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Review

An information system in Nigerian education: A study of data storage

E. D. Nakpodia

Department of Educational Administration and Policy Studies Delta State University, Abraka Nigeria.
E-mail: edwardnakpodia@yahoo.com. Tel: 08033862036.

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This paper dealt with information systems which had existed since the beginning of mankind. Information systems tagged as computer based information is employed in educational settings in all countries of the world especially Nigeria as a developing nation. This has changed over the years and has given rise to information technologies and data storage devices for recording information. These are virtually done in any form of energy spanning from manual muscle power in hand writing to acoustic vibrations in phonographic recording. As new information technologies are developed in educational industries, new categories emerge that can be used for information systems. This paper therefore examined information systems in Nigerian education as it affects data storage devices and data bank. This is because the power to process information rapidly makes the data bank a versatile centre for planning and research.

Key words: Information system, data storage, Nigeria education.

INTRODUCTION

Information system is also known as computer based information system. In general, the term information system refers to a system of people, data records and activities that process the data and information in an organization which includes the organization manual and automated process. In all industries, as it is in education industries in Nigeria, information is stored in data bank. A data storage device is a device for recording or storage of information. In a narrow sense, the term information system refers to the specific application software that is used to store data records in a computer system. It also automates some of the information-processing activities of the organization.

However, the advanced techniques of management, which were developed in industries and were in vogue in Europe and particularly in America since the 1960s, are yet to be widely acceptable in Nigeria. This 20 years lag generates gross inefficiencies which in turn renders Nigeria and other third world countries relatively less developed in spite of the massive efforts being mobilized, and the great sacrifices being made to 'catch up' with the rest of the world (Gilbert, 1986). The gap rather than been narrowed is getting wider daily at an alarming rate, and nothing that is being done today can be said to generate confidence that things will get better at any point of time in future. In short, Nigeria seems to be firmly caught in a trap which makes it hardly possible for her to stand still even at her best trial (Clark, 1969).

Education is one of the largest and visible industries which commands attention and consumes much of the limited resources of Nigeria, and like a home sickness, so many Nigerians are yearning for, striving and trying to have access to more and more of it. The pressures are irresistible and so the educational programmes multiply and the floodgates are opened to eager seekers who plunge into the mainstream. The viewpoint of this paper is that the journey to the ocean which is uncharted and in most cases, the objective which is the 'ocean of know-ledge' is never reached.

While this has been condoned so far, it is clear that with dwindling resources relative to need, this dispensation from strict accountability will be replaced by a critical examination of the decision making techniques in education and the subjection of the products of the system to the criterion of efficiency. The objective of this paper is to prepare Nigerians against these imminent challenges of educational practices and the demand to scrutinize its end products on information system in Nigerian education in relation to its data storage devices and data bank.

OVERVIEW OF INFORMATION SYSTEMS AND DEVELOPMENT

There are various types of information systems, for example: transaction processing systems, office system, decision support system, knowledge management systems, data management systems, and office information systems. Critical to most management systems are management technologies, which are typically designed to enable humans to perform tasks for which the human brain is not well suited, such as: handling large amounts of information, performing complex calculations, and controlling many simultaneous processes (Kock et al., 2002).

Information technologies are a very important and malleable resource available to executives. For example many companies have created a position of Chief Information Officer (CIO) that sits on the executive board with the Chief Executive Officer (CEO), Chief Financial Officer (CFO), Chief Operating Officer (COO), and Chief Technical Officer (CTO). The CTO may also serve as CIO, and vice versa. The Chief Information Security Officer (CISO), who focuses on information security within organization, normally reports to the CIO (Ciborra, 2002). In computer security, an information system is described by the following components.

Repositories, which hold data permanently or temporarily, such as buffers, RAM, hard disks, cache, etc. Often data stored in repositories are managed through a database management system.

Information technology departments in larger organizations tend to strongly influence information technology development use, and application in the organizations, which may be a business or corporation. A series of methodologies and process can be used in order to develop and use an information system. Many developers have turned and used a more engineering approach such as the System Development Life Cycle (SDLC) which is a systematic procedure of developing an information system through stages that occur in sequence. An Information system can be developed in house (within the organization) or outsourced. This can be accomplished by outsourcing certain components or the entire system.

