MATHEMATICS AND DEVELOPMENT IN NIGERIA BEYOND 2020

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Abstract

Mathematics is an essential component of every human culture and responds to its environmental social stresses. Every civilized society makes use of mathematics. The intertwining process of mathematics and other disciplines makes mathematics both the servant and master of other subjects. Other disciplines use mathematics a lot in their practice and development, thus it is acknowledged that people who wish to keep in touch with new developments, inventions and innovations need a wider knowledge and understanding of mathematics. Mathematics is the bedrock of science and technology. Invariably, mathematics is the queen of the sciences and no nation can hope to achieve any measure of scientific or technological development and growth without proper root and foundation on mathematics. It is based on these elucidations that this study examined the impact of mathematics in the development of Nigeria beyond 2020. The study emphasized on mathematics and science as they impact on development, human, social and other resources and their development were delved into. The prescriptions of this study and approach is so much influenced by the dictates of Economics, management, social and other relevant sectors to development, the realities of Nigeria, especially as regards its diversity and the continuing necessity to ensure that all prescriptions on how best to develop Nigeria benefit from creative minds fertilized by exposure to mathematics education. Prescriptions so far received in Nigeria has not helped Nigeria to develop as desired and may not take us to the destination of our dream. The significance of creative mind and inputs from mathematics is made

necessary by the simple fact that the articulation of units of ideas or projects is the beginning of the steps in development beyond 2020.

Keywords: Mathematics, development management, resources, prescriptions and articulation.

Mathematics is regarded as the study of quantities and relations through the use of numbers and symbols. It is the symbolic logic of possible relations concerned with hypothetical truth. In whatever definition, mathematics deals with numbers and numeracy. It plays a vital role in any society and occupies a very unique and unquestionable position in every society. In the years gone by mathematics was only needed by engineers and physicists but today and even beyond 2020 it is a pre-requisite for almost all human activities.

Nsor (1999) acknowledged that mathematics is one of the most useful and fascinating division of human knowledge. He noted that it is valuable because of its practical approach and application to our everyday life. A good knowledge of mathematics is a sound preparation for effective and useful living in the society. Mathematics assists people in the society to avoid a wasteful living.

This paper is focused on the role of mathematics in the development of Nigeria beyond 2020. For a proper exposition and thorough work, this paper started with the historical contribution and development of mathematics.

Mathematics and Development in Pre-Historic Times

Mathematics is an essential component of every human culture and responds to its environmental social stresses. Every civilized society makes use of mathematics. Nwagbara (2013) has opined that mathematics evolved in response to the needs of pre-history societies. He noted that as people lived together, their interaction created problems that needed practical solution. Activities as trading, building of houses, working on farms, even fighting all these had their attendant problems that found solutions in mathematics. The pre-historic society had to calculate the quantity of materials needed to build a house, the amount of food needed to provide for their army among others.

In addition to the practical problems of mathematics were those motivated by religion, for instance, the clergy found astronomy necessary for fixing the dates of religious festivals, there were geometrical problems arising from the construction of altars and temples.

Dedron and Itard (1973) lent support to the above views as they asserted that mathematics arose from the need for a system of counting and for calculating areas and

volumes. They however, opined that mathematics has over the centuries become less concerned with practical matters and has turned instead towards logic and pure intellectual speculation.

Numerical notations date back to the beginning of writings in the third millennium BC. Documents dated to about 2000BC show that both the Egyptians and the Babylonians had sophisticated systems of mathematics (Gittleman 1975). The Greeks, the Romans, the Hindus, the Arabians etc used mathematics for their development. For example, the Egyptian civilization as far back as 2900BC was advanced in mathematics enough to be able to build one of the wonders of the word, the great pyramids of Cheops.

New Trends of Development

Development is about wealth creation. It no longer simply refers to the state of economic growth, technological and infrastructural facilities, even though these also count. The human person is now the main focus of development, while the sustainable, continuous enrichment of the human condition is now regarded as its main goal and objective.

