)
The TPS serves the people in the operational level of an organization, it collects and stores information about transactions, and controls some aspects of transactions. A sale of item in the store is an example of a transaction. Similarly, it is generally used to process sales, purchase, inventory and other organizational database; these databases then provide the data resources that can be processed and used by Decision Support System and Executive Information System.

Transaction Processing System processed transaction into two ways:

i. Batch Processing
ii. Real Time Processing

In Batch Processing, data is accumulated over a period time and processed periodically; while in Real Time Processing data is immediately processed after a transaction occurs, for example: Sales and Inventory Processing

Process Control System (PCS)
It is a category of Operation Support System in which decision about a physical production process are automatically made by computer through routine decisions that control operational process, for example: A petroleum refining center uses electronic sensors which are linked to the computers to continuously monitor chemical processes and make instant adjustments that control the refined process.

Enterprise Collaboration System (ECS)
Enterprise Collaboration System (ECS) is the type of Information System that uses a variety of Information Technology to help the people to work together. Enterprise Collaboration System helps to collaborate and communicate ideas, share resources and co-ordinate work effort of an organization. The aim of an Enterprise Collaboration System is to use the information technology to enhance productivity and creativity of organization and work group in an organization. for example: E-mail, chat, video conferencing etc.

(B) Management Support System (MSS)
Management Support System (MSS) generally deals with providing information and support for effective decision making. It refers to computer technology and system theory to data processing in an organization. It helps in designing system frameworks for organizing information system application. It helps in management decision making and processing of data generated by business operation.

The various Management Support Systems:

1. Management Information System (MIS)
2. Decision Support System (DSS)
3. Executive Information System (EIS)

Management Information System (MIS)

MIS is a form of MSS that provides managerial end-user with information product that support their day-to-day decisions. It provides a variety of information in the form of report and display to management that contain information specified in advance by manager. Information is generally provided on demand or periodically to the managers. For example: Sales manager may use their network computer, net web browser to get instant display of the sales, result of their product and access their daily sales report.

Decision Support System (DSS)

Decision support systems are computer-based information systems that provide interactive information support to managers and business professionals during the decision-making process. It provides managerial end-users with information in an interactive manner i.e., analytical modeling, data retrieval, information presentation capability. For example: Product pricing, Risk Analysis

Executive Information System (EIS)

Executive Information System is an Information System that provides Strategic information tailored to the needs of executives and other decision makers (top management). It provides top management with immediate and easy access to select information about key factors that are critical to organizational strategic objectives. For example: The top-level executives may use the touch screen to instantly view text and graphics that display the key areas of the organization.

Other Classifications of Information System

Several other categories of information systems fall under ***Specialized Processing System*** and can support both operations support system and management support system.

1. Expert Systems (ES)
2. Knowledge Management Systems (KMS)
3. Strategic Information Systems (SIS)
4. Functional Business Systems (FBS)

Expert Systems

Knowledge-based systems that provide expert advice and act as expert consultants to users. Examples: credit application advisor, process monitor, and diagnostic maintenance systems.

Knowledge Management Systems

Knowledge-based systems that support the creation, organization, and dissemination of knowledge within the enterprise. Examples: Intranet access to best business practices, Sales Paper Strategies, and Customer Problem Resolution Systems.

Strategic Information Systems
Support operations or management processes that provide a firm with strategic products, services, and capabilities for competitive advantage. Examples: online stock trading, shipment tracking, and e-commerce Web systems.

Functional Business Systems
Support a variety of operational and managerial applications of the basic business functions of a company. Examples: information systems that support applications in accounting, finance, marketing, operations management, and human resource management.

The Components of Information Systems
Patterson (2012), defined information System as a group of interrelated components that work to carry out input, processing, storage, output and control actions in order to convert data into information that can be used to support forecasting, planning, control, coordination, decision making and operational activities in an organization. Every business organization in this era needs an information system (IS) to keep track of all business activities, right from business planning, till the product delivery via manufacturing and quality cycles.