A computer based information system, following a definition of Langford (1973) is:

- A technologically implemented medium for recording, storing, and disseminating linguistic expressions
- As well as for drawing conclusions from such expressions.

This can be formulated as a generalized information systems design mathematical program.

THE BASIC PROBLEMS

One of the indispensable things in any well run organization is the technique of rational decision making. However, this calls for an accurate description or knowledge of the organization and the means of monitoring it's functioning, comparing this with set objectives, and using that information/knowledge to modify future performance. In short, full information must be available and there must be a constant flow between the decision making body and the executors of the decisions as shown in Figure 1. To anyone familiar with educational practices and goals, it must be immediately apparent that the number of variables involved is enormous, and the task of isolating them awesome. For instance one must know a few things about the beneficiaries of the system, the learners - their number, age, entry qualification, sex, and location.

The existing physical facilities have to be identified; where they are located, their capacity, state of repair, availability of space for future expansion, and the extent of utilization to mention just a few obvious points. Then, of course, one has to contend with teachers, funds, content of courses, time tables, organization, and other activities associated with school and schooling. It takes proper organization and carefully thought out principles to achieve any degree of efficiency in a situation where so much must be known to take a simple but effective and efficient decision (Pinlus and Williamson, 2000).

Perhaps the most obvious and least emphasized fact is that the most critical information for making a decision must originate from the practitioner's level which is the operational one. The Minister for Education, to take a national decision on whether or not to provide school meals, must have information about actual pupils; their eating patterns; their physical and other characteristics; and the consequence of those patterns on learning. The more information he has, the better he is, if he has the will and the means to take national decisions which approximate to the objectives of schools and schooling. Unfortunately, if Nigeria lacks anything, it is the capability to initiate and sustain the flow of information in respect of the various components of the educational system. As has been adequately demonstrated above, this lack of information implies an inefficiently run system in which enormous wastes are inevitable.

AVAILABLE TECHNOLOGIES ON INFORMATION SYSTEM OF THE 21ST CENTURY

Computer based information system are in the field of information technology. As new information technologies are developed, new categories emerged that can be used to classify information systems. Some examples are:

- Transaction processing systems
- Management information systems
- Decision support systems
- Expert systems
- Office automation

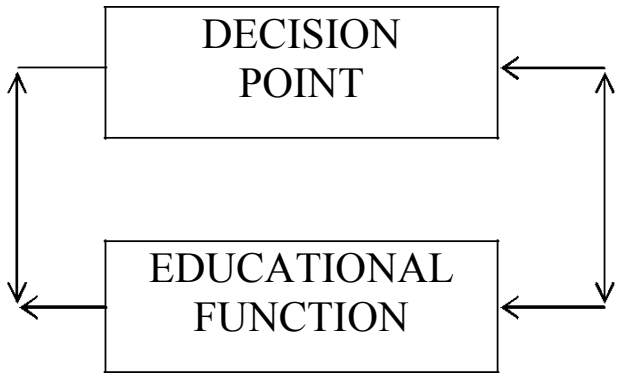

Figure 1. Flow of rational decision making in organisations.

- Business intelligence

It should be noted that all information is data. However, not all data is information (Gantz, 2008). Many data storage devices are also media players. Any device that can store and play back multimedia may also be considered a media player. Designated hard drives are used to play, saved or stream media on home entertainment systems; and it should be noted here that an organic brain may or may not be considered a data storage device. However, this obviously is not in line with today's experiences in that in almost all industries, technologies tend to change when mass production becomes inevitable as a result of expanded market demand. The automobile, textile, and printing industries are just a few examples of industries which have had to make great technological changes to cope with their altered circumstances (Bekenstein, 2003).

As a modern society progresses, more and more information are generated, and even Nigeria, with its primitive educational technology is no exception. The static state of information in Nigeria is a consequence of the technology we use. It is generally accepted by educational practitioners both at home and abroad that accurate educational data are hardly ever available for use in Nigeria. This of course is not one problem but three, since issues of accuracy, existence of data, and accessibility, particularly on short notice, are all wrapped up in that first simple statement. This is all the more surprising when it is realized that educational statistics and other data had been collected and in fact published on regular basis in Nigeria over the last twenty five years. This universally acknowledged dearth of accurate and easily accessible educational data for use in planning and in research deserves to be looked into a little more carefully. It should be noted also that devices that are not used exclusively for recording (e.g. hands, mouth, and musical instrument) and devices that are intermediate in the storing/retrieving process (e.g. eyes, ears, cameras, scanners, microphones, speakers, monitors, projectors) are not usually considered storage devices. Devices that are exclusively for recording (e.g. printers), exclusively for reading (e.g. barcode readers), or devices that process only one form of information (e.g. phonographs) may or may not be considered storage devices. In computing, these are known as input/output devices (Galliers et al., 2006).