Orubu(2004) had noted that development as seen during the 1960s, and during a significant part of the 1970s, was purely an economic phenomenon. The benefits of a sustained growth process and implied economic development were expected to trickle down to the people in the form of jobs and numerous economic opportunities. In this vein, development should focus on what is happening to poverty, unemployment, and inequality over time.

According to Seers(1969), development can only occur in an economy if the growth process led to a reduction in poverty, unemployment and inequality. Goulet (1971) Owens (1987) are of the view that development, more appropriate, should be seen as a multiple dimensional process involving changes in social structures, popular attitudes, national institutions, as well as the acceleration of economic growth, including the reduction of inequality and the eradication of absolute poverty. In all ramifications, development should increase the availability and widen the distribution of basic life sustaining goods such as food, shelter, health and personal protection, thereby raising the standard of living, and should result in higher incomes through the provision of more jobs, better education and greater attention to cultural and humanistic values Uwatt (2004) in tandem with the above views of development has identified availability of natural resources, the levels of capital accumulation and technology, the quality of human capital, organization of production, the socio-cultural setting of the people, a strong and efficient administrative and political structure as important determinants of development. In a sense, development would be achieved if there is an entrepreneur who harnesses all material and human resources for the improvement of human esteem.

From the foregoing, it is pertinent that mathematics has a great role to play in the development of Nigeria now and beyond 2020. A look at the following is strong enough to advocate for the proper place of mathematics in the developmental dimensions of Nigeria so as to give the nation a respected and esteemed position in the polity of nations.

The Sciences and Impact on the Development of Nigeria

Mathematics is the language of science, is the gate way and key to any success in the field of science. Scientists depend on mathematics because it is precise, accurate and amenable to brevity. It is gives exact quantities and disposed to the reporting of formulae and experimental observations. Technological breakthrough that is the precursor of development is hinged on science and mathematics. Technological innovations is an imperative in the socio-economic transformation and competitive advantage of any nation (Lall 2001). Mathematics as bedrock of the science is a veritable instrument for the development of technology in Nigeria beyond 2020.

Nwagbara, Bassey and Enun(2013) has emphasized that where there is no mathematics, there is no science, where there is no science, there is no technology and that the absence of technology implies absence of development. Gomwalk (1986) has it that science and technology together form the basis of modern development. Scientists, engineers, technologists, para-scientist and para-technologists must be properly grounded in mathematics as to properly fill their place in the development of Nigeria now and beyond 2020. Modern technological development, as we all know has its root from scientific inventions. Engineering is the application of science, while technology is the actualization of engineering science. In all ramifications, scientists prove and establish the existence of laws governing natural phenomena, engineers use the knowledge of the laws to determine how to harness natural forces for the benefit of man; and technologists make use of available resources to physicalize the concepts and ideas from the engineers' drawing board. Through mathematics, the interdependence of science, engineering and technology is made manifest. For technology to strive, the scientist and technologist have to posses workable knowledge of all basic sciences namely, physics, chemistry, biology and computer science, as well as in depth knowledge of mathematics. In this direction, mathematics will pilot the sciences and associated fields to achieve development for Nigeria beyond 2020.

Industries

In recent times, Nigeria had to adopt the survival strategy of import substitution of industrialization. Industries exist for the provision of goods that satisfy human wants; make profit, create jobs, secure the environment and contribute to the social welfare of the people. Mathematics is important for planning any industry. Many industries employ the services of competent mathematicians because they assist in engineering

projects like in the design of control measures, operation details, material usage and cash flow. Pythagorean ideas and principles are much employed in designing buildings for any industrial layout. Work shifts in industries, capacity utilization and the production functions are elements of mathematics that are applied to industries. Industrialization is the front burner of any development effort of any nation. Industrialization is not merely the isolated installation of foreign designed and foreign fabricated machinery in an alien environment, but an integrated process that involves the ability of a nation such as Nigeria to generate its own manufacturing processes by adapting fabrication, invention and innovation of technologies (Orji 1990). In this dimension mathematics becomes the first port of call for its services in the march to development now and beyond 2020.

