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ARTICLES AND RESEARCH REPORTS ON SCIENCE

THE DETECTION OF CHANGE VOLUME OF TAGWAI DAM, MINNA, NIGER STATE, NIGERIA, USING GEOLOGY, REMOTE SENSING (RS) AND GIS TECHNIQUES

By

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Abstract

Scarcity of potable water in Minna metropolis with population density of about 1.93 million, during the dry season creates a demand for sustainable water conservation and management. This requires using appropriate and reliable information and data; hence the use of geological mapping and remote sensing techniques for relevant findings and decision making for current and future management of Tagwai dam. Assessment of the dynamics of Tagwai dam in Minna, Niger state, Nigeria was investigated using Geological mapping, Landsat-ETM 2000 and Quickbird image 2008. The images were processed, interpreted and classified using ILWIS 3.3 software. The results of the study showed a sharp decline in the surface area of the dam as indicated by 59 percent reduction between 2000 and 2008. In the light of the above and to prolong the lifespan of the dam that serve the population of about 1.9 million people, there is need to carryout dredging and evacuate weeds which have colonized the dam.

Keywords: Assessment, Geology, LANDSAT-ETM and Quickbird, dam

Introduction

The World Health Organization (WHO) and the United Nation Children's Fund (UNICEF) estimated that at the beginning of the year 2000, one-sixth (1.1 billion) of the world's population lacked access to a safe water supply (WHO/UNICEF 2000). Despite global effort made in the decade between 1980 –1990, majority of the world's population with access to safe water remains in the developed countries. The principal target of the Millennium Development Goals (MDGs) is to ensure halving the proportion of people without access to safe water by 2015 (WHO/UNICEF 2000).

For these reasons conserving and managing water is very important for supplying water for human needs. This gave rise to the construction of Tagwai dam in Minna, Niger State in November 1978. Construction of a dam depend on many factors among which include size of the population, the prevailing level and pattern of socio-economic activities. This involves the diversion of rivers to store water during raining season for use in the dry season.

Scarcity of potable water in Minna metropolis, with population density of about 1.93 million (National Population Commission 2006) during the dry season creates a demand for sustainable water conservation and management. This requires using appropriate and

reliable information and data; hence the use of remote sensing and geological mapping techniques for relevant finding and decision making for current and future management of Tagwai dam. This study aimed at assessing the state condition of Tagwai dam between year 2000 and 2008.

The Study Area

Tagwai dam is located in the south-eastern part of Minna, Niger State, and lies between Latitude $09^0 33^1$N and $09^0 37^1$N; Longitude $06^0 39^1$E and $06^0 42^1$E (Fig. 1a). The dam covers a total area of 5.5Km^2. Vegetation of the area is Guinea Savannah. Rainfall is moderate as expected within the Savannah region. The bulk of the rainfall is between May and September, the heaviest rainfall is experienced in the month of August. Mean annual precipitation ranges between 1300 and 1350mm and mean annual temperature of 32^0C (Iloeje 1978). The Tagwai dam is drained by two major rivers namely River Jidna, and River Lumo (Fig.1b), which are of low capacity at the pick of dry season.

The study area is marked by undulating topography formed by dissected hill characteristic of the basement complex. The north-eastern end of the dam is formed by an upland with elevation of 462metres above sea level. The crystalline rocks have been weathered to form a regolith which varies considerably in thickness toward low lying ground of the dam.

The gross capacity of Tagwai dam is 28.3 x 10^6m^3 (NSWB 1978), and the associated head works were design to provide potable water supply to Minna town. The dam is located within a comparatively rural area. However the widespread cultivation of cash crops such as yam, cassava, millet and rearing of animals has led to the destruction of the original vegetation especially around the study dam and can further contribute to sedimentation of the dam and consequent vegetation growth.

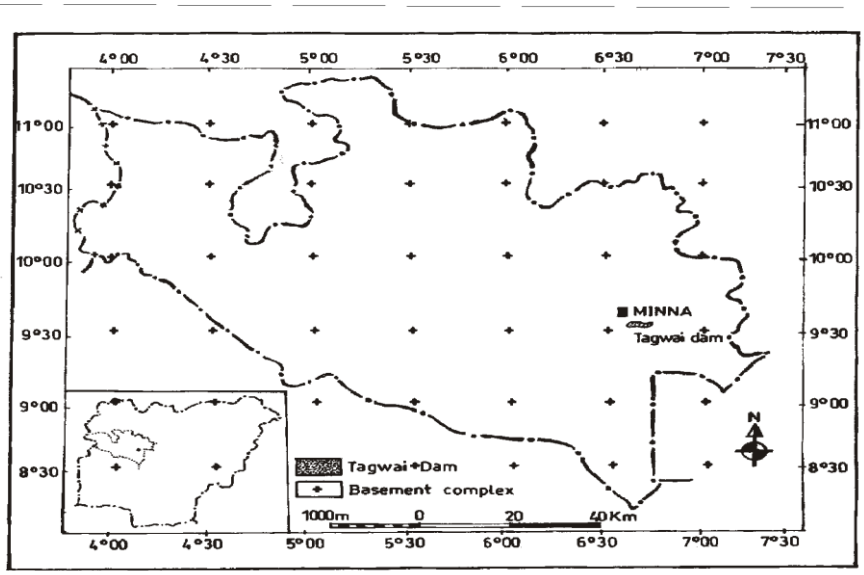


FIG. 1a **NIGER STATE MAP SHOWING TAGWAI DAM**

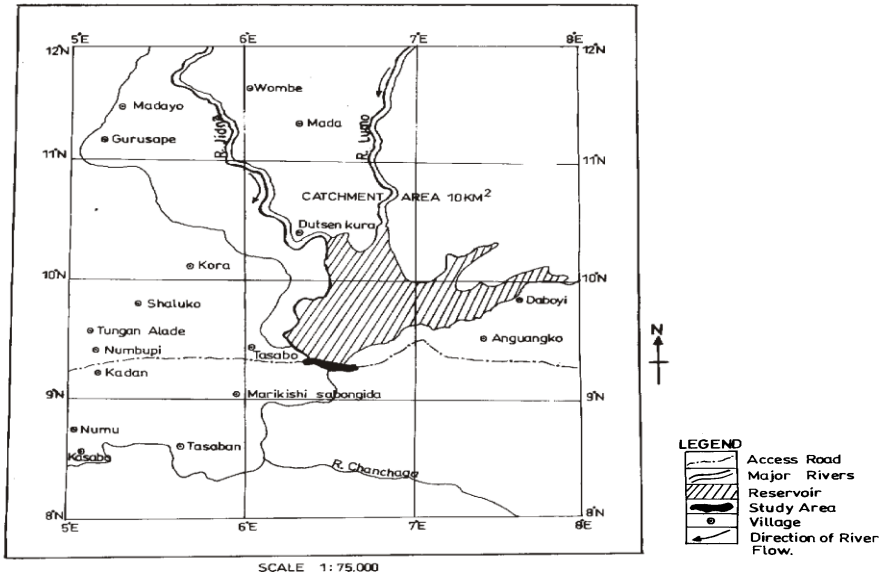


FIG. 1b **MAP OF TAGWAI SHOWING THE DAM SITE**

Methodology

Reconnaissance survey and geological mapping of the study area was carried out conventionally using topography map of Minna NE Sheet 164 on scale 1:50,000, GPS, hammer, compass clinometer and hand lens. The mapping exercise was carried out using footpath and canoe, between the months of November and April, at the period the study area is accessible. Area of 80km^2 covering the dam and it's environ was mapped. Each outcrop visited was investigated for their texture, colour, mineral composition in hand specimen and their structural relationship. Also, the slope nature of the outcrops was calculated.

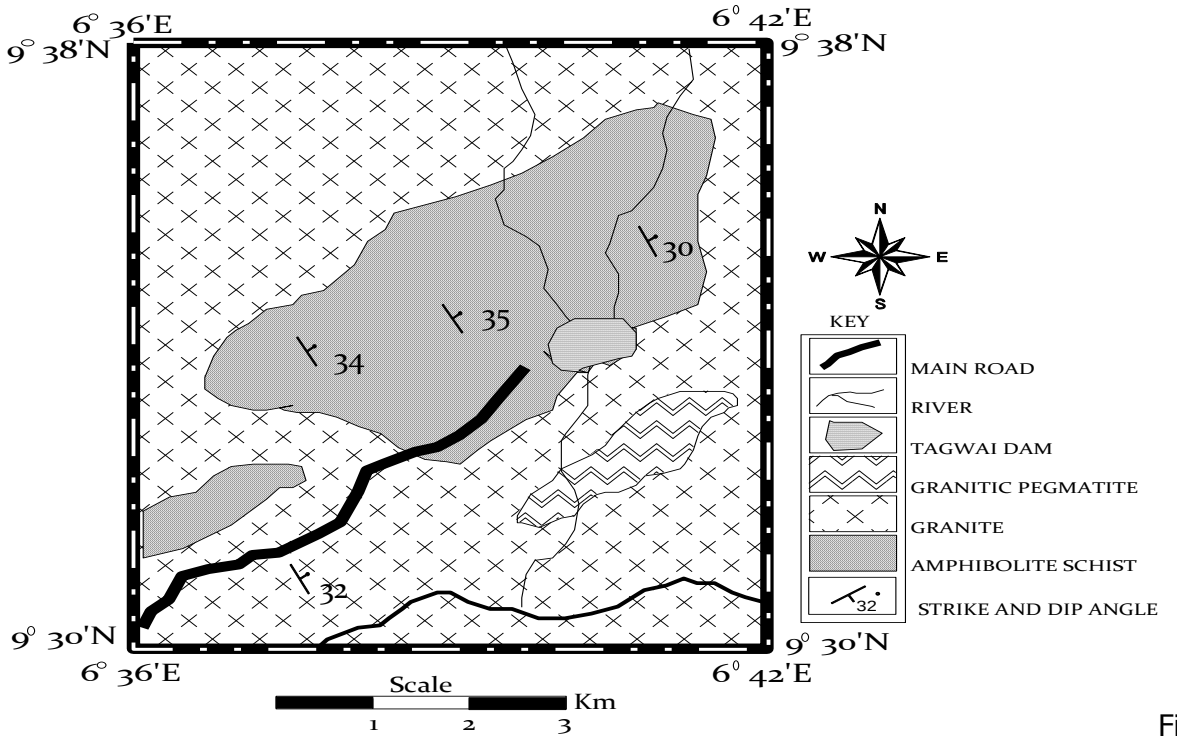


Fig 2. Geological Map of the Study Area

Remote sensing imageries covering the dam area were down loaded from Global Land Cover Facility (GCLF) website which is band sequential (BSQ) represented in seven bands in raster format, Enhanced Thematic Mapper (ETM) and Quickbird for 2000 and 2008 respectively. The images used for this study were already georeferenced and geocoded. Also, the images used for this study were taken during the dry season precisely December 2000 and 2008. The ILWIS 3.3 International Institute for Aerospace survey and Earth Sciences (Netherlands 1997), software was used for the processing of the image, while Arc 3.2 software was used for visualization and production of thematic maps for the study dam.

The processing of the images was done by importing the images from the file folder in the computer hard disk to ILWIS environment. In the ILWIS environment, each of the seven bands in the images were filtered using Linear AVG 3 by 3 filter before colour composite of the selected bands 4, 5 and 7 was carried out, Band 4, 5 and 7 were selected for the classification of land uses around the study dam due to reason that water body and vegetation features are best displayed in infrared, near infrared and middle infrared band ranges. Thereafter, the colour composite of the selected bands was created using the filtered bands. This was subsequently followed by the creation of the submap of the study dam area. The submap created was displayed in false colour composite (FCC) and images classification and analysis was done using unsupervised classification method.

In this study, after the spectral classes (that is dam, farmland/vegetation) were defined, the pixels are assigned to the classes based on criteria such as colour, farm,

pattern and association. The farmland/vegetation are added because these are related to the dam. After the classification was completed, the surface area of the study dam, rock types and land uses were determined using ILWIS 3.3 software.

The systematic method of investigation is summarized in the flow chart (Fig 3).

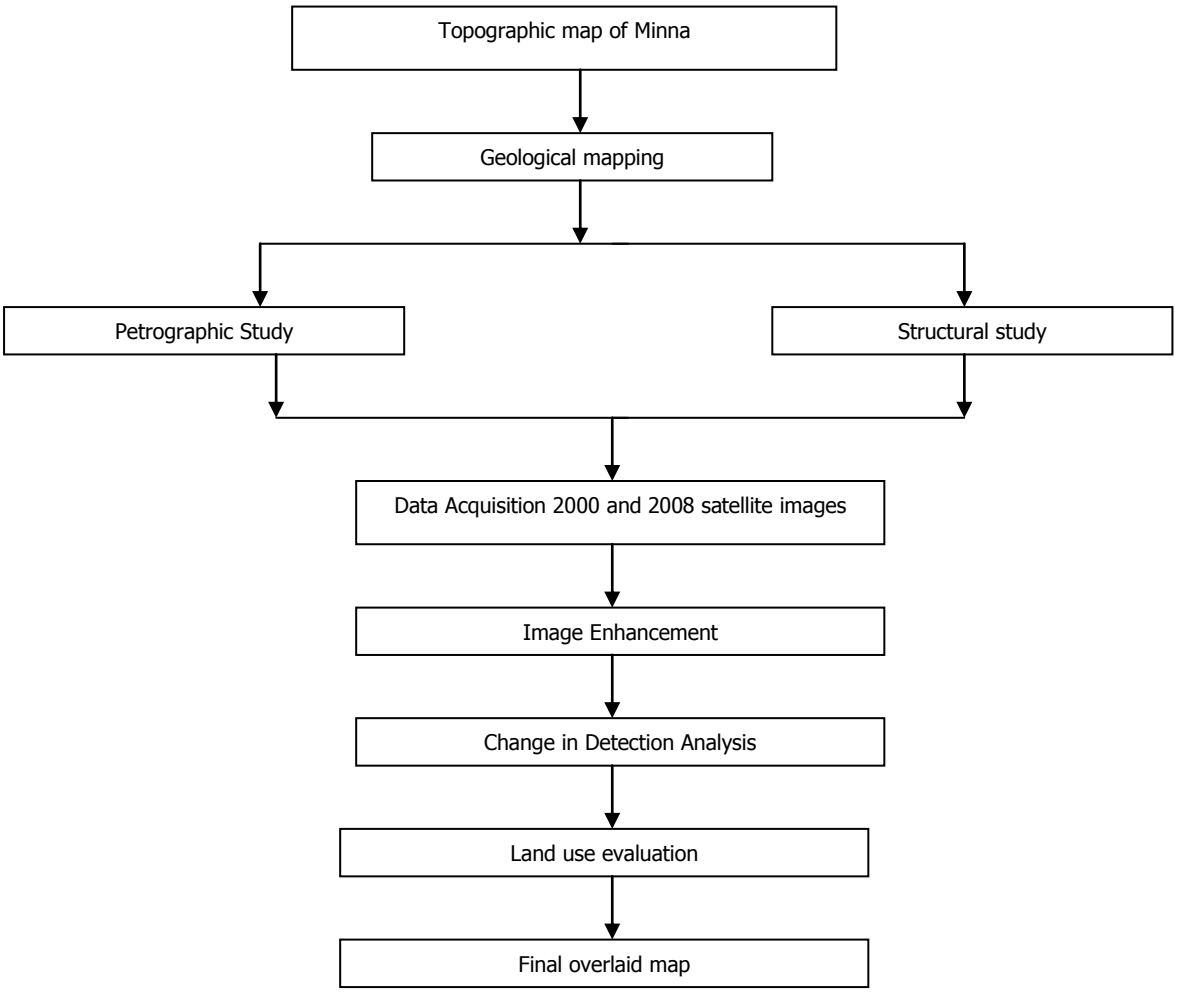


Fig. 3: Flow chart showing major steps in the study method

Result and Discussion

The result of the geological mapping shows that three rock types occur in the study area, these include amphibolite schists, granite and granitic pegmatite. The amphibolite schist occurred as flat laying outcrop at the central and western part of the study area and constituted 45% of the rock type in the area, granite occurred as batholiths, and granitic pegmatite as dyke cross cutting the granite at the eastern part of the area and constituted 55% of the rock types in the area. Petrographic study indicates that the granite is porphyritic, light in colour and predominantly dominated by quartz. The amphibolite schist is fine grained and poorly foliated. The rocks lack megascopic and mesoscopic structures and most of the joints were healed joints with no fracture. These structures were restricted

mainly to the granite. As observed during the field work the granite is more susceptible to mechanical weathering due to the phophyritic nature and can easily move down slope.