The problem is not that information is not available or that data are totally absent. When ministries of education have important plans to execute, they usually collect the necessary information for decision making directly from the field and/or from official records at their disposal. These are produced in formats appropriate to the problem in hand and are filed after use exactly as they were provided. The problem is that future challenges and needs for statistical information and data take total different shapes requiring different formatting of the data which then have to be prepared, all over again. This inability to build on previous efforts and records, results in tedious and repetitious filed exercises directed at producing new data each time such need arises. When time is short, as is almost invariably the case, this problem becomes greatly exaggerated and results in frustration for the researcher, especially if he is accustomed to obtaining information quickly, simply by pushing a few buttons (Gantz, 2008). The Nigerian problem is therefore not one of absence of data. If anything, there is enough information scattered in educational institutions all over the country.

The first problem is that sources of data are diffused and not centralized nor are they sufficiently identified to be traced and put to use promptly. The second problem is that the bulk of such information exists in formats which were designed for specific problems and are thus not readily transferable to new situations without extensive and costly paper work. Thirdly, the same data may exist in two or more places but in different formats and may give different and conflicting information due to reasons already alluded to. These then are central issues in any discussions relating to the storage and retrieval of educational data in Nigeria. For as long as the level of technology in use is as described earlier, so long will it be impossible to act quickly in retrieving information. One way out is to adopt a flexible system capable of processing WORDS and DATA, accurately, fast, easily, and cheaply. The rest of the world has entered the second industrial revolution. The first was characterized by the abundance of mechanical forces which far out performed the brawns of toiling people. The second revolution is on another level, where electronic devices out-perform the capabilities of the human brain. It is at this level that Nigeria must begin to operate provided, of course, the system is affordable and maintainable.

THE CONCEPT OF AN EDUCATIONAL DATA BANK

The concept of a data bank will be understood at least partially if its analogy to a financial bank is evoked. There are a few similarities. When money is put into a savings

account, the payment can be in any format or money denominations. After a lapse of time, interest is computed and credited to the account. If the depositor wants to withdraw some or all of the money in the account, it is done promptly on application, and payment is made in money denominations or format specified. Secondly, immediately after that basic transaction of putting in information has been concluded, much more can be gotten as bonus in form of processed information from the Bank. This processed information is available in addition to the original input and can thus be regarded analogously as the 'interest' to the deposit. Additionally, the withdrawal of information can be in any format (within the capabilities of the system used).

A few essential differences exist however, whereas the extent of withdrawal possible from the savings account is the sum of the original payment and the total interests earned, this is not so with the data bank. All the information originally entered could in addition to the processed data be recovered, and still the original input would remain in the bank. Thus the Data Bank is virtually an inexhaustible source which can yield information over and over again without its original input being expended. In fact, the same basic information and/or processed versions of it could be used to start off many other similar banks at other locations. This essential characteristic and the power to process information rapidly make the data bank a versatile centre particularly suited for storing educational data, especially those basic ones used frequently for planning and research. This then means that once a basic piece of information is entered, it becomes available unendingly for processing and retrieval. However, even when changes occur, only that portion of the original input so affected is amended in a way, which is analogous to erasing a pencil error and writing over it. Information thus gets more accurate and fuller the longer it remains in the system provided of course the necessary steps have been taken to make the system aware of changes and errors as they occur or are identified. Its overwhelming superiority lies in its compactness, easy accessibility, and capability to process information rapidly and present this information in the most relevant format on any occasion.

DATA STORAGE DEVICE

A data storage device is a device for recording (storing) information (data). Recording can be done using virtually any form of energy, spanning from manual muscle power in handwriting, to acoustic vibrations in phonographic recording, to electromagnetic energy modulating magnetic tape and optical discs (Treek et al., 2007). A storage device may hold information, process information, or both. A device that only holds information is a recording medium. Devices that process information (data storage equipment) may either access a separate portable (removable) recording medium or a permanent component to store or retrieve information.