Medicine and Medical Services

For any student undergoing training in the medical profession, a good knowledge of mathematics and the natural sciences is paramount for success, growth and development. The use of mathematical knowledge helps the medical doctor to calculate the atomic weight of elements and perhaps assist in the calculation of the quantity of chemicals needed for a particular mixture of pharmeuticals. Doctors used to strain themselves in routine work associated with clinical diagnosis, which can now carry out investigations using computer and mathematical analysis in an attempt to expedite the reports of laboratory investigations. The laboratory scientists has to use reagents in the correct proportion to do laboratory investigations, computation as to the volume of blood pumped with each heart beat and the amount of lung movement involved. These calculations use mathematics to settle the discrepancies found in patients. In prescribing the correct dosage of medicine and understanding the pattern of treatment, mathematics is used. Odili(1994) cited the use of mathematics in the treatment of cancer by radiotheraphy where it is important that the correct dosage of radium is administered and only to the exact area required. In modern medicine researchers are now able to produce contour maps of the human body. The associated graphs can be used to study human deformities and ailments. Plastic surgeons use mathematics to calculate the quantity of materials needed for their work. Proliferation of medical facilities, getting medical care to the doors of every Nigerian needs mathematics to have an accurate census and do the required planning. When medical care can easily be appropriated to the populace in the correct dosages and required time indicates growth and development. If the trend continues, Nigeria will experience development which will be sustained beyond 2020.

Planning and Management

To under achieve in any endeavour is to fail to plan. Planning is a very important aspect of management. Mathematics plays a very significant role in planning in any organization. In Nigeria, development plans must be hinged on the availability of data necessary for decision making. Facts have to be gathered to ensure objectivity in

the plans out layed for development. Kayode (2004) was quick to remark that Nigeria's development problems have been characterized by planning without facts. Mathematical approaches to solving management problems have been significant in recent time. Considerable progress has been made in quantifying management problems and arriving at mathematical solutions. Mathematical models and mathematical analysis in various experiments designed to demonstrate how a given set of conditions will lead to the objectives envisaged are used to arrive at management decisions. A model provides method of investigation that is less costly than an actual experiment. Application of mathematical treatment to managerial problem requires such significant steps as assembling the facts and the factors, constructing the model which involves translating a problem from the terms of ordinary language into the language of mathematics, evaluating the model, solving the model, testing the solution of the model and finally applying the solution. Mathematical programming as a mathematical approach to management decision making easily comes to mind.

Profit analysis, cost effectiveness, break-even analysis, optimization and minimization are all mathematical approaches to arriving at accepted and applicable decisions in business. Results of such approach lead to proper and achievement oriented decisions which enhance the realization of set goals aimed at developing the enterprise. When harmony pervades in societal organizations, there is equity, hence development is achieved both for the organization and society. The manifestation of the role of mathematics in increasing the pace of development is so much felt in management, business organization and production.

For the attainment of national development through social stability, improved efficiency and quality of life, creation of new culture, improved health sector and poverty reduction via proper planning and management of resources, mathematics education must receive a new impetus and thus propel the nation into development beyond 2020 (Agbajor 2013).

Research and Development

Mathematicians are always actively involved in various scientific researches. Research is a process of finding out solution to a problem, a process of getting and developing valid knowledge about something of material, social, economic or educational values we come directly in contact with (Nwana 1981, Nwankwo 1984). Research is not just an activity. It is an intellectual activity. Research is purposeful and is conducted to generate knowledge or add to an existing body of knowledge. In all fields of endeavour, research is undertaken for advancement of knowledge. Industries undertake research to improve their product, in medicine and pharmacy, research is engaged in to break new grounds and improve health delivery. In whatever form, there is observation of phenomena, gathering of information and data, classification of data, testing alternative view, data analysis and interpretation. All these stages need the