O'Brien & Marakas, (2007). Opined that information system (IS) can be any organized combination of people, hardware, software, communications networks, data resources, and policies and procedures that stores, retrieves, transforms, and disseminates information in an organization. People rely on modern information systems to communicate with one another using a variety of physical devices (hardware), information processing instructions and procedures (software), communications channels (networks), and stored data (data resources) According to Erik, (2007). The components of Information System are usually described as *hardware, software, network, Databases, people* and *procedure*. The first three, fitting under the technology category, are generally what most individuals think of when asked to define information systems. But the last two, people and process, are really what separate the idea of information systems from more technical fields, such as computer science.

Computer Hardware
These are the physical technology that works with information. They are physically handy and available. They include: computers, printers, image scanner, speaker, compact disc, iPads, flash drives, router, etc.; Hardware can be as small as a smartphone that fits in a pocket or as large as a supercomputer that fills a building. With the rise of the Internet of things, in which anything from home appliances to cars to clothes will be able to receive and transmit data, sensors that interact with computers are permeating the human environment.

Computer Software
Software is a set of instructions that tells the hardware what to do. Software is not tangible, i.e. it cannot be touched. There are several categories of software, with the two main categories being system software, which makes the hardware usable, and application software, which does something useful for the computer users. Software can be divided into two types: system software and application software. The primary piece of system software is the operating

system, such as Windows or iOS, which manages the hardware's operation. Application software is designed for specific tasks, such as handling a spreadsheet, creating a document, or designing a Web page.

Network

This component connects the hardware together to form a network. Connections can be through wires, such as Ethernet cables or fiber optics, or wireless, such as through Wi-Fi. A network can be designed to tie together computers in a specific area, such as an office or a school, through a Local Area Network (LAN). If computers are more dispersed, the network is called a Wide Area Network (WAN). The Internet itself can be considered a network of networks.

Databases and Data Warehouses

This component is where the "material" that the other components work with resides. A database is a place where data is collected and from which it can be retrieved by querying it using one or more specific criteria. A data warehouse contains all of the data in whatever form that an organization needs. Databases and data warehouses have assumed even greater importance in information systems with the emergence of "big data," a term for the truly massive amounts of data that can be collected and analyzed.

Human Resources and Procedures

The final, and possibly most important, component of information systems is the human element: the people that are needed to run the system and the procedures they follow so that the knowledge in the huge databases and data warehouses can be turned into learning that can interpret what has happened in the past and guide future action. In order to fully understand information systems, students must understand how all of these components work together towards bringing value to a university system.

Data

Data is a collection of facts; like software, data is also intangible. Pieces of data are not really very useful, but they are when aggregated, indexed, and organized together into a database. Data are powerful tool in any organization; University system collects all kinds of data and uses it to make decisions. These decisions can then be analyzed as to their full effectiveness in order to improve the university system.

Communication

Besides the components of hardware, software, and data, which have long been considered the core technology of information systems, it has been suggested that one other component known as communication should be added. An information system can exist without the ability to communicate the first personal computers were stand-alone machines that did not access the Internet. However, in today's hyper-connected world, it is an extremely rare computer that does not connect to another device or to a network. Technically, the networking communication component is made up of hardware and software, but it is such a core feature of today's information systems that it has become its own category.

Literature Review

A number of researchers have worked on information system in Nigerian Tertiary Institutions, using different theories and tools to establish their exploration; according to. Nakpodia, (2010); in his work, he examined information systems in Nigerian education as it affects data storage devices and data bank. He believes that the power to process information rapidly makes the data bank a versatile Centre for planning and research.

Nakpodia, (2010). Further observed that information system which is also known as computer based information system, is important in Nigerian educational systems at all levels because of its transaction process systems, knowledge management systems and information technologies designed to enable individual persons to perform task for which the human brain is not well suited. In addition, the organization of a data system with national coverage is very complex.