The result of the overlaid map of the study dam (Fig.6) shows the change in the surface area of the study dam between 2000 and 2008. The change in the size of the study dam is mostly visible by examining the corresponding changes in the surface area of the dam between 2000 and 2008 (Fig.4 and 5).

As observed during the field work the edges of the dam surface have been colonized by weeds and desiccation cracks. In addition, animal tracks, footpaths used by the herdsmen and farmland were noticed around the dam. These will further encourage high rate of run off loaded with sediment into the dam.

Furthermore, as evident from the field and overlaid images (Fig 6), there is sharp reduction in the surface area of the study dam from $320m^2$ in 2000 to $132m^2$ in 2008. In addition, as evident from the images, the decline in the surface area of the dam may possibly be due to increased exposure of the land surface around the dam resulting from the sharp increase in farming activities with decline in the area extent covered by vegetation in the area. This situation further exposes the area around the dam to direct rain drop impact and thus enhanced accelerated erosion into the dam. This confirms the findings of Mironga (2004) that rapid and continuous farming activities around reservoirs may result in silting of such reservoir.

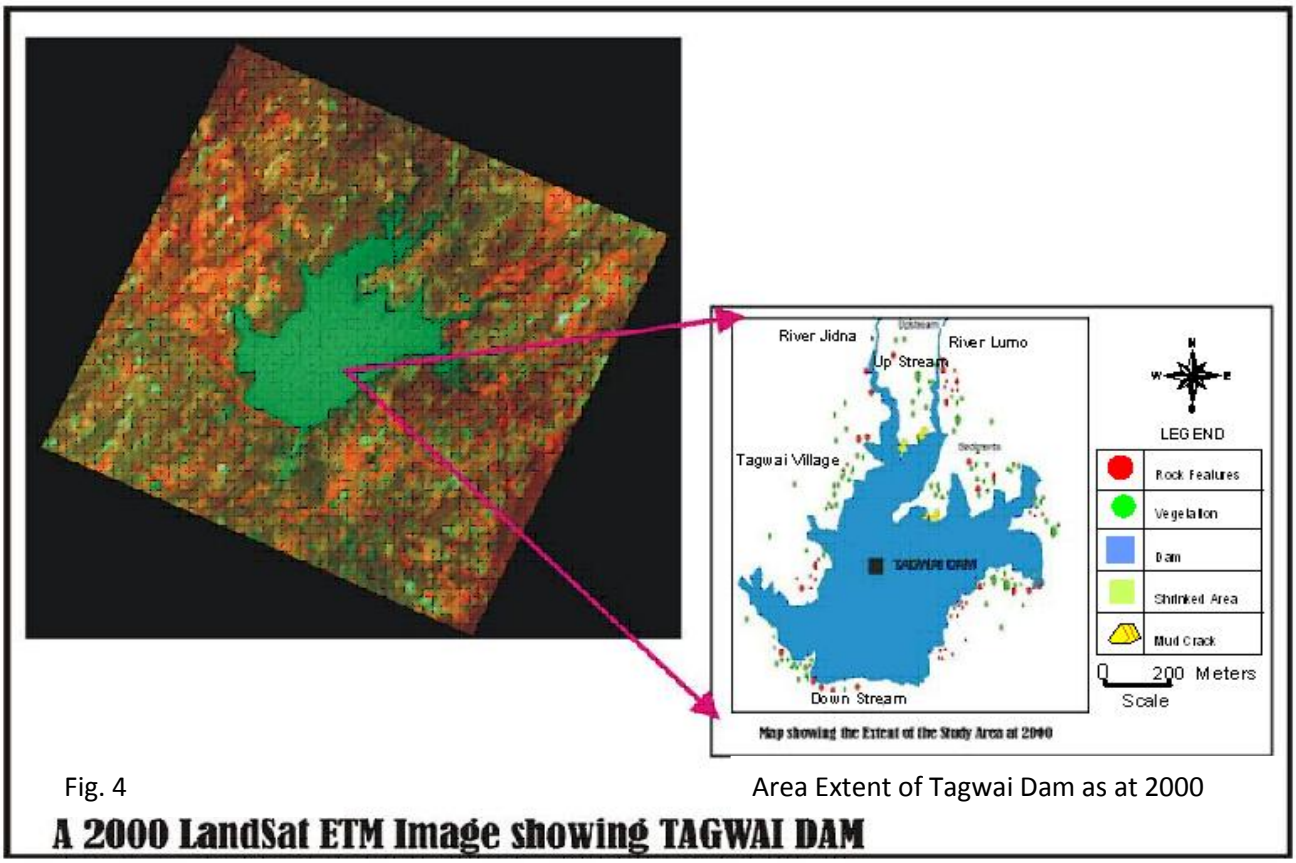
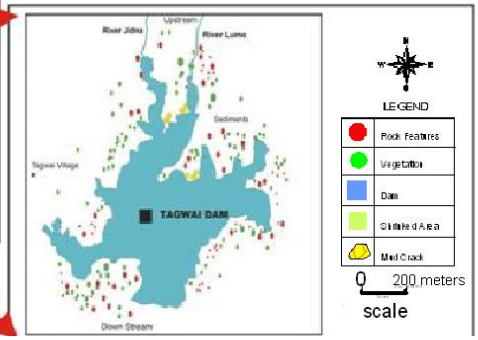


Fig. 4 Area Extent of Tagwai Dam as at 2000

A 2008 QuickBird satellite Image showing Tagwai Dam.



Area Extent of Tagwai Dam at 2008

Fig. 5

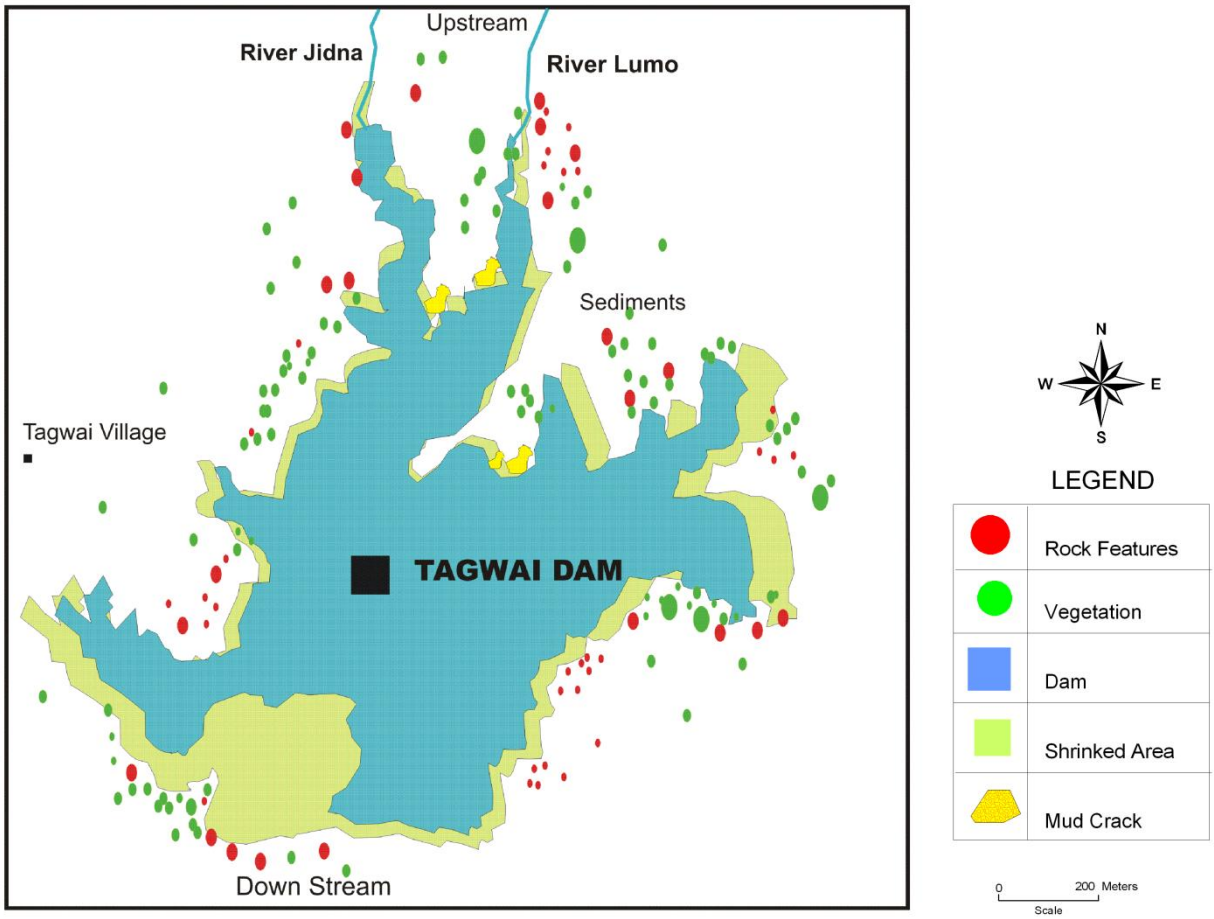


Fig. 6 **2000 and 2008 Overlaid Map of the Study Area Showing the Shrunk Areas and the present Dam Extent .**

Conclusion

The assessment of the dynamic of Tagwai dam in Minna, Niger State, Nigeria, was investigated using geology mapping, Landsat-ETM 2000 and Quikbird 2008 satellite images. It shows that the surface area of Tagwai dam reduced from 320m^2 in 2000 to 132m^2 in 2008, as a result of silts coming from the weathered granite ridge at the north eastern part of the dam, and also grazing around the dam.

To prolong the lifespan of the dam, there is need to carry out the dredging of the dam every ten years and remove weeds which have colonized the edge and thus reduced the surface area. Farming activities and herdsmen tract should be discouraged around the dam site, also the northeastern section of the dam should be embanked. This will maintain the volume of the dam.

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MENTORING AS A TOOL FOR RE-SKILLING THE 21ST CENTURY LIBRARIAN

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Abstract
The purpose of this article is to provide an overview of mentoring including its imperatives as means of re-skilling professional librarians in Nigeria. This is a literature-based opinion paper advocating for the use of mentoring as a leverage for re-skilling the 21st century librarians. Mentoring for re-skilling librarians is about using people, in other words, colleagues to re-tool, and improve the competences of co-workers. It identified new courses of professional actions, through the use of new technologies which will invariably further the career goal of individuals and strengthen the organization. Mentoring utilizes full advantage of existing expertise to develop new potentials. It is generally believed to be cheap and effective method of enhancing the professional circumstances of staff. The subject of mentoring for re-skilling librarians is critically and exhaustively treated with a view to developing a formal mentoring blue print.

Introduction

In a country like Nigeria where the debut of librarianship as a profession in very recent and where the number of internationally acclaimed librarians is abysmally infinitesimal, the need to mentor junior and the newly employed librarians becomes indisputable and irresistible. This is because mentoring functions highly as a great tool for enhancing career satisfaction, professional advancement and capacity building. Again, in the present era of knowledge economy, knowledge management and globalization, libraries stand out to be the most critical and essential spring boards. So, following their exalted position as the citadel of research, teaching, learning and recreation, staggering volumes of information that are generated and processed on daily basis appear very enormous. As these are churned out, other tremendous developments are taking place in libraries thereby demanding new skills and knowledge from the newly employed librarians and from the old whose trainings have not covered the current changes (Shea, 1994).

In other words, beginning a professional career can be a stressful experience. Career success involves much more than having Master in Library and Information Science (MLS) degree. Career is a constant journey; take advantage of it as much as one can to ensure he is successful, happy and productive. Mentoring has traditionally been defined as a relationship in which a more experienced person guides the career of a junior member as he or she "navigates" the world of work. It has also been called academic socialization and a collegial process that helps shape the academic community. However, a mentor is most

commonly defined as someone who guides you through a particular point in your life and or/career. A mentor is someone who gives support and encouragement as well as constructive criticism.

The bright side of Mentoring

To become successful and advance professionally, "one must develop a network of people who, open doors" (Moody 2004). You also need someone who can be an import resource in your satisfaction, greater career advancement and less work conflict. But it isn't only the protégé who benefits. The organization also benefits from mentoring relationship because mentors help create an atmosphere that is conducive to positive socializing. They also promote leadership skills.

The dark side of mentoring

Although the advantages of monitoring are numerous, mentoring is not without disadvantages. In fact, "mentoring relationships can be characterized as dysfunctional or destructive" (Johnson 2007). One hopes that if a mentoring relationship does not produce the desired results, either the mentor or the protégé will discontinue the association before it becomes harmful.

Exploitation: When the mentor uses his or her position to get something from the mentee. Exploitation is also experienced when a mentor uses the mentee to do his or her research for a publication and does not credit it to the mentee.

Frustration: The protégé feels frustrated when the mentor is not accessible or has not been active mentor.

What does a mentor do?

The role of a mentor can be multifaceted. Some act as coaches, others confidants, while the rest act more like guidance counselors. A worthy mentor can do the following things. Provide support by being an attentive listener, offering encouragement about your potential for being willing to collaborate on projects, and increasing a safe environment that encourages less risk taking and provides the opportunity to develop professionally and personally.

Initiate sponsorship and share power by encouraging participation in professional committees, to co-author papers or presentations and endorsing your research. Demystify the system by explaining how the library or organization works, who is who on the call within the community, what skills and competencies, are needed to advance and excel.

Nurture your dream and support aspirations by affirming your strengths and potential. Foster networks by introducing one to other people in the field and encouraging one to seek their advice.

What makes a good mentor?