services of a mathematician. The quantum of information and data is complex and calculations have to be made. The use of computer and mathematics has reduced the time span and drudgery of huge data analysis. The speed, reliability and precision of mathematics and computer in carrying out complex scientific and engineering calculation have been enhanced. The specific aim of research is to improve the quality of production, enhance performance. On this note Nwagbara (2007) has advised that government should invest massively in research and development to discover alternative methods of production that will make use of the abundant human and material resources available in the country for further development. Industrial research as a form of research suited for development now and beyond 2020 should aim at discovering substitute raw materials which were not known before now and by so doing reduce the import-dependence of Nigerian industries. For any research to be meaningful and ensure quality product delivery, the mathematicians, statisticians and analysts to be involved must be competent and professionally capable of finding the expected results. This is to say that research activities that are tantamount to development can hardly be undertaken without involving mathematics for clarity, precision and target oriented. Since development pivots around research, and mathematics is the fulcrum for delivery, it is no over statement to say that through mathematics and research, Nigeria has the potential to develop immensely beyond 2020.

Environmental Development

Environment connotes ones surroundings and the existing features. It could be political, educational, economic, social, industrial and whatever environment. The basic issue is that such environment has to be improved if development is expected. A transformation of the environment is an index for assessing development. In this regard, architectural designing impacts on the environment and architectural designers are well known for their creative works aimed at developing the environment. Designers use mathematics, they turn mathematics to arts. Designing is invaluable to civil engineering. To be a successful model engineer, one has to study and have a good knowledge of mathematics which help in measuring and shaping. Brick-layers(masons), carpenters, welders apply the knowledge of mathematics intuitively. They use mathematics as they deal with numbers, mensuration, capacity and volumes. Masons unconsciously apply Pythagoras theorem to obtain accurate corners of buildings as they use the 3, 4, 5 rule.

Town planning is essential for the improvement of man's environment. Nsor (1999) attests that there are attendant horrors of living in an unplanned environment like erosion, flood, epidemics, etc. School of environmental design produce town and country planners who must be sound in the knowledge of analytic geometry. Drainage and sanitary plans of any dimension require mathematical knowledge of curves that are formed by cutting a cone with a plane. Drawing of plans and elevations are application of projections, though it is done more by measurement than by calculation. Scale

enlargement or reduction which is simply an application of mathematical proportion and the drawing measurement of accurate lines and angles is basically an exercise in the correct and proper use of mathematical instruments (Nsor, 1999, and Hinrichs and Kleinbach, 2002). A field of study that has this repertoire of knowledge is an assurance for sustainable development beyond 2020.

Engineering, Mathematics and Development

Engineers are devoted to the practical application of the physical sciences. They transform natural resources into efficient useful form for human utilization. Mathematics is a tool for all comers. The astronomer who measures earth distances, or space navigators or the engineers who designs a bridge or scientists are not strictly mathematicians but by virtue of the importance of mathematics to them and their profession, they are induced to romance with mathematics. They use mathematical ideas that were discovered and developed by mathematicians. Mathematics is of great importance in all engineering projects such as designing high ways, aeronautical and industrial engineering. Mechanical engineering primarily deals with machines, power, energy and heat. They are concerned with the manufacture and operation of machinery and equipment that produce, transmit and use power of all kinds. Aeronautical engineering is in the field of research, planning, development, designing, manufacturing and testing of air and spacecrafts. The knowledge of mathematics used is calculus, in deferential and integral calculus, mechanics, dynamics, statics, inertia and finding the centre of gravity of a continuous body. Civil engineers design, and supervise the construction of roads, harbours, airfields, dams and tunnels, transportation facilities and buildings. Engineers develop the design, decide which material and strength of the material putting into consideration the cost, wearability, corrosiveness, amount needed and the cost required for installation. The successful completion of road projects are made possible through the employment of qualified personnels who are familiar with heavy earth equipment, can test and report on types of soil, give appropriate mixture and grades and other materials through the use of mathematical knowledge (Nsor, 1999). Engineering extends to surveying, which incorporates the concept of direction, scale and topology. The survey of boundaries of private lands, cities, states and countries, maps and contour lines is magnificently laid out by surveyors. The branch of mathematics employed by surveyors are geometry and numerical trigonometry. Surveyors and their work need accuracy of detailed specifications and this has warranted their use of delicate and sophisticated mathematical instruments and devices. The linear screw guage and French curves are a few to mention.

