AUTOMATION OF MATERIALS MANAGEMENT IN THE NIGERIAN INSTITUTE FOR RESEARCH

BY

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ABSTRACT

This research explores the extent of computer application in materials management, and in a research institute in Nigeria. In addition, to determine the input database and outputs of the inventory control application, the type of data processing system used and to draw the general diagram of the application. The research design was a combination of the survey, case study and the use of economic order of quantity (E.O.Q). From the statistical analysis, 50 out of the 50 respondent indicated that the computer was applied to the materials management and inventory control functions in the institute. Secondly, it was found that the inputs of the inventory control system were: accepted orders, stock receipts, notices, transaction data and miscellaneous inventory transactions. Respectively, database constituted of the inventory master file and back order file up data. The outputs of the system were inventory reports, listings, economic order quantity, filed orders, back orders, miscellaneous transaction data, reorder level, and out of stock. It is recommended that the administrators of the Institute should continue to use computers for their inventory control to enhance timeliness of operation.

INTRODUCTION

The focus of this paper therefore is to look at materials management – procurement, materials handling, inventory control and how to use the computer to perform a program of instructions, perform mathematical, logic, manipulate operations on the data and report result of the earliest possible time for quick decisions in the dynamic world of today especially in research instiutes with a case study of a research institute in Nigeria.

History of Research Institutions

The revolution of agricultural research institutions fall into three periods namely:

(a) The pre-indepdence era, that is, the era before 1960.
(b) The period of 1970 to date.

The pre-independence era started way back 1893 when a single Department of Agricultural and Forestry was conceived and a Botanical Garden established in Lagos. The Department was broken into two between 1910 and 1912 with a station Samaru Zaria and the other at Moore Plantation, Ibadan that served as the headquarters. A single department of agriculture was established in 1921 with amalgamation of the South and the North. A clear

cut agricultural policy was formalized in favour of industrial crops like cocoa, groundnuts, oil plam, rubber etc. to feed the industries in developed countries. Different research institutes along the line of this policy were established as shown.

Table 1: Research Institutes in Nigeria between1932 – 1960.

Date	Research Institutes Established
1923	Research on Tse-tse fly and human sleeping sickness.
1924	Department of Ventrinary, Vom.
1925	Department of Forestry, Ibadan.
1926	Soil Chemistry Laboratory, Ibadan.
1939	The Oil Palm Research Station, Benin City.
1940	Department of Fisheries, Lagos
1950	Federal Institute of Industrial Research, Oshodi-Lagos.

Source: [1].

Between 1950 and 1957 several commodity research oriented stations were created as part of the British Commonwealth West Africa Territorial Research Organization. Table 2 below shows the Institutes established by British Commonwealth West Africa Territorial Research Organization.

Research Organizations:

Date	Research Institutes Established
1944	West African Cocoa Research Institutes Tafo, Ghana
1947	West African Institute for Trypanosomiasis Research (WAITR) Kaduna
1948	West African Stored Products Research Unit (WASPRU), Lagos.
1951	West African Institute for Oil Palm Research (NIFOR), Benin City.
1952	West Afrian Fisheries Research Institute (WAFRI), Sierra Leone.
1953	West African Medical Research Council (WAMRC), Lagos.

Source: B. [1].

In the 1960 – 1970 periods, agricultural development was decentralized with the Regional Government dictating the pace and the Federal Government playing a supporting roe. In 1965 the Federal Ministry of National Resources and Research was established to co-ordinate Federal Government Program and projects. The period of 1970 to date witnessed a phenomenal increase in institutions and infrastructures dealing with Agricultural Development with the launching of new policies, programs and projects. The Agricultural Research Council of Nigeria (ARCN) was established to coordinate the activities of Research Institutions in the Agricultural sector in 1991 by Decree No. 25. From there different charges were made until some of the Agricultural Research Institutes was now cordinated by the Federal Ministry of Agriculture and Natural Resources. The Institutes have Governing Boards with specific powers backed by law. The Directors of Research Institutes are the Chief Executives and are responsible for the day to day management of the Institutes. Some of the responsibilities of the Governing Boards are delegated to the management of the Research Institutes for their smooth and efficient running [1].

At present, there are Agricultural Research Institutes established in order to achieve the objectives of agricultural development as research and technology constitute a major instrument for the development of the sector. The research institutes are designed to:

(a) Provide solution to existing and anticipated constraints to increased productivity.

(b) Develop technology that within the means and skills of small-scale farmers as well as production packages suited to intermdiate and large-scale farms and assist in the process of disseminating the results of research to ultimate users – that is the farmers.