Interestingly, not everyone can be a good mentor. If one is going to invest his time in establishing a productive mentoring relationship, it is important to have a mentor who is to the best of your belief a successful person. Mentors need to:

a. Exhibit empathy
b. Possess personal integrity
c. Show respect
d. Be committed to collegiality
e. Embrace honour.
f. Have a fundamental orientation to helping others
g. Possess a positive emotional disposition.

Tips for Mentee's Success

Simply having a mentor does not make someone successful. As a mentee, you must show a reasonable sense of responsibility that will help a relationship to be productive and successful. One must ensure that he/she is comfortable with the mentor in such a manner that the two of you can talk freely with each other.

Other factors that usually contribute to mentee's success include honesty and straightforwardness. Make sure your mentor knows what you need. In other words, one should not assume his mentor will intuitively know what the mentee needs. Lastly, conduct a self-analysis to know what your strengths and weaknesses are.

Types of Mentoring

(1) Formal
(2) Informal
(3) Semi-formal, semi-structured or facilitated
(4) Group mentoring
(5) E-mentoring

Formal mentoring takes place when the relationship is facilitated by the organization. Mentees are systematically matched with mentors based on parameters set by administrators who have little personal knowledge of the mentors and mentees.

Informal mentoring takes place when the relationship is created spontaneously and maintained informally by the pair. It is less structured and focuses on building a relationship between the mentor with whom they have a personal connection or social network. This scenario is preferable for the mentees as they choose a mentor with whom they have personal connection and with whom they feel comfortable having candid conversation about professional issues (Ragines & Switter, 2007).

Semi-formal, semi-structured, or facilitated mentoring: In this case, all recognize that mentoring is occurring within the workplace, but in designing a mentoring program, the organization allows for flexibility, while providing structured tools and support to show the organization's commitment.

Group mentoring takes place when more than a pair of individuals come together, with one or more in the group providing support or direction to others.

Co-mentoring takes place when members recognize the shared benefits for all in the relationship.

E-mentoring takes place when the relationship occurs primarily or exclusively on-line. It is pertinent to say that the best place for a mentee to begin to look for mentors is within their immediate or current extended professional network, and also by attending paper presentations with topics or speakers of personal interest. Long-tenured librarians or former supervisors are excellent mentors. Moore (2007) is of the opinion that the most effective mentoring model for professional success involves seeking out a variety of mentors. He said that it is unlikely that one person can act as a sole source of support, so mentees should seek out several individuals who might each play a part in their professional development and skill building. It is also his opinion that the mentee should not be on the receiving end of the relationship as through mentoring, mentors can grow and develop. Again, to create and maintain balance in the relationship, it is vital that both parties impart knowledge based on their skill set, recently acquired or otherwise.

Need for re-skilling Librarians in Nigeria and how mentoring can be applied

In the present millennium, coping with technology and change are the principal driving forces of the emerging information age librarians. The emphasis in special libraries and indeed all kinds of library is shifting from collection to access and the explosion in the quality, quantity, cost and communicability calls for new responses. Among these responses must be a willingness to embrace information and communication technology and accept change.

Today, very few organization can isolate the positive effect and return from investment in information technologies. Anyakoh (2004) stated that the ICT revolution is sweeping through the world. The strong wind of change has even caught up with developing countries like Nigeria. Every individual, every facet of the society and every profession is striving not to be left out. The librarian and other information professionals have also felt the bandwagon effect and are being enriched by enormous dividends of the revolution.

No doubt, traditional roles of librarians are changing. Information world was dominated by librarians whose major concern was management or (essentially stable) book collections. As the boundary lines are blurring, in the very near future the job of computer scientists and systems analysts will be growing faster than that of librarians (Cochrane,1990). This is not necessarily predicting that librarians are passing out. It is rather pointing to the fact that they should as a matter of urgency and necessity be in line with and responsive to the current realities of information transformation in today's technology age. The in-thing in information world is the provision and expansion of the scope of information available to users irrespective of their location. This has the advantage of ensuring effectiveness and efficiency in the service delivery (Okiyi, 1998).

Nwegbu (2004) said that the library's clientele continue to increase year after year while the complexity of their information needs continues to increase and the urgency with which the information required is to be supplied might be crucial to the success of activities for which the information is needed. For this reason, librarians have to turn to mentoring in ICT, seeking its aid in the solution to the complex information problems which they have to face daily. When people think of investing in a library, they usually think of investing in its collection, equipment, and physical facility. These expenditures are fundamental, but staff are at least as important as an investment for the library. The best collection and latest technology are useless without outstanding service-oriented staff (Turen & Raskin, 2004).

An organization can invest in staff by taking time to hire well, by training, by providing development and growth opportunities and by mentoring staff. Libraries should be prepared for the changes that are inevitable in the current environment. This can be accomplished through effective mentoring.

Brown (2008) emphatically noted that survival in today's world of work is a function of what one can offer, ones potential and ability to be in-charge of his/her career. Thus, Dahl, Banejee and Spalti (2006) warned that library centers that persist in the traditional services model in this era of ICT driven environment, flat budge and rising cost of resources may not succeed and are advised to embrace the realities of the time.

Since Nigerian library professionals are part of the global community affected by the above factors, there is need for re-skilling. Our observation as members of library profession in Nigeria reveals that mentoring as a strategy for re-skilling is imminent for the professionals due to:-

(1) Change in users' needs

There are disparities among people in the areas of economics, culture, geographical dispersion, politics and other physical challenges" (Minishi-majanja, 2008). Their information

need must be attended to. Again the way and manner users seek information have changed. To them, space and time should not be barriers while the era of print resources is gradually becoming obsolete.

(2) Competition

The costly assumption that librarians know best and that users would supinely continue to accept the service they had always been given is no longer valid. This is because new and diverse professionals are taking over library job and teaching users how to search for information. Thus, librarians have to brace up with the challenges posed by them as well as commercial search engines which users consider as the first port of call when searching for information (Bannerman, Nwogu & Anunobi, 2007).

(3) Providing opportunities for training and continuing Education

(a) The Nigerian Library Association (NLA) organizes at least one annual conference and two workshops every year. At such programmes, experts, nationally and internationally and knowledgeable resource persons are invited to discuss and demonstrate contemporary issues in the profession. Institutions and Library and Information Science (LIS) centers should expose their staff to training and continuing education nationally and internationally. For instance the Kenneth Dike Library, University of Ibadan has exposed 7 and 18 staff to national and international training respectively in areas of needs. Majority of the librarians working in multinational organizations in Nigeria always have the opportunity for international training. They later in most cases act as resource persons for some national training.

Libraries should have training units which will identify training needs of staff and negotiate for their actualization. Monthly meetings should be held in information centers to discuss re- skilling needs and how to achieve them.

It should be a policy in libraries that trainees on return from training will expose other staff to the acquired skills.

Employees are helped to develop their expertise in areas of interest through re-deployment to their units of interest and by providing them with opportunities for re-skilling in such areas.

(b) Opportunities should be provided for young librarians to be aware and develop their skills through the institution of Young Librarians Award by Nigerian Library Association (NLA). Through the award, professionals who are 5 years and below in the profession are sponsored to National conferences.

(c) Training should be provided by donor agencies, software and hardware vendors. Training on such areas as WINISIS software provided by United Nations Educational

Scientific and Cultural Organisation (UNESCO), use of E-Granary; Information Training and Outreach center for Africa (ITOCA), training on the use of Health Internetwork Access to Research Initiative (HINARI),Access to Global Online Research (AGORA),Online Access Research in the Environment (OARE) etc, professionals are explicitly or implicitly exposed to diverse and new skills.

(4) Listserve

Online discussion forum is available for all library professionals in Nigeria. Through the forum, information such as sites where grants could be provided, types, nature and location are made available to members. Diverse views on re-skilling issues are discussed. Literature is also posted to forum members. All library professionals are encouraged to join the forum. Interest groups have their own forum where the less skilled are helped through mentoring. Through the use of electronic mails, individuals are engaged in mentoring by more exposed professional colleagues. By so doing the issue of distance as a barrier to mentoring is removed.

Conclusion

As libraries increasingly encounter new and diverse challenges, it behoves the librarians to acquire the requisite training and skills that will enable them to remain relevant to their user community. Mentoring is one of the veritable skills. The underlying philosophy of any mentoring initiative is when the mentee learns the rudiments of conducting research and publishing. These range from conception of researchable topic, literature search, research methodology to adopt and appropriate medium for publishing the research efforts.

As such, young or newly employed librarians in particular and indeed every information professional should be adaptive, receptive to new ideas, committed, humble and have respect for the mentor for the mentoring relationship to be beneficial to mentee, mentor and the library.

Recommendations

Based on the impact of mentoring as discussed in this work, the writers make the following recommendations.

(i) Library authorities in Nigeria should develop formal mentoring programmes which will meet the needs of both the Organization and staff and such needs include ensuring the continuing existence of the library as well as career satisfaction of staff.

(ii) In a bid to reflect more diversity in the subject background of librarians, individuals who have qualifications in other fields other than librarianship are usually employed and so, to get them grounded on their jobs, mentoring as a tool for re-skilling should be encouraged.

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MAPPING LAND AREAS THAT FAVORS FADAMA FARMING IN BOSSO AND ENVIRONMENT NIGER STATE

By

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Abstract
Fadama lands are regarded as very rich agricultural areas. They encompass land and water resources that could easily be developed for irrigation agriculture. Because of the importance and scarcity of Fadama land as well as the need for sustainable development, mapping of areas favourable for Fadama farming is likely to be reliable step towards effective Fadama farming and rural development in Bosso Local Government Area. The study uses Remote Sensing and GIS techniques to map out areas that are suitable for Fadama farming. SPOT 5 image of the study area, which has 5m resolution, was used. Hand held GARMIN III GPS was used to pick points which were used to generate Digital Elevation Model of the study area, Arc GIS 9.2 was used to create the DEM of the study area. Ilwis 3.2 software was used to classify the spot 5 image. The result obtained shows that areas lying below 300m above sea level along the banks of Bosso dam and in areas such as Popoi, Nini, Dyafa e.tc. are considered favourable for Fadama farming. The areas favourable for Fadama farming in the study area covers 3690.00 hectares which is an extensive area within the area under study which covered an approximately 10503 Hectares of land. It is therefore, recommended that it is important to create the soil databases and land information system, including soil types, soil fertility, terrain, current land use status, climate, slope, vegetation cover, soil erosion and land unit map.

Keywords: Mapping, Favorable, Fadama Farming

Introduction

Fadama, the Hausa name for irrigable land, is floodplains and low-lying areas underlain by shallow aquifers and found along Nigeria's river systems (Ingawa et al, 2004). Fadama lands are regarded as very rich agricultural areas. They encompass land and water resources that could easily be developed for irrigation agriculture (World Bank, 1992). Fadama land covers about 4.9 million hectares in Nigeria. When Fadama spread out over a large area, they are often called 'Wetlands' (Blench & Ingawa, 2004).

Sub – Saharan Africa farming is said to be risky since it is based on rain – fed systems and as such developing countries are faced with the challenge of producing adequate food to satisfy her growing population. This has contributed immensely to a widening gap between food supply and demand. However, efforts in the present problematic rain fed agricultural production need to be complemented through dry season

farming. This is absolutely necessary because the productive realm of the small scale producer needs expansion

As a result of the peculiar hydrological characteristics, Fadama soils have the potential to be used for agricultural production in a sustainable way. Such potential is particularly relevant in view of the degradation of the uplands of Nigeria [World Bank, 1992]. The major crops grown in Fadama are vegetables, wheat and rice with initial bias for vegetables (Olugbemi, 1989).

Nigeria's population is now quoted at about 140 million people. The irrigated landscape remains very dynamic which brings about considerable uncertainty about the exact extent, area and cropping intensity of irrigation in different parts of the world, due to the dynamics and systematic problems of under reporting and over reporting of irrigation in different contexts and countries (FAO, 2000).

According to FAO (2000), Nigeria is among those nations that are at the moment technically unable to meet their food needs from rain fed production at a low level of inputs and appear likely to remain so even at intermediate levels of inputs at some point in time between 2000 and 2025.

The low-lying areas which are usually flooded during the wet season, popularly known as Fadama areas, are scattered across the ecological zones of Guinea Savanna, Sudan Savanna, and the Sahel and the area vary from 1.5 to 3 million ha out of the 33 million ha of land put into cultivation (FAO, 1997). These diverse wetlands are valuable for grazing, agriculture, and other domestic uses. The Fadama/wetlands have been used for dry season farming in Nigeria and it has contributed greatly to food crop production in the country. This is more pronounced in the semi arid and arid regions of Nigeria. Over the years many farmers in the study area cultivate small areas in Fadamas during the dry season, using water directly obtained from streams and rivers manually or using electrical power generators to pump water into their lands.

The soils of Fadama are subjected to seasonal flooding and are naturally rich in nutrients deposited in the plains at the recession of the flood. Large volumes of sediments are seasonally discharged into the flood plains and help to renew the fertility of the soils. The abundance of water and the seasonal supply of fresh alluvium make these soils fertile and suitable for rice and other crops such as maize and sugarcane.

Geographic Information System (GIS) and remote sensing serve as tool to access potential land for irrigation/Fadama farming. GIS can integrate many different data sets and information systems to create a broad overview of how potential Fadama area can be located. This approach to Fadama farming planning enables communities and concerned

agencies to potent and increase their productivity. Thus, implementing a GIS analysis will be part of a larger, long term effort to gain a better understanding of floodplains favourable to Fadama farming (Ishaya & Mashi, 2008)

One of the potential approaches of doing this involves the use of Digital Terrain Modeling (DTM) to map out areas that are favorable for Fadama farming. DTM provides a so-called bare earth model, devoid of landscape features .A DTM is a quantitative representation of the topography of the Earth (or sometimes other surfaces) in a digital format. They are a common component of Geographic Information Systems (GIS) and are usually represented by Cartesian coordinates and numerical descriptions of altitude. In contrast with topographical maps, the information is stored in a vector format. The DTM is a valuable component in analyses involving various terrain characteristics such as profile, cross section, line of sight, aspect and slope. DTM also encourages internet mapping, flood mapping, agricultural planning etc. (Natale et al., 2007).

Statement of the Problem

Fadama rural communities are exposed to a wide range of social ailments including: insecurity or uncertainty of land tenure for landless farmers, lack of basic infrastructure and services such as qualitative education, agricultural services and market outlets, adequate health care facilities, potable water and other social services, and gender-based discrimination and social conflicts.

Inappropriate land uses and land management practices contribute to land quality problems such as increased rates of wind and water erosion and accelerated rates of soil acidification, nutrient decline, and carbon losses (FAO, 2000). Arable Fadama land mapping and management practices will be the major approaches for improving the management of land resources for Fadama farming. In this era, a key developmental agenda for many developing countries is the development of their agricultural base through irrigation.

In order to propose any short and long term measures to enhance Fadama farming in the Bosso Local Government Area, it is essential to have reliable data on areas favorable to Fadama farming.