Electronic data storage is storage which requires electrical power to store and retrieve data. Most storage devices that do not require vision and a brain to read data fall into this category. Electromagnetic data may be stored in either an analog or digital format on a variety of media. This type of data is considered to be electronically encoded data, whether or not it is electronically stored in a semiconductor device, for it is certain that a semiconductor device was used to record it on its medium. Most electronically processed data storage media (including some forms of computer data storage) are considered permanent (non - volatile) storage, that is, the data will remain stored when power is removed from the device.

In contrast, most electronically stored information within most types of semiconductor (computer chips) micro-circuits has volatile memory, for it vanishes if power is removed (Rockart, 1996). With the exception of barcodes and OCR data, electronic data storage is easier to revise and may be more cost effective than alternative methods due to smaller physical space requirements and the ease of replacing (rewriting) data on the same medium. However, the durability of methods such as printed data is still superior to that of most electronic storage media. The durability limitations may be over-come with the ease of duplicating (backing-up) electronic data.

THE WORKING OF A DATA BANK

Before this concept is developed further there is need to at least show that:

It is easy to operate
It can make information flow
It is affordable

Since most educators seem to have been misled into thinking that computers are complex giant machines that store data, process them, and dish these out in required formats, one feels very reluctant to use the word "computer".

The point is that computers do compute and they are extremely good and fast; although that is the least of the problems confronting the educational planner or administrator. The administrator needs information in a flexible form. This is a word processing which many typewriters can handle, and it is as the product of a typewriter that the reader should view the data bank proposed.

To drive a car does not require one being an automobile engineer. To use a typewriter does not demand knowledge of applied mechanics. Any one who can use a typewriter can learn, in a matter of hours, how to process words, that is, operate a data bank.

An example of the 'currency' used at the bank is:

15 Dada, F. K. Born Kaduna January 7, 1956 Male, Divorced, Graduate in Geography, Diabetic, very hard Working Teaching.

Of course, a bank will standardize the currency used for its transactions. Although it will have a special foreign exchange department for changing to other currencies. Hence, once that format or currency is defined, the information will come in that form.

27 Madike, J.F. Born Ilesa March 16 1959 Female, Unmarried, NCE in French, Tantrums, Lazy.

The above is an acceptable format and it highlights the essential characteristics of this particular bank. In order to ensure that the currency used at this bank is uniform, these records are broken down into files thus:

Name and initials of subject:……..……...25 spaces
Place of Birth…….……..15 spaces
Data of Birth:…….……8 spaces
Sex:……..……1 spaces
Marital Status:……....1 spaces
Qualification and subject of examination……...4 spaces
Health/Psychological Information:……..……12 spaces
Attitude to Work:…….……...2 spaces

Thus we have the following currency which can be coded as follows: Where 16031959 represents the 16th day of the third month (03) of 1959; F = Female; 0 unmarried; and the (:) when, a blank space. The number 27 before the name merely indicates the numerical order of the transaction. Basically, this is all it takes to operate a data base and it should be clear that the skills called for are minimal. Once someone defines the fields as above and the variously numerical equivalencies are given, anyone who can type and count spaces can put information into the bank. It is the Nigerian experience that when you go to the bank to deposit say N1,000, the transaction is over in a few minutes especially if you use fifty N20 notes. However, when you want to withdraw N10 you spend up to 40 min and sometimes over an hour. Any bank that does not deliver promptly is not worthy of the name. So it is with a data bank.

Information is for use and must come out promptly when required and in the denomination appropriate to the occasion. A cheque for N100.000 will be appropriate for paying for shares in a company, whereas 50k notes will be appropriate for a village burial ceremony. The information already put in the bank is structured to allow rapid retrieval. For example, let us find the date of birth of those in our bank. Note that (excluding the transactional numbers) information about date of birth for every one begins on the 41st column and ends on the 48th thus.

0 0 0 4 4 4
1 2 3……. 1 8 9
15 D A D…….0 7 0 1 1 9 5 6 M….