Roheet. et al (2016). Examined the role of Information Systems in a University system and discovered that the University can be better handled by developing and using an automated application (Information System) which can improve the functioning of the university. They further discuss the need of a central repository to update and maintain a document management system so that stakeholders can access and make use of the information for their specific purpose from time to time. They concluded that it is imperative that the university obtain and maintain accurate and timely information about faculty professional activities.

An Evaluation of ICT Infrastructure and Application in Nigeria Universities Analysis of findings on Research Question 1 has revealed that, ICT infrastructure utilized in most Nigeria universities are computers, the internet and telephone and that the internet resources of Email, the web and websites are the ICT services utilized in most Nigeria Universities. This is an indication that Nigeria universities are still low in provision and utilization of ICT facilities. Blerta, (2013). Examined Higher Education Information Systems with respect to the latest trends and issues and observed that there is very little information available on information systems strategies and technologies in HEI's or on information strategies. He stressed further that It is important to understand that the accessibility, reliability, consistency, and relevance of data underpinning information systems are crucial to its use and effectiveness in a university setting.

Methodology

This research paper focuses on exploring the effective implementation of information system using selected Institutions in Edo States. For this purpose, this study attempts to answer the following research questions:

1. Are there available Information Systems resources in Nigeria Tertiary Institutions?
2. To what extent is Information system implemented in Nigeria Tertiary Institutions?
3. What are the least utilized Information System facilities in Nigeria Tertiary Institutions?

A descriptive survey approach is more appropriate for this study since it focuses on people, facts about people, their benefits, opinions, attitudes, motivation and behaviour. A descriptive survey was considered most appropriate for this study because it sought the relationship among factors regarding the Investigative Study of Effective Information System Implementation in Nigerian Tertiary Institutions. The study was carried out in the South-South regions of Nigeria. These areas were chosen because they have a good number of Tertiary Institutions for such study. The population of the study comprised students, lecturers and administrators in these Tertiary Institutions. The students, lecturers and administrators of the Tertiary Institutions were chosen because they are in the best position to provide the required information on the Investigative Study of Effective Information System Implementation in Nigerian Tertiary Institutions.

A total of 240 respondents were randomly selected from a total of 4 Tertiary Institutions; each institution is represented by, 20 lecturers, 20 administrators and 20 students. A questionnaire was developed and used as the research instrument for this study. The questionnaire has three sections. Section A was used to collect general information about the respondents; Section B has 20 items (1-20) intended to elicit information on the availability and relevant information system resources in Nigeria Tertiary Institutions (Research question 1) Section C has 10 items (21-30) which sought information on the level of effective implementation of information system in Nigeria institution; While Section D has 10 items (31-40) required information on the challenges of effective implementation of information system strategies in Nigeria Institution (Research Question 3). The items were structured on a five-point Likert rating scale with response options of: Strongly Agreed (SA), Agreed (A), Undecided (U), Disagree (D), Strongly Disagree (SD).

The instrument (questionnaire) was validated by two experts from the Economic/Statistics Department of University of Abuja, FCT of Nigeria; they examined the questionnaire items for clarity and suitability for use in collecting data for the study. The observations and suggestions of these experts improved the instrument. The reliability was determined by a pilot test for the instrument which was administered to 10 respondents comprises of 5 students, 3 lecturers and 2 administrators from an institution outside the zones used for the study. The instrument was administered in the various Tertiary Institutions and 218 copies of the questionnaire, out of 240 copies administered were retrieved and used for the study and the return rate was 90.8%. The research questions were analyzed using a simple mean statistic. This indicates that in each of the response items, the mean score of the item is computed and interpreted based on its boundary limits (Table 1 and Table 2).

In other words, for research question 1, a mean score on an item statement that was equal to or greater that 0.50 (≥ 0.50) was accepted as available; while a mean that was equal to or less than 0.49 (≤ 0.49) was accepted as unavailable (Table 1).