In all ramifications, mathematics permeated engineering courses significantly that no engineer can boast of any achievement without a proper knowledge of mathematics. The multiplier effect is the attendant growth, health environment and material development that will catapault Nigeria into the committee of developed economies now and beyond 2020.

Information and Communication Technology

Information, and Communication Technology encompasses a wide range of elements that are used in processing, management and maintenance of information which includes all forms of computer communication, network and mobile technologies that mediate access to information (Hamilton-Ekeke, 2011). There is a great deal of demand of the workforce that use technology as a tool to increase productivity and creativity. The organization of information and how such information can be made available poses a challenge to information professionals, hence Idowu(2000) has asserted that it is one thing to generate as much information as possible and quite another thing however, to make such information accessible to others in the field when(where) needed. The advancement in world telecommunication had led to the development of e-mail services, on line database, worldwide network of information systems, the internet or information superhighway. ICT has reduced the world to dynamic and veritable global village and has been accepted as one of the unavoidable variables of the scientific world. The main thrust of Information and Communication Technology is the computer. Ekpenyong, Okon and Eteng (2013) have it that Information and Communication Technology (ICT) is the use of computer and other electronics multimedia to facilitate information delivery and retrieval. Computers are becoming household equipment. ICTs have redefined the information environment in such a way that it now poses technical, intellectual and ethical challenges to every profession. The development of the computer is traceable to the development of and influence of mathematics. Mathematics is regarded as one of the fundamental tools in the development of computer and hence very crucial as one of the elements of the computer. Many of the functions and operations in all programming language require some mathematics. Early computers were using machine language in writing of computer programmes and these machine language were in the form of binary numbers. Other operations in computer development which encompassed mathematics include logical operation, data analytical operation, comparison, arithmetic and conditional operations. In some aspect of computation in computer operation, algorithm is used. Theoretical computer science strongly involves discrete mathematics which is basically the study of mathematical structures that are discrete rather than continuous and so, this theoretical branch of computer science involves a lot of mathematics in the form of graphs, algorithms, computational geometry, quantum computation etc.

From this point, computer native language is binary number system. When letters or words are typed in the computer, it translates them into binary numbers as the computer can understand any number from 0s and 1s. The usefulness of mathematics in terms of technology to the development of computer comprises of audio-visual aids, video tapes, videodisc, multimedia, integrated media, projected media and electronic media etc. The invention of the computer arose from the desire to overcome the limitation of earlier methods employed in calculations. Before the advent of the

computer as a mathematical aid, counting had been done with fingers, toes, pebbles, abacus and slide rules. These were found to be inadequate as they had no speed in aiding calculation and also prone to human error. Napier John in the year 1617 blazed the trail in computer development by the introduction of the logarithmic scale version of counting machine and used the device to perform direct long multiplications and divisions. The counting items were bones, hence the term John Napier's bones being the name given to the machine. Punch cards, electronic computer etc to the present version of the computer (digital). All these inventions, had their root in mathematics and allied subjects like statistics, mathematical constructions etc.

From the foregoing, Information and Communication Technology is an offspring of mathematics and also has its basic inputs like data, numbers etc originating from mathematics. Hence the developmental process of the computer as Odili (1994) has remarked is in generations as one generation is associated with one sort of technological innovation or another. Each generation usually makes possible certain things which were not possible earlier. The characteristics of the present computer were arrived at through a process of development, most of which had been occurring since the mid nineteen forties. Mathematics was the anchor and had to midwife the development of the computer that has redefined the trend of national development and charted a new dimension in the development equation and is still capable of remaining at the forefront of Nigerian development beyond 2020.

Human Resource Development

The greatest form of development is human resource development. This involves the education of the Nigerian citizens. Education can be acquired formally or informally. For this country to develop beyond 2020, the entire populace have to be given the opportunity to be literate.