The ultimate goal of research activities therefore is to increase the nation's agricultural production since the Research Institutions evolved from existing Institutions owned either by the Federal, State or Regional Governments. Some ofthem had some overlapping responsibilities. This was recognized sometimes ago [1].

The function of the research institutions listed in the Research Institutes established by Decree of 1975 were well stated. The responsibilities of some of the Institutes particularly those of the Institutes of Agricultural Research and Training and Institutes for Agricultural Research that evolved from Institutions owned by the defunct Regional Governments. Similarly, most of the Research Liaison Services to disseminate agricultural research results in addition to the Agricultural Extension Research Liaison Services which formerly had responsibilities over the defunct nine Northern states of Nigeria for research result dissemination [1].

However, recently, the Government approved new functions and responsibilities for Research Institutes to improve their effectiveness and to remove areas of overlap and sharpen their focus. The functions and responsibilities are designed to increase agricultural productivity, diversify sources of food and foreign exchange earnings increase livestock and fish production ensure availability and adequacy of food throughout the year through the development of appropriate storage and processing techniques increase the nations forest products and wildlife to maintain ecological balance. All these follow the same pattern in terms of materials management.

REVIEW OF RELATED WORKS.

INTRODUCTION TO DATA PROCESSING

Every organization whether business, government, or social requires certain amount of paperwork. This paper work is called data processing. Any procedure, equipment, programs and people for which this paperwork is accomplished make up the data processing system. Data processing systems are essential in handling the information needs of an organization [2]. Today, data processing is generally assumed to be computer, data processing or EDP. In the past, data processing consisted of manual procedures to do paperwork. With the advances in technology, electrical machines were introduced in many organizations to replace manual data processing systems. The term automatic data processing or ADP was used to describe the systems using these machines. ADP system was used to reduce the amount of paperwork needed and the clerical functions associated with it. Comptuer systems were used initially in many organizations to perform essentially the same functions as ADP Systems [2].

As organizations grow in size and complexity, they become more dependent on computers to process data and provide information for decision making. Recently, significant technological advances have reduced the cost and size of the computer to such an extent that organizations of almost any size can now benefit by using computer data processing. Through computer data processing, organizations of all sizes are attempting to meet the ever-increasing needs for information in a complex and ever-changing society. Unorganized facts are data. Data processing whether manual, electromechanical or electronic consists of the operations needed to capture and transform data into useful information and the transmission of this information to managers or other specific individuals or groups. Thus data processing is a means to an end, not an end in itself. When the results from the capture and organization

of data are used, they become information. Information then is the basis upon which efficient and effective decisions can be made. This is one of the major reasons why data processing is very important to the successful operations of any organization [2].

Data processing is usually divided into two major areas; business and scientific. The major function of business data processing is the establishment of files of data, the retention of this data and the processing of it to produce meaningful information. Business data processing usually involves large volumes of data, few mathematical and/or logical operations performed on this data anda large volume of results. For example, a public utility msut maintain a record for each customer and each month present a bill to the customer for services used. This requires reading the customer record to determine name, address and any past due amount. The customer bill involves a few sample of calculation. Then it is printed. In this example many thousands of records have to be read, updated and printed, this the majority of processing time is spent manipulating data [2].

COMPUTERS AND MATHEMATICS IN THE MODERN SOCIETY

Mathematics, the science of space and quantity is basic to all branches of science and technology. It is a very desirable tool in virtually all spheres of human endeavour, be it science, engineering, industry, technology and even the arts. There has always existed a close inter-relationship between mathematic on the one hand, and technology on the other. Indeed, one of the most recent and exciting developments in mathematics is the birth of numerical analysis optimization and control theories. Their shaperes of influence not only transcend the dynamics and contruction of machinery and work plans, but also concern the economic stability of a society [3].

Mathematics is indeed an everyday language, which is used by all mankind in varying degrees. It is a logical language for expressing ideas of shape, qantity, size and order. It is also used to express our growing understanding of the universe to facilitate the transactions of the market places to understand and explain the complexities of modern society [3].

Although the first generation of computers came into being during the second world war (1939 – 1945), if was Charles Babbage a Cambridge mathematicians who first conceived he idea of a mechanical device to compute and store premiums of insurance purposes in the early nineteenth century [3].

We are now in the age of the computer revolution which has to a large extent widened the gap between the developed and developing nations originally created by the industrial revolution. Since the Second World War a substantial knowledge of the immense power of electronic computers, computing theory and the diverse areas of the application of computers has come to the attention of mankind. This had led to the taking of significant strides in the production of large, fast and reliable computing systems [3].