Aim and Objectives

This study is aimed at mapping land area suitable for Fadama farming in Bosso local government area of Niger state with a view of creating data base that would enhance decision making for improved agricultural production. This would be achieved through these sets of objectives;

1. To create Landuse /Landcover map of the study area
2. To generate Digital Elevation Model (DEM) of the study area

3. To identify and map out areas suitable for Fadama farming

Justification of the Study

This study is capable of reducing scarcity of Fadama land in Bosso local government as well as the needs for their sustainable development and management. Mapping of potential areas is likely to be the reliable step towards effective and efficient way in securing the food needs of the populace and as well as developing the rural areas in Nigeria.

There is a gradual shift from paper work to geospatial database building. This is easier to manage and update as well as the fact that it makes the dissemination of information faster. The need to produce a map of areas favourable for Fadama farming is to help government and farmers identify Fadama land for proper allocation and management by the communities.

Study Area

Bosso local government in Niger state is one of the twelve local governments where Fadama farming is currently practiced. Niger state has a favourable climate with distinct dry and wet seasons, vast fertile arable land and the large water bodies (Rivers Niger and Kaduna) with their numerous tributaries as well as Lakes /dams (Shiroro, Kainji and Jebba) which give the state exceptional potential for rain-fed crop farming, Dry season (Fadama) crop farming, Livestock production and fishing. These potentials make the state known as the food basket of the nation. The major food and cash crops produced in Bosso are rice, maize, sorghum, millet, cowpea, sweet potatoes, yams, cassava, sugarcane, melon, soya beans and dry season crops such as vegetables, okra, tomatoes, pepper, garden egg and onion. The major livestock produced in the area are cattle, sheep, goat and poultry including chickens, turkey, guinea fowl, duck and pigeon.

The study area (Bosso local government) is located in Niger State. It lies in the middle belt of Nigeria, situated in the wet tropical or Guinea climate in the Guinea savanna zone. It extends on latitude 9^0 31 79N and longitude 6^0 16 65 E.

The climate of the area is a resemblance of any tropical region of the world. The major wind direction is normally along the southwest and northeast axis.

Brief Literature Review

Remote Sensing technology produces an authentic source of information for surveying, identifying, classifying, mapping, monitoring, and planning of natural resources and disasters mitigation, preparedness and management as a whole (Ibrahim et al., 2007 and Graham, 2007). Multiband, multidate and multistage satellite imaging has been extensively used in Asian countries and the developed countries of the world for water

resources studies, monitoring and management of agricultural lands (Pramanik et al., 1992; Panagopoulos, 2001).

One of the potential approaches of doing this involves the use of Remotely Sensed and Digital Terrain Model (DTM) to map out areas that are favourable for Fadama farming. A DTM is a quantitative representation of the topography of the Earth (or sometimes other surfaces) in a digital format (Andreas and Manos, 2002; Ibrahim et al., 2007). The DTM is also a valuable component in analyses involving various terrain characteristics such as profile, cross-section, line of sight, aspect and slope. DTM also encourages, flood mapping, Urban planning, agricultural planning etc (Natale et al., 2007).

Methodology

The materials, used in this study include the following: The topographic map sheet of Minna south west was obtained and the study area was extracted from the same sheet.

SPOT 5 image of the study area, date of acquisition is 05-04- 2009, with 5m resolution, was used. The bands used for this study include Band 1 Red, Band 2 Green and Band 3 Infrared. The software used include ArcGIS; This was employed in the vectorizing of the development map favourable for Fadama farming, and DEM generation and ILWIS this was used in the classification of the image.

Pre-Processing Method

The coordinates used on the digitized and interpolated contour maps were obtained from the scanned topographic maps and checked through ground truthing exercise using a hand held GARMIN 6 GPS of popular points in the study.

Producing DEM

In creating DEM for the study, analytical procedures of ARCGIS 9.2 were employed. The topographic map was digitized on screen. This process of screen digitizing involves creating and/or editing a segment or point map while an existing raster map is displayed as a background in a map window**.** The digitized contours from value domain were interpolated to obtain rasterized surface of the topography. Subsequently, the DTM of the entire area was produced by interpolating the four glue digitized contour maps that were produced through digitizing in the value domain. Areas of different elevations that were identifiable on the created DTM were digitized to produce a new segment map showing areas of different elevation characteristics

The spot 5 imagery of the study area produced was overlaid on the DTM in order to identify areas favourable for Fadama farming. Areas identified on the overlaid spot 5 HRV imagery on the DTM (digital terrain model) were overlaid to generate map of the areas favourable for Fadama farming

Discussion of Results

The DTM, Classified and Unclassified Spot HRV image shows areas favourable for Fadama farming. Alluvial soils are highly concentrated at the valley of Bosso Dam and other rivers like river Suka in the study area. These soils cover reasonable part of the study area. The water holding capacity is very high and the water table around the places where this type of soils is prominent, is usually very high with well decomposed organic matter content in the surface layer and its texture become heavier with depth, as the weathered parent material, the alluvial soil support to a great extent Fadama farming.

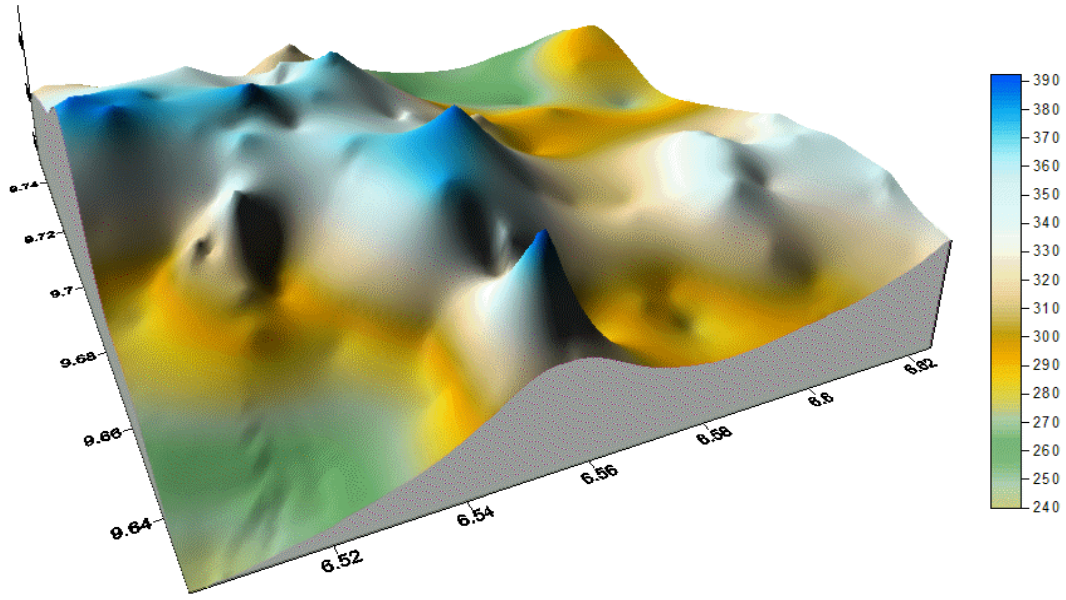

Fig. 1: Digital Elevation Model of the study area (Source Authors Analysis)

Figure 1 shows the Digital Terrain Model of the study area which was generated from points picked at different parts of the study area during the data collection phase (Ground Thruthing) using a handheld GPS device. The generated DTM shows the elevation of the various parts and also showed significant evidence of areas that are on the flood plains of river suka etc within the study area. It is evident also that area less than 300 meters above sea level is good area for Fadama farming.

The Hill Shading (fig. 1) was also generated using Arc Map 9.2 software, this was done to further enhance the finding of the generated Digital Elevation Model (DTM) of the study area and also to aid the easy identification of areas which are suitable for Fadama farming through their ability to retain water from either underground source or accumulation of run – off from high lands or upper portion of the study area.

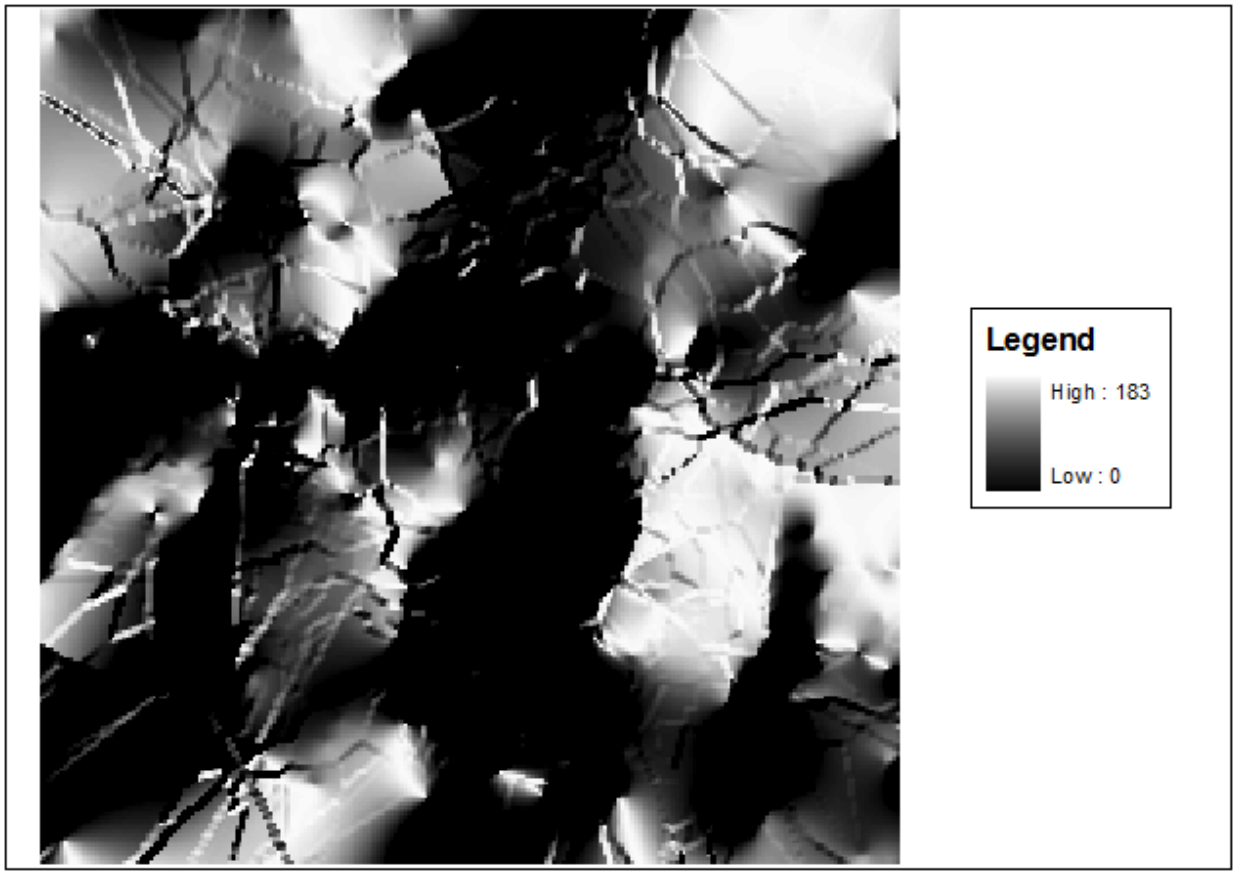

Fig 2. Hill shading of the study area (Source Authors Analysis)

According to (Meridian Energy, 2007) water level changes with discharge point of the shallow aquifers are expected to be less than what is further away from opposite points as water level discharge will be decapitated through changes in discharge rates from the river or spring. Wetted land is expected in the lowest lying areas in the surrounding close to the river or spring. Areas that have such characteristic on the DTM, classified and unclassified Spot 5 HRV Image falls between elevations less than 300m above sea level and are mapped FV (favourable for Fadama farming).

The areas favourable for Fadama farming in the study area is cover 3690.00 Hectares which is an extensive area within the area under study.

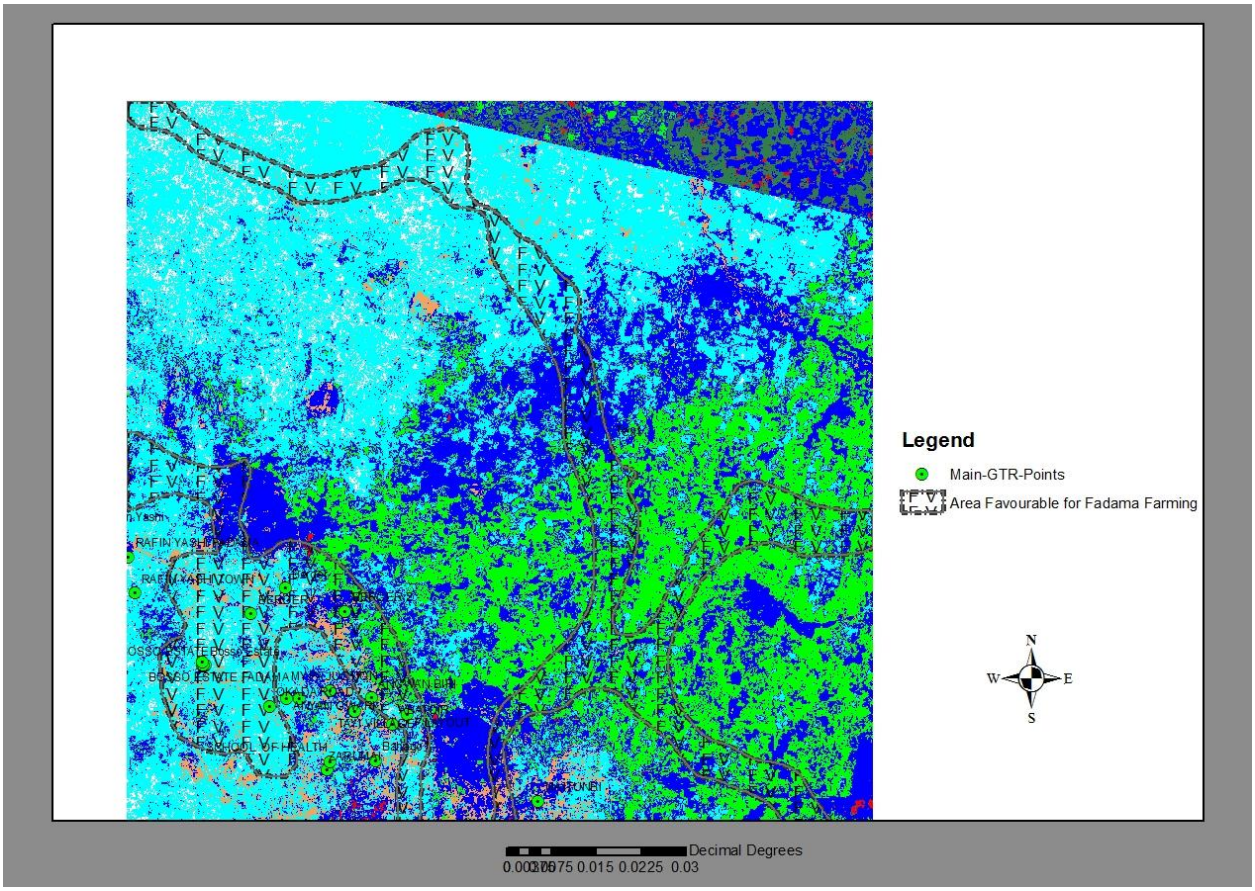

Fig 3. Areas Favorable for Fadama Farming (Source Authors Analysis)

From figure 3 reasonable extents of the areas considered favourable for Fadama farming is dominated by wetland vegetation, vegetation and farmlands rather than developmental structures. Areas considered less favourable for Fadama farming are actually dominated by urban structures, vegetation and upland farmlands within Bosso local government area.