Mathematics education is to live up to expectation if the average Nigerian could be numeracy literate. Mathematics ensures the development of a critical and analytic mind of the individual. Through mathematics education, the individual will be free in mind and socialize with ease. Mathematics alters the reasoning of the recipient in the positive direction and enables an easy and overwhelming integration into the society. An educated mind will be free from diseases, will have self esteem, employed, make useful contributions to the society and above all help in the reduction of poverty. Equal opportunity to mathematics education guarantees equity and eradication of inequality.

Mathematics is the harbinger of science and technology and every country needs to improve its human, material and natural resources. Mathematics develops a creative and productive mind. Mathematics releases the human resources that are employed in the industries, firms, military bases, hospitals and other institutions as engineers, scientists, technologist, economists, surveyors etc. It is the development of

these human resources that makes the difference in the developmental pace of nations. Managers and captains of industries need mathematics to function effectively and be productive. Mathematics encourages entrepreneurial development and with such a position becomes a necessary ingredient for further development. Human development is paramount to the development of Nigeria because it is human effort that will develop the environment. Kayode (2004) has noted that the development of man's resourcefulness is his best resource. The human resourcefulness embraces his ability to turn his environment, his organization and knowledge into resources. There are attributes of man that trigger the need for change and development, such things as his orientation, opinions, values, concepts etc. These factors make the role of man in economic development very critical. Nayudama (1978) emphasized that development is not to make the poor wealthy, but to make the poor productive because the need of the poor is not relief, but the release of his inherent potential for individual growth, enhanced productivity and higher social and political responsibility. It is no bragging or over assumption to hold the view that mathematics education turns man into an asset, not liability. Man, who is mathematically equipped, therefore will contribute his quota into the developmental effort of Nigeria beyond 2020.

Energy and Development

Energy is one of the major building blocks of modern society. Energy is needed to create goods from natural resources and to provide many of the services we have come to take for granted. Economic development and improved standards of living are complex processes that much rely on the availability of an adequate and reliable supply of energy. The modernization of the West from a rural society to an affluent urban one was made possible through the employment of modern technology based on a multitude of scientific advances – all of which are energized by fossil fuel. Energy pervades all sectors of society-economics, labour, environment, international relations, in addition to our own personal lives-housing, food, transportation, recreation and more.

Hinrichs and Kleinbach (2002) agreed that the use of energy resources has relieved us from many drudgeries and made our efforts more productive. Energy is found in many forms such as wind and flowing water, and stored in matter such as fossil fuels-oil, coal, natural gas-where it can be burn for vigorous action. Energy is a basic concept in all the sciences and engineering disciplines. Energy is a conserved quantity that only can be converted or redistributed.

In Nigeria, the economy is over dependent on the petroleum sector that other form of energy are neglected. Electrical energy is not in constant supply except for the use of dynamos and generators. The exploration of Nigerian oil and gas, the distribution of the electrical energy, the harnessing of the dams for the generation of energy, all of which draw heavily from mathematics. Assessment of cost of exploration and

distribution of energy in any form is a mathematical approach. For example, the total energy consumed in any activity can be thought of as the product of two factors.

Total energy consumption = energy required for the activity (intensity) X frequency of activity. Mathematics pervades the use of energy in Nigeria and therefore accounts for its contribution to the development of Nigeria. Beyond 2020 the importance of mathematics to development of Nigeria energy sector cannot be overstressed.

Educational Implications and Recommendation

The need for mathematics in the development equation of the nation, and effort should be geared towards teaching mathematics appropriately in the schools. Qualified and professionally competent teachers should be employed to teach mathematics in the schools. Instructional materials should be made available for optimal results in the teaching approaches. Class size is always a hindrance to proper learning and teaching of mathematics such a situation calls for adequate attention because the teacher student ratio is vital to assessment and evaluation.

Conclusions

Mathematics is a part of life not only does history show the links to areas of study of mathematics, but also it shows that mathematicians are human not cold automatons. History also show mathematics solving people's everyday problems- Egyptians laying out farms, Lewis Carrol applying mathematical logic to children's literature etc. Mathematics has been used in religion and in war, in art and in industry, in calculating pay rolls and planets.