. Both the Japanese, the countries of Europe under the umbrella of the E.E.C and the Americans are independently working towards the launching of the 5^{th} generation of computers by early 1990s. Each of these countries is investing billions of US dollars to realize this objective [3].

This enormous amount being expended on the computer industry by the developed societies exceeds by far the entire need not bother so much as regards producing computer hardware. Rather, computer scientists in these relatively backward zones should concentrate their curriculum in computer science on the development and application of software, which are of immediate relevance to their existence. Apart from application in more classical areas like engineering physics and chemistry, efforts should be made at computer assisted

modeling and control in ecology, urban planning, medicine, weather forecasting, military, water resources, traffic flows, transportation, oil exploration, banking and insurance [3].

The theory of Games (which is based essentially on Probability Theory) is of immense applications in war, politics and business. Games of pure chance (e.g. dice, cards, and roulette) can be analyzed by means of probability theory, which was formulated since the seventeenth century. Towards the end of the Second World War was the theory of 2 persons zero-sum game (which is based on pure and mixed strategies) was introduced [3].
. We now examine some of the problems confronting the computer industry in developing countries. First and foremost, most of these countries lack continuous and stable electricity supply. This damages most computers easily and in a situation where spare-parts are not available, the result is that most computer installations are not functional at all times.
The manufacturers should aim at developing computers, which can operate with batteries, and without the need of an air-conditioned environment. Hewlett Packard has just introduced the HP 9000, which does not require being air-conditioned. This is indeed a step in the right direction. This should also be a challenge to the electricity generating companies. They should establish a viable and capable applied mathematicians, computer scientists and engineers who will examine and resolve most of the existing problems that bug electricity generation in developing societies [3].

Lastly, the computer vendors in developing countries should be more realistic and moderate in the selling prices of their computers. Besides, the after-sales services require a surgical operation. Adequate efforts should be expended on the training of customers of varyin categories before and after the sale of a particular computer. This minimizes the risks of damaging the equipment while learning its operation by trial and error approach [3].

A SURVEY OF RURAL SMALL BUSINESS COMPUTER USES

The introduction of microcomputers into small busines has had a tremendous impact on their ability to operate efficiently and enhance the decision making process through the computer-based information systems (CBIS). Prior research on the influence of computer use on decision performance has almost exclusively been conducted in large organizations.

Deleon's and Raymond's empirical investigation which focused on studying the impact of organizational characteristics on computer use, and MIS success in the contact of small businesses, marked new research direction. However, research that explores the impact of computer technology in the context of rural, small business is still limited [4].
The utilization and impacts of computer technology may vary depending on the context of the application. This study deals with the application of computer technology to decision making in the rural small business context. In addition to decision support, it is important to assess how business executives perceive the impact of computer technology on the decision making process.

The perceived effectiveness and efficiency of computer use are particularly relevant. If computer technology is perceived to have impact on the decision making process then it is important to find out specific ways in which computer-technology helps (or fails to help) rural business executives in decision making. The small business executives were asked to identify the computing resources that were employed to support their decision-making. Each of the respondents was asked to select more than one answer from the list of computing resources. These answers were then tabulated and categorized. The hardware resources deployed in the respondents' organizations were identified as falling into four categories: personal computers, workstations, minis and minframes. As for the software resources, an

analysis of respondent's selection suggests that they fall into four categories – word processing, accounting, sales and decision support packages [4].

RESEARCH METHOD

The research method chosen for the study is a combination of survey in which the researcher does not have control of independent variables affecting comptuer application to materials management because they have already occurred and so they cannot be manipulated by the researcher and the use of computer programming. If it were possible for the researcher to manipulate the explanatory variables affecting the computer application in the institute the proper research design to use would be an experimental research design, rather than a survey.

A survey research design is described hereunder that:

1. It is a research strategy in which primary data are gathered from members of a sample that represent a known population or universe;
2. A systematic gathering instrument such as a questionnaire or an interview schedule is used to collect the primary data;
3. Data are got directly from the subject in their natural work settings where they provide the primary data;
4. Answers of the respondents are assumed to be largely unaffected by the context in which they are elicited;
5. Impacts of confounding variables are controlled statistically; and

The purpose of the research may range from the exploration of phenomena to hypothesis testing [5].