Table 1: Response options with points and boundary limit

Response option	Points	Boundary limit
Available	1	0.50 - 1.00
Unavailable	0	0.00 - 0.49

Similarly, the decision rules for the research question 2 and 3 are: a mean score on the item statements that was greater than or equal to 3.50 (≥ 3.50) was taken as Agree while a mean that was less than or equal to 3.49 (≤ 3.49) was taken as Disagree (Table 2).

Table 2: Response categories with points and boundary limit

Response option	**Points**	**Boundary limit**
Strongly Agree	5	4.50 - 5.00
Agree	4	3.50 -4.49
Neutral	3	2.50 -3.49
Disagree	2	1.50 - 2.49
Strongly Disagree	1	0.50 - 1.49

Looking at the reality of the available data, regarding research question 1, explicitly, "are there adequate Information system resources in Nigeria institution?", responses and results are presented in Table 3, which depicts that a mean value of **0.48** which is less than **0.50 (< 0.50)** was accepted as unavailable. This specifies therefore, that Information system resources are inadequate in Nigeria Tertiary Institutions.

Table 3: Showing mean score analysis on availability of information system resources

B	Availability of Information system resources	AVAILABLE	UNAVAILABLE	MEAN(X)	DECISION
1	Institutional eBooks/eBook reader	51	167	0.23	UNAVAILABLE
2	Bespoke/collaboration software to facilitate students learning	64	154	0.29	UNAVAILABLE
3	Broadcast lecture delivery	24	194	0.11	UNAVAILABLE
4	Teleconferencing/videoconferencing	8	210	0.04	UNAVAILABLE
5	Online/E-learning course delivery	87	131	0.40	UNAVAILABLE
6	Laptops /Desktop computers/accessories	215	3	0.99	AVAILABLE
7	Interactive whiteboard for lecture and presentations	211	7	0.97	AVAILABLE
8	Use of Projectors for classroom lecture	214	4	0.98	AVAILABLE
9	Intranet/extranet facilities	3	215	0.01	UNAVAILABLE
10	Private Internet facilities	120	98	0.55	AVAILABLE
11	E-library services	20	198	0.09	UNAVAILABLE
12	Use of telephone (fixed mobile) service within the institution	70	148	0.32	UNAVAILABLE
13	Use of Institutional website for online forum	96	122	0.44	UNAVAILABLE
14	Institutional Web portal	201	17	0.92	AVAILABLE
15	Campus Area Network	84	134	0.39	UNAVAILABLE
16	Lightings/Fans /AC in all offices	206	12	0.94	AVAILABLE
17	Wide Area Network	78	140	0.36	UNAVAILABLE
18	Emails services	122	96	0.56	AVAILABLE
19	Power protection devices	131	87	0.60	AVAILABLE
20	Surveillance device	85	133	0.39	UNAVAILABLE
	TOTAL	**104.5**	**113.5**	**0.48**	

Table 4: Level of information system implementation in Nigeria Institution

S/N	Level of Information system implementation in Nigerian Institution.	SA(5)	A(4)	U(3)	D(2)	SD(1)	Mean (x)	Decision
1	My institution uses Intranet/extranet services	3	20	2	71	122	1.67	Disagree
2	My institution uses E-library services	3	2	12	34	167	1.35	Strongly Disagree
3	we use Teleconferencing /Videoconferencing for lectures, seminars, etc.	9	12	0	104	93	1.81	Disagree
4	We use telephone (fixed mobile) service for communication within the institution	2	11	0	88	117	1.59	Disagree
5	We use of Institution's website for online forum	4	11	9	127	67	1.89	Disagree
6	My Institution use a Web portal for staff and students' activities	86	123	0	3	6	4.28	Agree
7	my school use Internet facilities	89	110	0	3	16	4.16	Agree
8	we use E-Mail services in my school	15	174	8	17	4	3.82	Agree
9	Staff/Students can access their details on the school portal	47	162	6	0	3	4.15	Agree
10	There exists a master database for both staff and students' activities	2	9	2	71	134	1.50	Disagree
							2.62	

Source: Author's Computation (2020)

The findings on Research Question 2 which bothered on to what extent is Information system implemented in Nigeria Tertiary Institutions. In table 4, it was established that among the information system resources available in Nigeria Tertiary Institutions, the lowest mean score were observed for Institutional eBooks/eBooks reader, Bespoke/collaboration software, Broadcast lecture delivery, Teleconferencing/videoconferencing, Online/E-learning course delivery, Intranet/extranet facilities, E-library services, among others; this account for a total *Mean* value of **2.62**, which is an indication that there is a low level of information system implementation in Nigeria Tertiary Institutions.