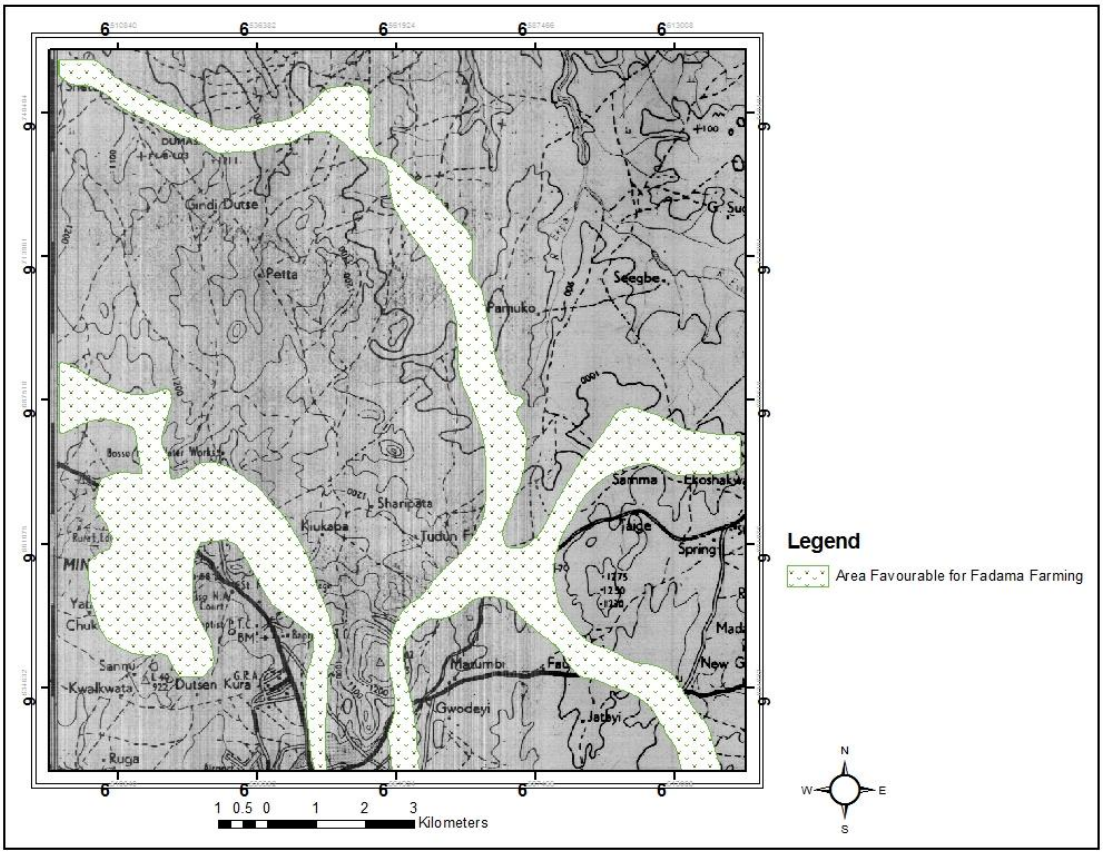

Fig 4. Mapped out areas that favor Fadama farming overplayed on topographic sheet of Minna (source; authour's analysis).

The major potential crops in the study area include Rice, Maize, Okro, Pepper, Water Leaf, Pumpkin, Sugar Cane, Greens, Spinach, and Tomatoes

Conclusion and Recommendations

This study revealed the potential of Remote Sensing and Geographic Information Systems (GIS) techniques in the struggle towards achieving sustainable environmental development and food security with a sole interest in mapping areas favourable for Fadama farming, to know the extent of the area useful for Fadama farming and also to identify the extent of the various land uses within the study.

In this study some of the major findings are: Areas on the DTM considered favourable for Fadama farming fall between elevations less than 300m above sea level which include Popoi, Nini, Dyafa and Gusasa. Potential fadama land in the study area covers 3690.00 hectares of the entire study area on the DTM.

It is recommended that geographic information system be used to create the soil database and land information system, including soil types, soil fertility, terrain, current land use status, climate, slope, vegetation cover, soil erosion and land unit map. The database system if created using GIS software, will allow users to access, edit, update, overlay and

with some analysis will create a new map which could be used for decision making. Application of other information sources like remote sensing images; Global Positioning System (GPS), etc should be encouraged because it will help in bringing real time change in land use and management strategy

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DETERMINATION OF LEAD IN WELL AND BOREHOLE WATER SAMPLES IN BAUCHI, NIGERIA

By

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Abstract
Water samples from 12 boreholes and 18 wells were collected in Bauchi from February to April, 2010 and analyzed for lead concentrations ($mgdm^{-3}$) in triplicate using Atomic Absorption Spectrophotometric Technique. The mean levels of lead obtained ranged from 0.002 to 0.13 $mgdm^{-3}$ and 0.001 to 0.17 $mgdm^{-3}$ for borehole and well water samples with corresponding grand mean concentrations of 0.032 $mgdm^{-3}$ and 0.058 $mgdm^{-3}$ for the same water source. The variations in the concentrations of lead determined in the borehole and well water samples of Bauchi were found to be statistically the same ($P<0.05$ and $P<0.10$) as determined by a two-tailed Mann-Whitney test. The grand mean concentration of lead determined for the two water sources investigated were found to be contaminated with lead above the 0.01 $mgdm^{-3}$ permissible limit set by World Health Organization (WHO) drinking water guidelines.

Key words: Borehole water, well water, lead, two-tailed Mann-Whitney test.

Introduction

Although water has an essential role in supporting human life, it also has a great potential for transmitting diseases and illnesses if contaminated (Musa et *al*, 2004). About 80% of ill-health in most developing countries like Nigeria was reported to be associated with contaminated and unsafe water (Seth *et al*, 2002). This is the major reason why water that has been detected to contain any amount of impurities should be completely avoided (Santillan-Medraw & Jurinak, 1992).

Population growth, coupled with other factors such as urbanization, agricultural activities, industrial and commercial processes, has resulted in the accumulation of wastes and pollutants which end up in water bodies, thereby polluting them (Hutchinson & Meema, 1987; Dike et al, 2004) in Hassan (*et al*, 2009).

Lead is a potentially hazardous trace metal to most forms of life, and is considered to be toxic and relatively accessible to aquatic organisms. Lead is a neurotoxic metal that may accumulate in our body and has no biological values. Lead metal is toxic because when ingested or inhaled and absorbed, it can harm virtually every system in the human body, especially brain, kidney and reproductive system since it disrupts enzyme system mediated by iron, zinc and calcium that are important to the body (Funtua et al, 2007; Ojiodu & Atasie, 2005 in Hassan *et al*, 2009).

Human exposure to lead occurs primarily through particulate materials of lead in sources of drinking water, lead based paints on painted surfaces, plumbing materials that have been lead-coated and used over a long period of time. Mechanical workshops, illegal mining areas and refuse dumpsites are other common sources of human exposure (U.S.EP.A, 1990).

Accumulation of lead in different concentrations in the body have been found to cause poisoning of the blood associated with broad health effects such as inhibition of the biosynthesis of hemoglobin, acute headache, abnormal movements in the body, fertility problems, dizziness and renal problems, which often leads to death (Bryce & Clarkson, 2005). Lead is toxic to children and the young of other species. A number of detailed studies aimed at assessing the health effects of chronic lead exposure in children have revealed significant effects on intelligence and neuropsychological performance. Lead and cadmium are industrial pollutants which have strong negative effects on human and animal health (Albaiges, 1981; Martin, 1982; Szkoda & Zmudzki, 2005 in Hassan *et al*, 2009). Lead is also toxic to plants at concentration range of 3-20 ppm depending on plant species, to animals at a concentration of 1 mg/day and humans at 10 g/day (Bowen, 1979).The aim of this study is to:

(i) determine the concentration of lead in the borehole and well water samples in Bauchi metropolis

(ii) compare statistically the concentrations of the lead in the two water sources under investigation.

Materials and Method

Analytical reagent (AnalaR) grade chemicals and distilled deionized water were used for the determination throughout the study. All glass wares and plastic containers used were washed with detergent solution, followed by 5% (v/v) nitric acid, rinsed with tap water and finally with distilled deionized water. The apparatus were then allowed to dry (Walter, 1995).

Sampling and Sample Treatment

Water samples were collected from twelve (12) boreholes and eighteen (18) wells distributed throughout Bauchi, Nigeria (Fig.1). 1.0 dm^3 of water samples were collected three times in screw-capped plastic jars from February to April, 2010 in each site and labelled appropriately for analysis. A total of 36 and 54 water samples were collected from all the boreholes and wells respectively and analyzed for lead. The water samples collected were filtered using Whatman number 1 filter paper and preserved by acidifying with 2.0 cm^3 of concentrated nitric acid (Musa *et al*, 2008).

Digestion Procedure

50.0 cm^3 of the water sample was measured into a 100.0 cm^3 beaker and 10.0 cm^3 of concentrated nitric acid was added. The beaker and its content were moderately heated on a hot plate at 80^0C for about 2.0 hours until brown fumes of nitric acid appeared (LPFWA, 2004).Heating continued until the content reduced to about 10.0 cm^3 volume. After cooling, the content was quantitatively transferred into a 50.0 cm^3 volumetric flask and made to volume with water before transferring into a smaller screw-capped plastic jar and stored at room temperature for the determination of lead using a Buck Scientific Model 210-VGP Atomic Absorption Spectrophotometer (Musa *et al*, 2004). This procedure was repeated for all the samples under investigation.

Results and Discussion

The concentrations of lead in well water and borehole water of Bauchi determined in this study are shown in Tables 1 and 2 respectively. The differences in the mean concentrations of lead determined in the well and borehole water samples of Bauchi were found to be statistically the same ($P<0.05$ and $P<0.10$) as determined by a two-tailed Mann-Whitney test.

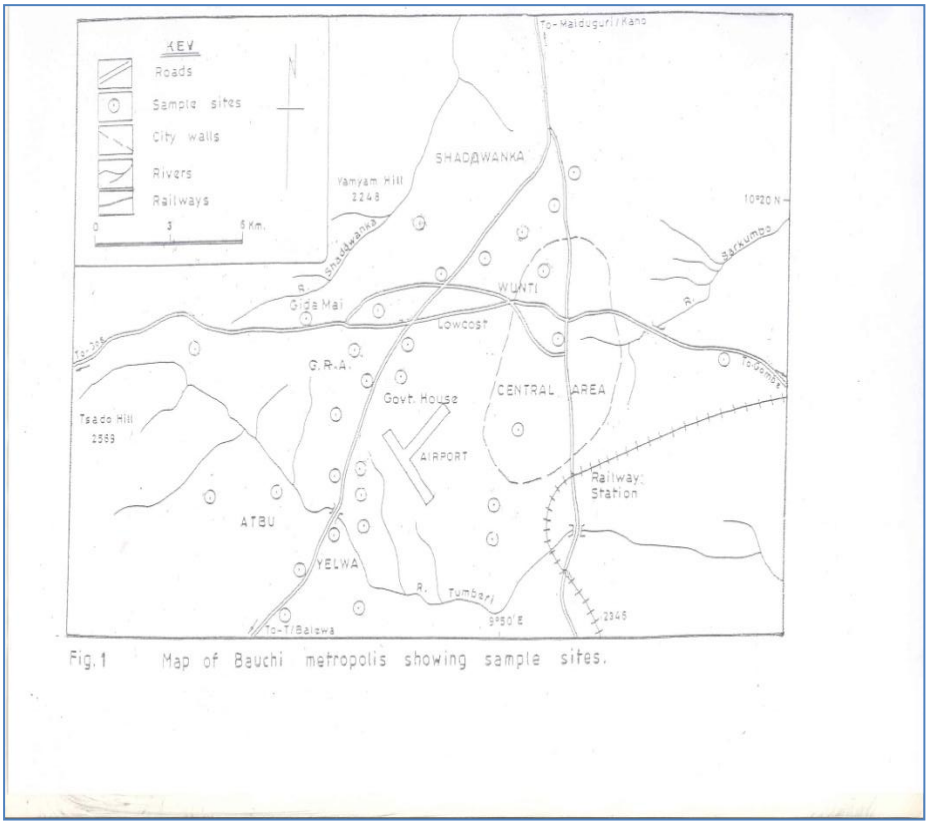


Fig. 1 Map of Bauchi metropolis showing sample sites.