MEASUREMENT OF VALIDITY AND RELIABILITY

[5], wrote that one way of seeing reliability is from the standpoint of the extent to which the measurement of the attributes contains an error. To the extent that scores yielded by some measures are error-free, to that degree, the measure is reliable [6],
gave other synonyms or reliability to be accuracy, predictability, consistency, stability and dependability. In this research project, the test-re-test method of the questionnaire is administered to the 50 respondents at two points in time and the scores are correlated. The Spearman's rank correlation coefficient of 0.97, which is very near to 1, indicates that our measure is reliable.

Despite reliability of the measure, the validity of the measure is significant and has to do with the measure measuring what it purports to measure. The content validity is used which has to do with the degree that items making up the measure are a representative sample of the domain of items associated with the domain of items associated with the variable being measured [7]. The lottery method of simple random sampling is used to get the sample of 50 respondents from the materials management department of the Institute thus giving our measure content validity. In practice, the primary data collected with the questionnaire is validated by cross-checking with information from the statement of accounts of the Institute.

DATA PRESENTATION

Table 1: The summary of the personal data of 50 respondents

(1) **Sex**	**Frequency**	
Male	37	
Female	13	
Total	50	

(2) **Marital Status**	**Frequency**	
Married	30	
Single	10	
Divorced	4	
Widowed	3	
Separated	3	
Total	50	
(3) **Age**	**Frequency**	
Less than 20 years	05	
21 – 30 years	08	
31 – 40 years	10	
41 – 50 years	11	
51 – 60 years	10	
Above 60 years	06	
Total	50	
(4) **Higher Educational Qualification**	**Frequency**	**Angles in degree**
Senior School Certificate	05	36.0
Trade Certificate	04	28.8
R.S.A	06	43.2
Diploma	04	28.8
O.N.D.	03	21.6
H.N.D.	06	43.2
First Degree	10	72.0
Second Degree	05	36.0
Membership	07	50.4
Total	50	360

Source: From the questionnaires administered

From Table 1 above, it is shown that out of the 50 respondents, 37 of them are males while 13 of them are females. For the marital statuses of the 50 respondents, they are married, single, divorced, widowed and separated with frequencies of 30, 10, 4, 3, and 3 of them respectively. For the ages of the 50 respondents, they are below 20 years, 21 – 30 years, 31 – 40 years, 41 – 50 years, and 51 – 60 years, above 60 years with frequencies of 5, 8, 10, 11, and 6 of them respectively. The highest educational qualification are Senior School Certificate, R.S.A, Diploma, O.N.D., H.N.D., First Degree, Second Degree and Membership with frequencies of 5, 4, 6, 4, 3, 6, 10, 5 and 7 out of 50 of them.

PERCENTAGE ANALYSIS

Table 2: The percentage analysis of the respondents to the two Yes or No questions

	Yes in No.	**%**	**No in No.**	**%**	**Total in No.**	**Total in %**
1. Do you apply omputer to the materials management function?	50	100	0	0	50	100
2. Do you apply the computer to inventory control in your Institute?	50	100	0	0	50	100

Source: From the questionnaires administered.

Table 2 above shows the responses to the Yes or No questions in absolute numbers and in percentages. The 50 respondents the materials management function and all of them making 100% of them said yes. The 50 respondents are asked if they applied the computer to the inventory control in their Institute and all of them making 100% of them said yes.

The Derivation of the E.O.Q model formula

Let $\frac{Q}{2}$ be the average inventory $Ch\frac{Q}{2}$ the inventory holding cost and $\frac{CoD}{Q}$ the ordering cost at that point of minimum cost.

$$Ch\frac{Q}{2} = \frac{CoD}{Q}$$

$$Q^2 = \frac{2CoD}{Ch}$$

$$Q = \sqrt{\frac{2CoD}{Ch}}$$

Source: Derived by the Researcher.

CONCLUSION AND RECOMMENDATIONS

The main objective of the study was to handle a computer application in materials management in an institute in Nigeria. Nonetheless, it was found that 10% of the respondents said that the computer is applied to the materials management function and to the inventory control function in the Institute. It was found that the inputs of the inventory control system were accepted orders, stock, receipt notices, transaction data and miscellaneous inventory transaction in that descending order of magnitude. It was found that the database consisted of the use of inventory master file and back order file output. It was recommended that the administrators of the institute should continue to use computers for their inventory control to make for timeliness of operations.

It is recommended that the administrators of the Institute should continue to use computers for their inventory control to make use of computers for their inventory control to make for timeliness of their operations. It is recommended that the output of inventory control reports should be emphasized to give timely information for management meetings. It is recommended that the Institute should continue to perform electronic data processing system to enjoy such qualitites of the mass storage, precision, security and indefatigability.

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