Right from time, mathematics had been for developmental purposes. In the present situation, mathematics is applied to various areas of developmental efforts. In aviation, engineering, economics, road building and others. A thorough look at the development of Nigeria, shows that it is apparent that mathematics has to be involved. Development is not static but dynamic, mathematics as well is dynamic, so the required change and effort to develop further beyond 2020 would also be found in mathematics to weather the storm.

References

Agbajor, H. T. (2013), The Impact of Mathematics Education and Economic Empowerment on National Development in Nigeria: Implications for Counseling Practice *Knowledge Review, a multidisciplinary Journal 28(2)* 150-156.

Dedron, P & Itard J. (1973) *Mathematics and Mathematicians vol. 1* London, Open University set Book. Transworld Publishers Ltd..

Gittleman, A (1975) *History of Mathematics* Columbia Charles E Merril Publishing co.

Gomwalk, U. D (1986), Education for Science and Technological Development. Realities and Challenges of the Nigerian educational system. A Publication of the Educational studies Association of Nigeria (1) 76-78.

Goulet, D (1971). *The Cruel Choice. A new concept in the theory of development* New York Artheum,.

Hamilton-Ekeke J. T (2011) Competence and Utilization of internet/internet facilities in studying among students' of the Faculty of Education Niger Delta University, African Journal of Education and Information Management 12(1 & 2)10-16.

.

Hinrichs, R. A & Kleinbach M. (2002) *Energy, its use and the Environment* 3rd ed. Australia Bookscole,.

Idowu, A. G (2000) Readymade Software for Nigerian Libraries. *Lagos Librarians*, 21(1) 18-20.

Kayode, M. O (2004), Towards a re-birth of Nigeria's Economic development. *The fifth Annual Public Lecture of the Nigerian Economic Society, delivered at Nicon Hilton Hotel(Abuja, 24th February 2004.*

Lall,, S (2001) *Competitiveness, Technology and Skills*, Cheltenham, U.k: McArthur press

Nayudama, Y. (1987) Endogenous Development: Science and Technology Vienna, Institute for Development *occasional paper 78/3.* 21-29.

Nsor, E. N (1999), Mathematics and the society. *Akamkpa Journal of Science and Mathematics Education (AJOSME) 2(1&2)*

Nwagbara, A. C (2013) *Understanding Guidelines of Mathematics Laboratory Practicals* Calabar. Jutoy Educational Services.

Nwagbara, A. C, Bassey, E. E and Enun, E. E (2013), Computer assisted Learning and Achievement in Mathematics for Socio-economic Transformation *Niger Delta Journal of Education. A publication of COEASU South-south 1(1).* 32-38

Nwagbara, A. C. (2007) Structural Factors and Industrial sector Development in Nigeria. *Unpublished M.Sc. Thesis University of Calabar. Calabar*

Nwana, O. C (1981), *Introduction to Educational Statistics,* Ibadan: Heinemann Educational Books.

Nwankwo, J. J. (1984) *Mastering Research in Education and Social Science.* Ibadan: Bisi Books Nigeria Ltd.

Odili, G. A. (1994) *Teaching Mathematics in the Secondary School*. Ugamuna, Obosi Anachnna Educational books, Anachuna house.

Orji, B. C (1990) Dynamics of the Nigerian Financial System. The Nigeria Finance Association (NIFA), Lagos, Oxford University Press.

Orubu, C. O (2004) Measuring the Quality of life: Evolution and the need to adjust. Disaggregated country indexes to reflect local conditions. Leading issues of macroeconomic management and development Nigerian economic society. 44-49

Owens, E (1987) *The future of freedom in the developing world. Economic development as a political reform.* New York: Addison coy.

Seers, D (1969) *The meaning of Development in eleventh world conference of the society for international development* New Delhi: Vigdth ltd.

Uwatt, B. U (2004), Governance and Nigeria's development prospects. Leading issues of macroeconomic management and development, Nigerian economic society.62-68.