Table 1: The mean concentrations and range of lead in mgdm^{-3} in well water samples of Bauchi

S/No.	Sampling location	Mean concentration and range
1	Yalwa market	0.090
		0.00-0.100
2	Yalwan makaranta	0.170
		0.170-0.180
3	Lushi, Bakery Road	0.040
		0.040-0.040
4	Police Barrack, Rafin Zurfi	0.008
		0.008-0.008
5	Old Dass Park	0.007
		0.007-0.008
6	State Secretariat	0.003
		0.003-0.003
7	Federal Low-Cost A	0.048
		0.048-0.049
8	Federal Low-Cost B	0.061
		0.060-0.061
9	Gidan Mai, Jos Road	0.091
		0.091-0.092
10	Muda Lawal Market	0.130
		0.130-0.140
11	Muda Lawal Motor Park	0.150
		0.150-0.160
12	Bank Road	0.002
		0.002-0.002
13	Gombe Road	0.043
		0.043-0.044
14.	Wunti Market	0.061
		0.061-0.061
15	Sam Nuyoma Street	0.001
		0.001-0.001
16	Yandoka Road	0.110

		0.110-0.110
17.	Bauchi Hospital Management Board	0.002
		0.002-0.002
18	Bauchi State Agricultural Dev. Prog.	0.033
		0.033-0.034
	Grand mean =	0.058 $mgdm^{-3}$

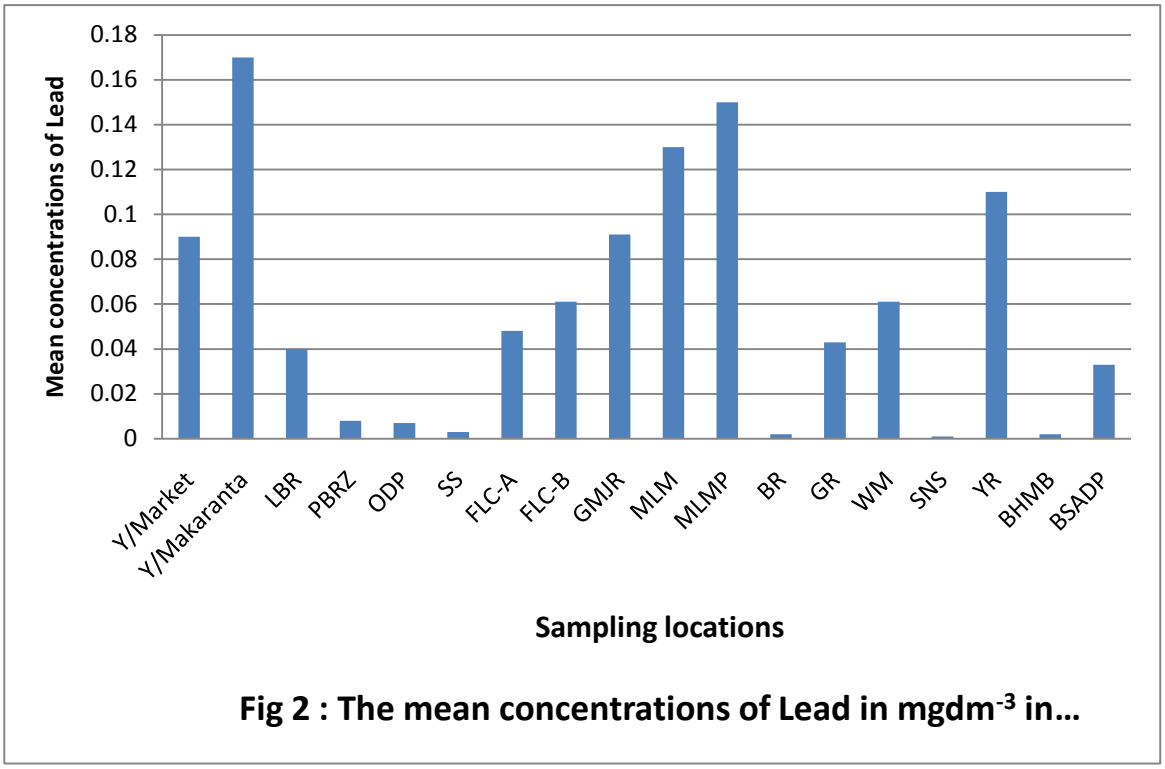
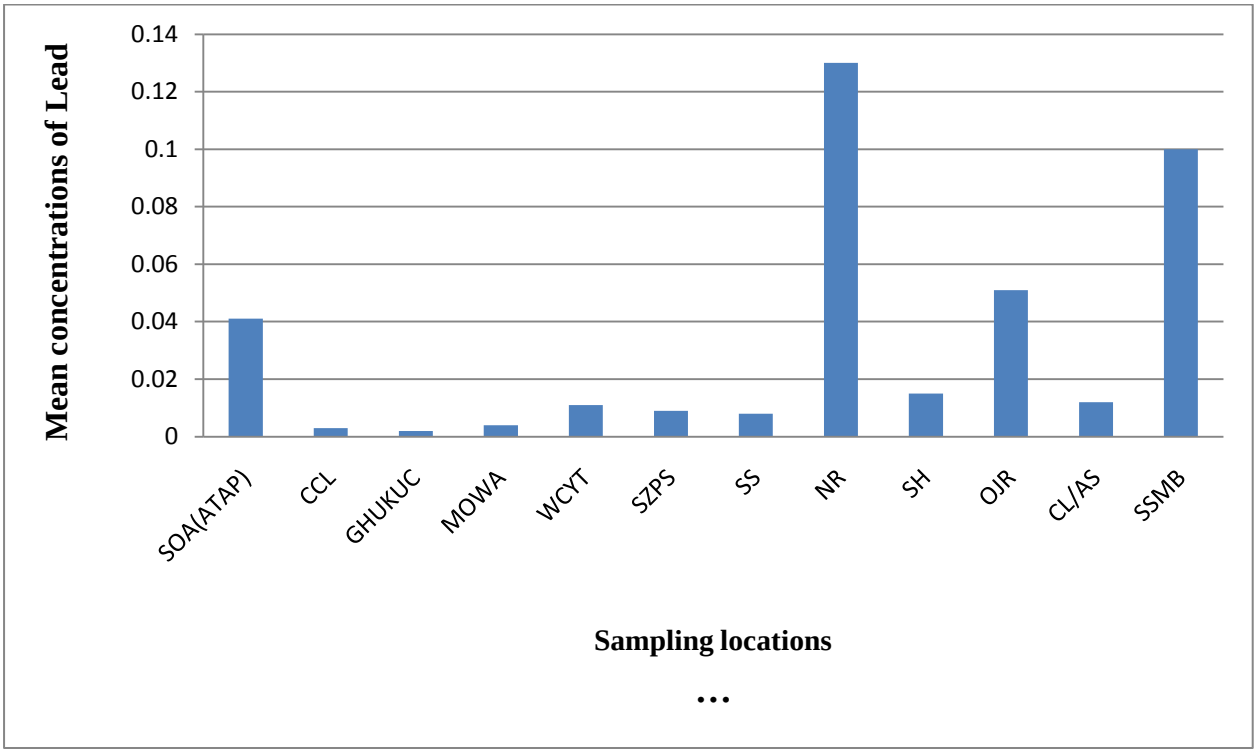


Fig 2 : The mean concentrations of Lead in $mgdm^{-3}$ in…

S/No.	Sampling location	Mean concentration and range
1	School of Agriculture (ATAP)	0.041
		0.039-0.041
2	Christian Corpers Lane	0.003
		0.003-0.003
3	General Hassan Usman Unity College	0.002
		0.002-0.002
4	Ministry of Women Affairs	0.004
		0.004-0.004
5	Winners Charpel, Yalwan Tudu	0.011
		0.010-0.012

6	Sa'adu Zungur Primary School	0.009
		0.007-0.010
7	State Secretariat	0.008
		0.008-0.008
8	Nassarawa Road	0.130
		0.110-0.140
9	Specialist Hospital	0.015
		0.014-0.017
10	Old Jos Road	0.051
		0.050-0.052
11	College for Islamic/Arabic Studies	0.012
		0.012-0.012
12	Special Schools Management Board	0.100
		0.100-0.100
	Grand mean =	0.032 $mgdm^{-3}$



The mean concentrations of lead determined in Bauchi well water samples ranged from 0.001 to 0.17 $mgdm^{-3}$ with a grand mean concentration of 0.058 $mgdm^{-3}$. Sam Nuyoma street well had the lowest mean lead concentration of 0.001 $mgdm^{-3}$, while Yalwan Makaranta had the highest mean lead concentration of 0.17 $mgdm^{-3}$. This could be

attributed to the fact that Sam Nuyoma Street is less densely populated compared with other sampled locations, including Yalwan Makaranta.

Lead was detected above 0.01 $mgdm^{-3}$ permissible limit set by World Health Organization (WHO) in twelve out of the eighteen well water sampling locations. This therefore shows that 66.67% of the Bauchi well water samples analysed are contaminated with lead above the 0.01 $mgdm^{-3}$ WHO drinking water guidelines. The grand mean concentration of lead in the well water samples of Bauchi (0.058 $mgdm^{-3}$) was far below that of Musa *et al*, 2008 (0.25 $mgdm^{-3}$) in Zaria. Another reason for the low grand mean value of lead reported here could be due to low industrial activities in Bauchi compared to Zaria town.

The mean concentration of lead as determined in Bauchi borehole water samples ranged from 0.002 to 0.13 $mgdm^{-3}$ with a grand mean concentration of 0.032 $mgdm^{-3}$. General Hassan Usman Unity College borehole had the lowest mean lead concentration of 0.002 $mgdm^{-3}$, while Nassarawa road borehole had the highest mean lead concentration of 0.13 $mgdm^{-3}$. The few borehole water samples with relatively high lead concentrations might be due to peculiar human activities and lack of good drainage systems within the sampling sites. Leaching from various domestic wastes, organic matter, vulcanizing shops, mechanical workshops, as well as lead-based paintchips flaking from homes and offices associated with the areas could be responsible for the relatively high mean lead values. Another reason could be due to the geological nature of the areas. It was also reported that the origin of lead pollution could be from natural sources (Omuku et al,2009). The boreholes affected are Old Jos Road (0.051 $mgdm^{-3}$), Special Schools Management Board (0.10 $mgdm^{-3}$) and Nassarawa Road (0.13 $mgdm^{-3}$) respectively.

Lead was also detected in some of the boreholes above the 0.01 $mgdm^{-3}$ permissible limit set by World Health Organization (WHO). This also shows that 58.33% of the Bauchi borehole water samples analyzed are contaminated with lead above the 0.01 $mgdm^{-3}$ WHO drinking water guidelines. Comparatively, the grand mean concentration of lead in the borehole water samples of Bauchi (0.032 $mgdm^{-3}$) was below the grand mean lead level (0.158 $mgdm^{-3}$) of Zaria (Musa *et al*, 2008). At high concentrations, lead can cause irreversible brain damage, seizure, coma and death if not treated immediately. Kidney disease, both chronic nephropathy and acute is a feature of lead toxicity (Hassan *et al*, 2009). It has also been found to cause infertility in men by disrupting semen production and quality (Bryce and Clarkson, 2005).

Conclusion

The determination of lead in well water and borehole water of Bauchi above the permissible limit set by WHO is a problem of growing concern in the town more especially in the sampled sites where the concentration of lead is relatively high. There was no published data on the determination of lead in water in the study area of Bauchi to compare the results with; hence this research work can be used as a baseline study for future work.

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AN INVESTIGATION OF FACTORS AFFECTING THE USAGE OF AFRICANA RESOURCES IN NIGERIAN UNIVERSITY LIBRARIES

By

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Abstract

In this study, thirteen first and second generation federal university libraries were studied to investigate the factors affecting the usage of Africana resources in Nigerian university libraries with a view to suggesting ways of improving usage. The population comprised of 42873 users. Descriptive survey research method was used. Questionnaires, interviews and observation checklist were administered to a sampled population of 1,974 users comprising of post graduate study lecturers, masters' and doctoral students and these constitute 10% of each group studied. The questionnaires were appropriately validated by three experts. These include one expert from test and measurement and two professional colleagues. The interview and observation checklist were used to gain more insight on some of the issues raised by the study. The mean was used to answer the research question mapped out for the study. The findings revealed that: the factors hindering usage of Africana resources include; restrictions on borrowing, poor acquisitions, poor library service, lack of staff, lack of effective use of ICT tools, lack of users' awareness of available Africana resources and lack of users' appreciation of their own culture.

Introduction

There are various concepts of Africana by different writers and organizations. Afeworki and Holley (2006) stated that Africana resources cover the study of the African continent in general including their history, politics, culture, literature, religion and economics. Some organizations see it from the point of view of the African indigenous knowledge. Okore, Ekere and Eke (2009) define it as encompassing all forms of knowledge be it technological skills, practices and beliefs that enable the community to achieve stable livelihood in the environment. Africana resources are therefore essential information sources in Nigerian academic libraries that ought to be preserved for both the present and future generation. They include written and oral information by Africans or non- Africans about Africa.

Africana resources cover subject areas of cultural anthropology, folklore, psychology, sociology, traditional medicine etc. The resources also cut across different subject formats like almanacs, charts, pictures, subject files, internet information resources, Compact Disc-Read Only Memory (CD-ROM) etc. Africana resources in the face of information technology has also expanded to include video recordings of events in African countries in filmstrips and Video Compact Disks (VCDs); South African Book Development Education Trust publications (SABDET 2004).

However research findings have proved that the usage of the Africana is not very wide and this may have affected the extent of availability of the resources in Nigerian university libraries. No wonder a body like the South African Book Development Education in Africa (SABDET) was set up with its main theme as – Readers and libraries in Africa, (SABDET 2005). One of the major roles of an African university library should be to provide a centre for all local information, whether generated through consultancies, student research, government- generated data such as statistics and other government documents. These should form the nucleus of the materials to be included in form of abstracts, indexes, bibliographies and databases on global information arena, to this there is still a missing link.

If nothing is done about their gradual disappearance, negligence and under utilization in Nigerian university libraries, generations of Africans may not know much about the history of their origin or their cultural heritage. Studies have proved that the original documentaries on Africana resources in different subject areas are fast disappearing due to neglect by both librarians and users, Alegbeleye (1994) and (SABDET, 2005). This study therefore intends to find out the factors affecting the usage of Africana resources in Nigerian university libraries. It is expected that the study will arouse interest in the development and usage of the resources in Nigerian university libraries.

Methodology

Descriptive survey was used to carry out the study in Nigeria and it is limited to federal university libraries that have Africana collections. Eighty-nine Africana librarians in the thirteen first and second generation federal university libraries involved in the study made up the total population. They include; University of Nigeria, Nsukka, University of Port Harcourt, Port Harcourt, University of Benin, Benin, University of Calabar, Calabar, University of Uyo, Uyo, University of Ibadan, Ibadan, University of Lagos, Lagos, Obafemi Awolowo University, Ile-Ife, Ahmadu Bello university, Zaria, University of Sokoto, Sokoto, University of Ilorin, Ilorin, University of Jos, Jos and University of Maiduguri, Maiduguri. The thirteen universities were selected considering the fact that these first and second generation universities have clearly set up Africana units in their libraries. The sampled size comprised of 35 Africana librarians from the six selected universities. The sampling procedure adopted comprised of three stages. The first stage involved the selection of the federal universities whose library staff (Africana staff) will participate in the study.

The second stage involved the identification of the six universities (out of the thirteen first and second generation federal universities) selected from the six geopolitical zones for good coverage. The third stage of the sampling technique involved the identification and selection of the respondent group, (all library staff in Africana).

Librarians' Questionnaire, Observation Checklist, acquisition policies and interview Schedule directed to unit heads and Africana librarians were the instruments used to elicit answers from the respondents. Mean scores and standard deviation were used to answer the research question stated for the study. The researcher used a 4 - point rating scale and therefore, for the research question, limits of real numbers (as shown below) were used to make decision on the extent of quantity availability.

Limits of real numbers for decision on research questions-

Usage: 0.05 - 1.49 = Not Often (NO)1 .50 – 2.49 = Sparingly (S); 50 – 3.49 = Often (O); 3.50 – 4.49 = Very Often (HO).

Results

The results from the data analysis for the study are presented under this chapter. These results are presented in accordance with the research question that guided the study. The relevant data to the research question are presented in the table and analyzed and a summary of the major findings were presented thereafter.

Research Question

What are the factors affecting the usage of Africana resources in Nigerian university libraries?

Table 1 displays the results of the analysis in respect of the response of users (PG lecturers, master degree students and doctoral degree students) on the factors affecting the usage of Africana resources in Nigerian university libraries.