27 M A D…….1 6 0 3 1 9 5 9 F…..

The command will be simply to print out columns 41 to 48 for each person using the transactional number (15 and 27) to differentiate them. This is done most efficiently and very rapidly and then printed for use. The advantage of the MICRO-PROCESSOR is that it can print out what is required very rapidly and without error. Let us take another simple example, if you want to know how many males are in the bank, all you need to do is to command that all Ms in column 49 be totaled. No doubt some critical readers might think that the issue has been over simplified. This is not quite so, the person who sets up the system (the programmer) has done all the work and retrieving information is almost as easy as indicated above. In fact, most recent processors have gone a long way to eliminating the professional programmer whose role is reserved more for complex jobs. With the basics being commonly available, almost anyone can programme if one can spend as much time in learning BASIC as is put into learning to ride a bicycle. One needs the professional programmer only if one wants to perform spectacular stunts.

The question of affordability must loom large in any discussion about data retrieval system. This is because after the second industrial revolution, not only are micro-processors portable but they are also very cheap. A typical system with capacity to handle information in respect of about 15,000 teachers at once (2 mega bites) can now be installed for about N30, 000. If there are more than 15,000 information, they can still be processed but in batches of sequence of 15,000 each time. It must be stressed that these prices will only go down as miniaturization progresses and mass production increases. A few years ago, a system with this capacity cost well over N18,000. The low cost of a system is no index of affordability. Rather, the cost relative to the overall expenditure of the agency, and the resultant benefits, will determine whether or not a system can be procured. No state government in Nigeria spends less than N20,000,000 on education each year. An expenditure of N50, 000 representing ¼ of 1% must be affordable especially as it will eliminate the largest single problem that leads to waste in education.

USES OF THE DATA BANK

The broad aims of such a bank include:

1. To coordinate nationally, the necessary expertise for refining the raw data thus assembled and to up-grade the integrity of the Data Bank through research and statistical tests and analysis.
2. To operate a retrieval system which will be simple and flexible in formatting and which can be accessed directly by almost anyone with minimal training and without the intervention of any grade of specialists as is the case with

complex computer systems.

3. To offer specialized and continuous training to all levels of educators throughout the country with responsibility for collecting and collating data; for compiling educational returns; for taking decisions on aspects of quantitative and qualitative development of education; for school system plans and budgets; and for national developmental plans.

4. To offer services to ministries of education and specialized agencies of government in formulating their educational plans and policies along scientific lines resulting from the use of the most accurate data available at one time.

5. To be national source for obtaining, at very short notice, accurate information and data on schools, teachers, finance, structure of education, curriculum, and other auxiliary educational services. In addition providing when requested, computer projections and trends and to process data for researchers, ministries of education, etc.

6. To be one of the major national centers of research activities on education, educational planning and finance.

7. To disseminate nationally, information on educational plans and projects and to offer assistance to trainees in the field through a news sheet of publication this will be distributed nationally to all educational practitioners.

These are, however, the larger objectives. Ordinarily, these processors can store information with respect to students; teachers; courses; physical facilities; grades; funds; instructional materials and perform computations to determine the overall efficiency of the system, others will extend these ideas to teaching and library services. Unfortunately for Nigeria, the telephone cannot be said to have arrived since it does not work. However, when it does work efficiently and consistently the uses of the processor can be extended considerably. Many users can pool together to share the same processor, each retaining a typewriter-like terminal through which to send and receive information.

CONCLUSION

In conclusion, 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. It requires agreement on at least the following:

i. Compatible equipment (hardware)
ii. A standard language
iii. A standardized format for record keeping

In a nutshell, a sustained and planned effort will have to be made to ensure that the raw pieces of information on which data banks are based come in regularly from the grassroots and are used in updating records as they arrive. A bank with no new input will soon find that the 'old notes' are 'defaced' and almost untenable. Perhaps the most crucial part of it all is the need to put out information, with automatic printers which can type faster than the typist.

Infact, Nigeria cannot continue to live in biblical times and hope to have a place in the 21st century. The funds to experiment with should be made available; the people to spearhead the move are Nigerians and they have to be ready. There can be no further justification for delaying the inevitable. The Federal Government should invest more and see what can be done, and let the doubting Thomases who are frighten of change have a chance to see and use these processors; let those who fear break downs watch the wizardry of the 20th century as ordinary housewives or change panels and restore a tired processor to life. Let all these happen so that Nigeria's fears might be justified or dispelled. This is the way of science - to think, to test, and to learn.

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