Examining the findings on the least utilized Information System facilities in Nigeria Tertiary Institutions (Research Question3), Figure 2 show that Institutional eBooks/eBook reader, Bespoke/Collaboration software to facilitate students learning, Broadcast lecture delivery, Teleconferencing/Videoconferencing, Online/E-learning course delivery, Intranet/extranet facilities, E-library services, telephone (fixed mobile) service within the institution, Institutional website for online forum, Campus Area Network, Wide Area Network, and Surveillance devices rank the least utilized facilities with *Mean* values of 0.39, 0.36, 0.39, 0.44, 0.32, 0.09, 0.01, 0.40, 0.04, 0.11, 0.29, and 0.23 respectively.

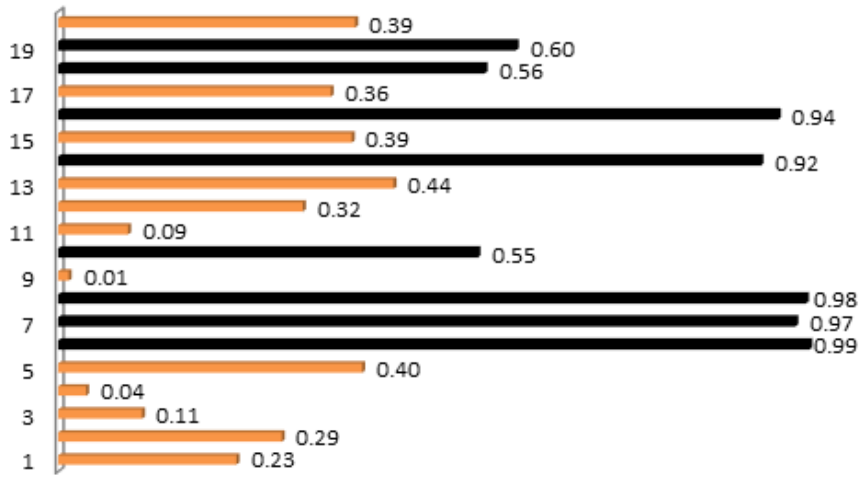

Figure 2: The least utilized Information System facilities in Nigeria Tertiary Institutions.

Conclusion

It is important to note that the implementation of Information Systems are powerful tools in the hands of many Institutions around the globe, and if deployed appropriately can bring dramatic change in the way Tertiary Institutions perform and achieve their various objectives; however, the benefits of IS facilities in Nigeria Tertiary Institutions are quite enormous and the levels to which an institution can provide and utilize these IS facilities define the status of the institution.

Unfortunately, there is indication that IS facilities is lacking in Nigeria Tertiary Institutions and the level of implementation is low. The main IS facilities and services that are least utilized in Nigeria Tertiary Institutions were identified to include Institutional eBooks/eBooks reader, bespoke/collaboration software, Broadcast lecture delivery, Teleconferencing/Videoconferencing facilities, Online/E-learning course delivery, Intranet/Extranet facilities, E-library services, and the use Facsimile Machine

Recommendation

It is recommended that necessary actions should be taken for adequate provision of other important IS facilities identified to be lacking including:

1. Use of Intranet/Extranet services – These services will help us to connect computers and other workstations within and outside the Institution for easy sharing of resources and information.
2. The use of E-library services – The Electronic Library System provides the latest functions as well as allowing books to be displayed on screen as if they were printed books. The system makes advances in retrieving books and papers.
3. The use Teleconferencing/Videoconferencing for lectures, seminars, etc.

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