Table 1: Mean of the response of users (PG lecturers, master degree students and doctoral degree students) on the factors affecting the usage of Africana resources in Nigerian university libraries

Items	Master Students	PhD Students	PG Lecturer	Total	Decision
	$\overline{X}$	$\overline{X}$	$\overline{X}$	$\overline{X}$	
1. Restriction on borrowing limit use of Africana resources	3.00	3.03	3.24	3.07	ME
2. Poor acquisition makes access to Africana resources very difficult	2.88	2.73	3.00	2.86	ME
3. Poor library services discourage use of Africana resources	2.87	2.72	2.76	2.82	ME
4. The staff in Africana are insufficient to render adequate library services	2.55	2.52	2.73	2.60	ME
5. Africana unit is not comfortable for reading	2.30	2.20	2.55	2.36	LE
6. Africana staff are not helpful to users	2.29	2.24	2.28	2.28	LE
7. The location of Africana collection limit use	2.54	2.29	2.46	2.49	LE
8. ICT tools are not effectively applied in accessing Africana resources	2.80	2.59	2.82	2.78	ME
9. Uses are not aware of resources available in Africana	2.73	2.70	2.73	2.73	ME
10. Africana collections fail to meet the information needs of users	2.52	2.38	2.49	2.49	LE
11. Many Africans do not value their own culture	2.61	2.31	2.47	2.53	ME
12. The organization of Africana is poor	2.51	2.21	2.32	2.32	ME
Overall	2.63	2.49	2.65	2.62	ME

Where 'ME'=Moderate extent, 'LE'=Low extent

Table 1 shows the mean of the response of users PG lectures, masters and doctoral degree students) on factors affecting usage of Africana resources in Nigerian university libraries. The table also shows the total response of the users combined. The users agreed that items such as; restriction on borrowing limit use of Africana resources, poor acquisition make access to Africana resources very difficult, poor library services discourage use of Africana resources, the staff in Africana are insufficient to render adequate library services, ICT tools are not effectively applied in accessing Africana resources, users are not aware of resources available in Africana and many Africans do not value their own culture (1, 2, 3, 4, 8, 9, and 11) are factors affecting the usage of Africana resources in the Nigerian university libraries with the mean of (3.07, 2.86, 2.82, 2.82, 2.60, 2.78, 2.73, and 2.53) respectively. The users disagreed with items such as Africana unit is not comfortable for reading, Africana staff are not helpful to users, the location of Africana collection limit use, Africana collection fail to meet the needs of users and the organization of Africana is poor, (5, 6, 7, 10 and 12) as factors affecting the usage of Africana resources with the mean of (2.36, 2.28, 2.49, 2.49 and 2.32) respectively. However the factors affecting usage vary from user to user. For instance in item 7 (the location of Africana collection limit use), masters students agreed that the location of Africana collections limit the use of Africana while the doctoral degree and lecturers disagreed on the items. The mean responses also revealed that the three groups agreed that restrictions on borrowing limit use of Africana resources, poor acquisition makes access to Africana resources very difficult and that poor library services discourage use of Africana resources. They however disagreed that Africana staff are not helpful to users. The table shows that there is a general weakness in the different groups' agreement or disagreement of all the factors raised as can be seen in the overall responses of masters' students (2.63), Ph.D (2.49) and Pg lecturers (2.65).

To add to these factors, the Africana librarians interviewed were of the view that lack of a separate index for Africana, lack of an up-to-date catalogue for Africana and where it exists, it is normally fragmented, affect the usage of Africana. For instance, the researcher's observation showed that in Ahmadu Bello university library, part of Africana catalogue is upstairs and some are downstairs in the library building. All these affect the usage of the resources in the libraries. Some of them are also of the opinion that lack of tools for using the resources, lack of open access, the poor location of the resources and lack of adequate staff are also factors that affect the usage of the resources in university libraries.

Summary of Finding

The study revealed that poor library services, lack of staff, lack of effective use of ICT tools, lack of users' awareness of available Africana resources and lack of appreciation

for their own culture are the factors that hinder the use of Africana resources in Nigerian university libraries. However, restrictions on the borrowing of Africana resources, poor library services and poor Africana acquisitions are the strongest factors expressed by the respondents that hinder usage of Africana in Nigerian university libraries. But generally, Africana resources are not adequately utilized in Nigerian university libraries.

Discussion of Findings, Conclusion and Recommendations

As can be seen from table above, all the respondents (PG lecturers, masters and doctoral degree students) agreed that; restrictions on borrowing limit use of Africana, poor acquisitions (low availability of the resources) make access to Africana very difficult. Poor library services discourage use of Africana resources. The staff in Africana are insufficient to render adequate library services, ICT tools are not effectively applied in accessing Africana resources, users are not aware of resources available in Africana and many Africans do not value their own culture. The users however disagreed that Africana unit is not comfortable for reading, Africana staff are not helpful to users, the location of Africana collection limit use, Africana collection fail to meet the information needs of users and the organization of Africana is poor as factors militating against the use of Africana resources in university libraries. It is also striking that the respondents disagreed with some of the speculations of the researcher which include that the Africana is not well located in the libraries and poor organization of the resources as factors militating against the usage of the resources. However these agreements and disagreements vary from one user to another. While some masters and Ph.D degree, students agreed that Africana unit is not comfortable for reading, PG lecturers said that the Africana unit is comfortable for reading.

Some of the masters' students also agreed that the location of Africana resources limit its use, the doctoral students and the PG lecturers disagreed to this. It is however clear from the findings of this research that the factors that the users agreed upon actually restrict the use of Africana resources in the university libraries. It is equally striking and worthy of note that restrictions on the borrowing of Africana resources, poor acquisitions in Africana resources, poor library services in Africana and ICT tool not effectively applied in accessing Africana resources were very outstanding as can be seen on the table. But concerning the agreement on closed access as one of the factors hindering access of the resources, the researcher is very skeptical on the issue considering the nature of the Africana resources. If an open access is allowed, it may lead to plagiarism (especially theses), theft and mutilation of the resources which most often will be very difficult or impossible to replace.

On the issue of restriction of access of Africana resources to users, majority of the librarians interviewed were of the view that closed access of Africana is one of the factors hindering the usage of the resources but also stated the consequences of this as above. One of the librarians stated clearly that users should be allowed semi open access whereby the users can go in to the shelves to take what they want because the Africana shelves are always dark and the Africana staff are not adequate to effectively and efficiently render such help to the users. The agreement of low availability as one of the factors militating against the usage of Africana resources confirmed the assertions of Schmdt (1995), Etounga-Manguelle (1998), and Afeworki and Holley (2006) that the availability of works on Africa is not encouraging in African universities. Thus, Okore, Ekere and Eke (2009) therefore suggested ways of increasing the quantity of the resources such as collecting, preserving the resources among others. The respondents' agreement on poor library services as one of the factors responsible for poor usage is consistent with the assertion of Edoka (2002) and Udensi (2002) that poor library services and inadequate library staff are the cause of inadequate use of library resources (of which Africana is a part) in the university libraries in Nigeria. The respondents also agreed that lack of computer tools affect usage of the resources confirming Davison's (2004) assertion and the opinion of the Africana librarians interviewed that there are not yet indexes exclusive to Africana. The lack of ICT tools for sourcing and retrieving information in Africana identified by the respondents is consistent with the observations of the researcher in course of collecting data for this research. The observation showed that only two libraries were using ICT tools to retrieve Africana resources, the others were still in the process of implementation and some still in this process have rendered some ICT tools bought for this obsolete.

One other factor pointed out by the respondents as being responsible for inadequate use of Africana resources is also in consonance with findings of Schmdt (1995) that Africans do not have much interest in the development of their resources. If they do, they will show interest in developing the collection. To buttress this further, Serageldin (1998) observed that Africa will lose her soul if she renounces the unique cultural features that set her apart and that are being eroded daily by foreign culture. The finding also confirmed the negligence in use of and in the collection of the resources by Africans themselves as observed by Afigbo (1990) when he took a tour of African universities in the United States of America.

The information theory of use developed by Shannon and Weaver in1949 states that, the freedom to choose an information resource such as Africana is in the hands of the user (Nwachukwu, 2008). This is a further support of the need to pay attention to the findings of

this research on the factors that militate against the usage of Africana resources. The theory emphasized that information is a measure of one's freedom of choice. In other words, the choice or the use of an information resource like the Africana is the exercising of one's freedom of choice. Therefore the rate and the amount of the usage of an information resource like the Africana depend on the interest of the user. So every effort must be made by the libraries and the librarians to alleviate the factors that militate against the usage of Africana resources in Nigerian university libraries.

Recommendations

The following recommendations based on the findings of the research are made:

1. There should be increased funds for the management of the library so as to accommodate increase purchase of more Africana resources, taking care of currency of the resources, different formats and subject areas in Nigerian university libraries. This will consequently increase usage.
2. The library management should vigorously pursue the establishment of different marketing or awareness strategies so as to create awareness of the usefulness of Africana resources in university libraries in Nigeria. This will go a long way in changing the perception of users about the resources thereby increase the usage of the resources by both the Arts and Science users. It will also make users to be aware of the Africana resources that are available in the library.
3. The University librarians should endeavor to use qualified and experienced professions as unit heads in the Africana units and also that adequate library staff should be sent to the units so as to increase users' assistance in the retrieval of information.
4. The Africana unit should be equipped with ICT information retrieval tools and Africana staff should be trained and retrained in the knowledge and use of ICT in the Africana unit.
5. New arrivals in Africana should be displayed at strategic places so as to attract more users to the use of the resources.
6. The reading environment in the Africana unit should be made more comfortable by providing better chairs and reading tables and by also installing air conditioners in the units.
7. Semi open access should be considered for the Africana resources. It is a situation where users are allowed to retrieve what they want as it is done with the other books. They are however not allowed to borrow the resources out but are allowed to

photocopy in the Africana unit only and every Africana unit should be provided with photocopiers.

8. The factors that limit usage of the resources (found out by this study) should be avoided.

Conclusion

The amount of the usage of an information resource like the Africana depends on the interest of the user. So every effort must be made by the libraries and the librarians to alleviate the factors that militate against the usage of Africana resources in Nigerian university libraries. Such factors according to the findings of this study include; poor library services, lack of professional staff, lack of effective use of ICT tools, lack of users awareness of available resources etc.

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STUDY OF THE ANCIENT IRON-SMELTING SITES AT PANTAKI, TSAUNI AND SAMARU-WEST, NORTHERN NIGERIA, USING NEUTRON ACTIVATION ANALYSIS

By

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Abstract
Neutron activation analysis was used to obtain concentrations of some elements in samples of potsherds and furnaces obtained from Pantaki, Tsauni and Samaru-west ancient iron-smelting sites in northern Nigeria. Using WARD method, cluster analysis of the elements was carried out to establish the relationship between the archaeological samples in term of similarity in elemental concentrations. It was found that there is some level of similarity among the potsherd samples from the three sites. Also, most of furnace samples display some similarity. It was established that there was cultural linkage between the iron-smelters at the different sites. The similarity between the samples lead to a conclusion that pot makers and furnace makers could have existed, who made and sold the products to users in different communities. The pot makers obtained their clays from common source. The furnace makers also obtained their clays from other common source, different from the source of clay used by pot makers.

Keywords: Iron-smelting, Pantaki, Tsauni, Samaru-West, Neutron activation analysis, WARD's method.

Introduction

Archaeologists have shown interest in the ancient iron-smelting sites at Pantaki, Samaru-west and Tsauni in Zaria, Northern Nigeria since around 1976 (Effah-Gyamfi, 1981). It was discovered that there was conspicuous evidence of large scale iron smelting activity at the sites. In attempt to determine age of the sites, Sutton (1976) submitted charcoal samples for radiocarbon dating and obtained some set of dates for iron-smelting at Samaru-west. It was intended to compare the age of the three sites. Unfortunately all excavations at Tsauni and Pantaki yielded no dateable charcoal. So, only Samaru-west was dated. As a follow up to this, Oladipo *et al.* (1992) analysed the elemental composition of potsherds from the three sites, using neutron activation analysis method. The result showed that samples from Samaru-west and Tsauni are not much similar, while those from Pantaki scatter among Tsauni and Samaru-west samples. The present study is a scientific follow up of those previous studies. Remnants of furnace samples that are still available at the sites are the main focus for analysis in this study.

Fig 1 shows the location of the three ancient iron-smelting sites. Pantaki (a) is the name of an area on the popular Kufena inselberg, at 11º06´N and 7º40´E. Two major sites

are recognized at this site. One is a low level, surrounded by a fence of rock. There was a layer of laterite on the rock, and some slag, which is an indication that iron smelting took place there in the past. The remaining part of this lower site is littered with potsherds. Some of them are thick and gritty while others are relatively thinner. On one part on the rock-top is an occupation site. This is covered with a layer of soil about 30cm thick, and is littered with potsherds. No furnace remnant was found from the site. At Samaru-west (b), located at 11º9½´N and 7º37´E, three different sites were found with slag heaps. Tsauni sites (c) are located along old Zaria-Brinigwari road at 11º06´N and 7º35´E. Two large iron-smelting sites were found there.

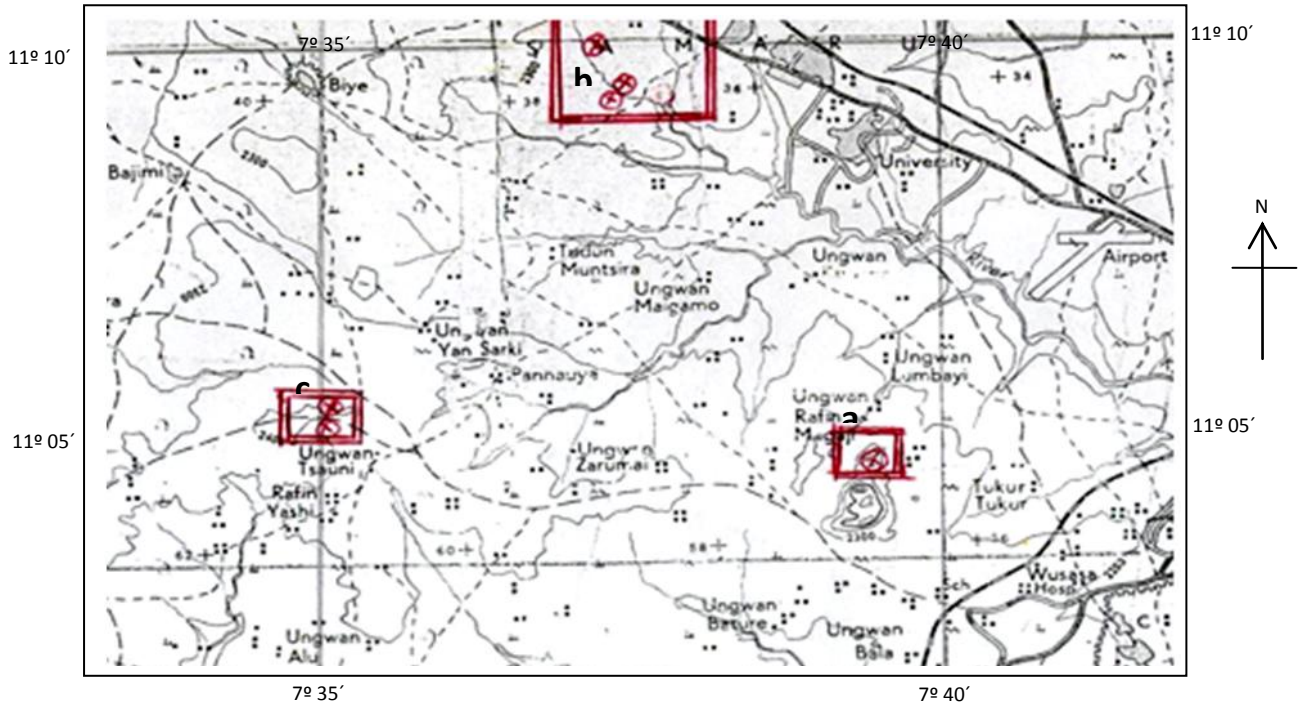

Figure 1. Part of Zaria map showing (a) Pantaki, (b) Samaru-west and (c) Tsauni ancient iron-smelting sites (Scale: 1:100,000)

Furnace samples were collected at Samaru-west and Tsauni site, while potsherd samples were collected at all of the three sites. Neutron activation analysis (NAA) using thermal neutron from Nigerian nuclear reactor (NNR-1), located at the Centre For Energy Research and Training, Ahmadu Bello University, Zaria, was employed to determine the concentration of some trace elements in the samples. The use of NAA to solving this problem is based on the premise that materials of which the ceramics are made will be finger-printed chemically thus reflecting their places of origin.

Experimental Procedure

The Samples

A number of representative samples were collected from each of the industrial sites. Table 1 is a presentation of samples and their description.

Table 1: Samples and Description

S/N	SAMPLE	DESCRIPTION
1	SF 1	Samaru-west Furnace 1
2	SF 1CR	Samaru-west Furnace 1 (crumble-like)
3	SF 2	Samaru-west Furnace 2
4	SF 3	Samaru-west Furnace 3
5	SF 4	Samaru-west Furnace 4
6	SP E N	Samaru-west potsherd, excavated, thin sample.
7	SP E K	Samaru-west potsherd, excavated, thick sample.
8	SP S K	Samaru-west potsherd, surface found, thick sample.
9	TNF 1	Tsauni north furnace 1
10	TNF 2	Tsauni north furnace 2
11	TSOF	Tsauni South occupation site furnace
12	TSGF	Tsauni South gully side furnace
13	TSSF 1	Tsauni South slagheap top furnace 1
14	TSSF 2	Tsauni South slagheap top furnace 2
15	TSSF 3	Tsauni South slagheap top furnace 3
16	TSOP 1	Tsauni South occupation site potsherd 1
17	TSOP 2	Tsauni South occupation site potsherd 2
18	PUP TN	Pantaki upper-part thin potsherd
19	PUP TK	Pantaki upper-part thick potsherd
20	PLP TN	Pantaki lower-part thin potsherd
21	PLP TK	Pantaki lower-part thick potsherd

Samples were washed thoroughly with distilled water and then allowed to dry to a constant weight at temperature of 60°C in an oven. With aid of a diamond scraper, the outer layer of the samples was scraped to remove any trace of contamination. The dirt-free samples were then powdered in an agate mortar. About 0.13 mg was carefully weighed and sealed as a capsule in a prewashed and dried polythene container. The sample was then placed in a plastic vial and packed with cotton wool before sealing with cellotape. Samples were prepared for both long-lived and short-lived irradiation. Three standards – soil-7, fly

ash and IAEA-312 – samples were prepared and included in the vial for irradiation. These are for quality assurance test.

Sample Irradiation

For short-lived irradiation, samples were subjected to two minutes irradiation in a neutron flux of 1×10^{11} n/cm^{2}sec. After removal from the reactor, the samples were allowed to cool till radiation dose fall to a level save for handling (ca 30μSv). For long-lived irradiation, samples were irradiated for six hours in neutron flux of 5×10^{11} n/cm^{2}sec. The samples were allowed to cool for four days to allow short-lived species to decay away before counting, for the first set of long-lived radionuclides. The counting was repeated after nine days in order to take measurement for the next set of radionuclides.

Counting of Neutron Activated Samples

Counting was done with high purity Germanium detector with resolution of 2 keV per channel. The counting of samples was usually preceded by system calibration with a standard Cs-137 (662 keV) and Co-60 (1173- and 1332.5 keV) source. The spectra acquired from the counting were processed using a programme called "WISPAN". This programme calculates background by integrating areas indicated by the analyst on each side of the desired peak. This is then subtracted from the total peak area. The results were corrected for dead time, sample weight and half-lives. The programme has a built-in library of radionuclides. The analyst has to indicate the elements of interest to his investigation before the names and concentration of such elements are displayed if they are present in the sample whose energy spectrum is being analysed. Table 2 shows the elements of interest in this investigation with their nuclear characteristics.

Table 2: Elements of interest and their nuclear characteristics

Target isotope	**Product Isotope by(n,γ) reaction**	**Half life ($t_{½}$)**	**Gamma (γ) ray Energy (keV)**
^{23}Na	^{24}Na	14.96 h	1368, 2754
^{41}K	^{42}K	12.36 h	1524
^{55}Mn	^{56}Mn	2.58 h	846, 1810
^{164}Dy	^{165}Dy	2.33 h	95
^{26}Mg	^{27}Mg	9.46 min	1014
^{27}Al	^{28}Al	2.24 min	1778
^{45}Sc	^{46}Sc	83.81 d	889
^{48}Ca	^{49}Ca	8.72 min	3084

^{50}Ti	$_{51}$Ti	5.76 min	320
^{50}Cr	^{51}Cr	27.7 d	320
^{51}V	^{52}V	3.75 min	1434
^{58}Fe	^{59}Fe	44.5 d	1099
^{59}Co	^{60}Co	5.27 y	1173, 1332
^{64}Zn	^{65}Zn	243.9 d	1115
^{75}As	^{76}As	26.3 h	559
^{81}Br	^{82}Br	35.3 h	776
^{85}Rb	^{86}Rb	18.8 d	1076
^{121}Sb	^{122}Sb	64.8 h	564
^{139}La	^{140}La	40.3 h	1596
^{151}Eu	^{152}Eu	13.3 y	1408
^{152}Sm	^{153}Sm	46.3 h	103
^{159}Tb	^{160}Tb	72 d	879
^{174}Yb	^{175}Yb	4.19 d	396
^{176}Lu	^{177}Lu	6.7 d	208
^{180}Hf	^{181}Hf	42.4 d	5482
^{181}Ta	^{182}Ta	115 d	1221
^{232}Th	^{233}Pa	27 d	312
^{238}U	^{239}Np	2.36 d	277

Results and Discussion

Elemental concentrations for fourteen elements in twenty-one ceramic samples have been obtained. Qualitative information were established for Na, K, Mn, and Dy, through short-lived irradiation, and for Sc, Cr, Cs, Fe, Co, Rb, Eu, Th, U and Hf through long-lived irradiation. To find the similarity between the samples, a multivariate statistical package, MINITAB on Windows version 10, containing a body of techniques called "cluster analysis" was employed. Clustering of the samples was performed using WARD methods, as shown in figure 2. This method commences with the number of cluster equal to the number of samples and links these together until only one cluster remains. The criteria for linking clusters is minimization of the error sum of squares given by

$$SS = \sum_{\text{cluster(c)}} \sum_{\text{samples(i)}} \sum_{\text{elements(j)}} \left(L_{ij} - L_{ij(c)}\right)^2$$

Where , $L_{ij(c)}$ = mean value of j for (c) to which sample i is assigned. WARD's method calculates the squared distance from each point in a cluster to the centre and sums

these to produce an "error sum of squares". The smaller and more tightly packed the cluster, the smaller the error sum of squares. Merging two clusters increases "SS" value, but the steps involving the smallest increases in SS are the ones considered by WARD's method (Oladipo, 1992)

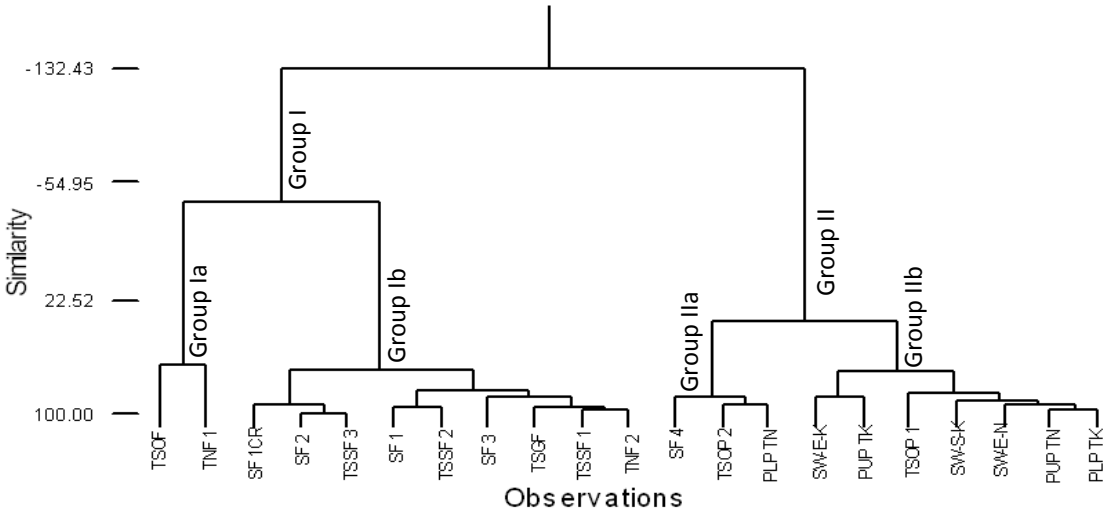

Figure 2: Dendrogram of furnace and potsherds

As can be seen in figure 2, the samples break into two major groups: I and II. Group I consists of only furnace samples, while group II consists of all potsherds with a furnace sample, SF4. Group I can be sub-divided into groups Ia and Ib. Group Ia consists of only two of Tsauni samples (TSOF and TNF1). Either this group is an outlier or the two samples were made with clay of different origin. Group Ib is sub-divided further into two groups. Each of these is heterogeneous group consisting mixture of furnaces from Samaru-west and Tsauni (SF1 CR, SF2, TSSF3, SF1, TSSF2, SF3, TSGF, TSSF1, and TNF2). The group II that consist mainly the potsherds can also be subdivided into groups IIa and IIb. The similarity between these groups is however higher, compared to groups Ia and Ib. Group IIa contains, in addition to two potsherds, a furnace sample (SF4), which is an outlier. The remaining two potsherds are a mixture of two sites (TSOP2 and PLPTN). Group IIb is heterogeneous in composition as it contains potsherd samples from all the three sites. (SWEK, PLPTK, TSOP1, SWSK, SWEN,PLPTN and PLPTK). It can be deduced from figure 2 that there is no distinct differences between the potsherds used in each of the sites. This agree to some extent with Oladipo *et al* (1992) who showed that Pantaki samples cluster with both Samaru-west and Tsauni sample. Two of Tsauni furnaces show higher dissimilarity with the rest, while the remaining five show great similarity with each other and with Samaru-west furnaces. The

implication of this result is that there was strong interaction between iron-smelters at these sites, as Effah-Gyamfi (1981) suggested. It is possible that some members of one of the site specialised in art of pot making and/or furnace making, and sell these to other communities that need them. This can explain why there could be great similarity between samples in different sites that are a few kilometres apart. It is however clear that the group of people making pot might be different to those moulding furnace, and use clay from different origin to that used for making the furnaces.

Conclusion

Using WARD procedures, Cluster analysis was conducted on samples of potsherds and furnace obtained from Samaru-west, Tsauni and Pantaki. The elemental concentrations in the samples were obtained by method of neutron activation analysis, using neutrons from a nuclear reactor. It was found that samples from the three sites are similar. There was dissimilarity however between potsherd and furnace samples. It was concluded that pot makers or furnace makers existed probably in one of the communities, whose primary occupation was to make and sell the product to others within and outside their communities. The pot makers are different from furnace makers. The pot makers obtained clay from common source. Similarly, the furnace makers obtained clay from a common source, which however, is different from that of pot makers.

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EFFECT OF SOIL MOISTURE AND AXLE LOAD ON DEPTH OF COMPACTION

By

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Abstract
The effect of soil moisture and axle load on depth of compaction was studied on loamy soil. It was observed that greater axle loads and wet soil conditions increase the depth of compaction in the soil profile. Compaction caused by heavy axle loads on wet soils can extend to depths of more than two feet.

Introduction

In many studies, it has been reported that soil compaction caused an increase in soil bulk density and soil strength, resulting in poor hydraulic and physical soil properties (Carter, 1990; Smith, 1997 & Arridsson, 1998).

Soil compaction, which refers to an increase in soil bulk density or decrease in soil porosity as a result of applied loads or pressure is a function of both compactive effort and the water content (Gill, 1959; Adelabu & Uno, 2001, 2004). Greater axle loads and wet soil conditions increases the depth of compaction in the soil profile. The total axle load, as well as contact pressure between the tire and the soil, affects subsoil compaction. As equipment weight increases, tire size also increases (Voorhees *et al,* 1986). It has been reported by Petersen et al, 1986, that deep or sub surface soil compaction is caused by tractors with high axle weights. As tractors becomes heavier, compaction stresses go deeper into the soil. Also, soil is more compressible when wet. Traffic during high moisture conditions may compact soil, whereas the same traffic under dry conditions will not. As soil dries, it has higher soil strength, making it less susceptible to compaction, and supports traffic more readily than a wet soil. The objective of this study is to evaluate the effect of compactive loads on soil at different moisture contents at different depth.

Materials and Methods

Five sets of PVC tubes of length 30cm and 7cm diameter each filled with soil samples identified as loamy were subjected to different levels of compaction (5,15 and 25 blows ,equivalent to pressures of 100,150 and 150Nm^{-2} respectively) using a proctor hammer at five different moisture levels at depths of 12, 14,16cm in an open field of Bwari

Area Council, Abuja. The dry Bulk density and optimal moisture contents were determined by weight.

Theoretical Considerations and Calculations

Soil compaction occurs when soil particles are pressed together, reducing pore space between them (Adelabu & Uno 2001). Heavily compacted soil contain large pore and have a reduced rate of both water infiltration and drainage from the compacted layer. In addition, the exchange of gases slows down in compacted soils causing an increase in the likelihood of aeration-related problem (Frisby et al, 1993). Soil compaction increases soil strength, the ability of soil to resist being more by an applied force (Petersen et al 1996).

Pressures exerted on the soil surface depend on the characteristics of the load of soil surface.

The porosity [P] of the soil is the ratio of total (air plus water) pores volume to total soil volume, usually expressed in per cent.

$$\text{Prorosity (P)} = 1 - \text{DBD/DSG} \quad \ldots\ldots (1)$$

Where DBC is the dry bulk density of the soil and DSG is the density of individual soil grain.

The proportion of total volume occupied by air-filled pores (PA) can be found using the formula:

$$PA = \frac{\text{Volume of air-filled pores}}{\text{Total soil volume}} \quad \ldots\ldots (2)$$

$$PA = \frac{\text{Porosity} - BD \times MC}{\text{Density of Water}} \quad \ldots\ldots (3)$$

Where MC is the moisture content given as:

$$MC = \frac{\text{Weight of Water in a Soil Sample}}{\text{Dry Weight of Soil Sample}} \times 100\ \% \quad \ldots\ldots (4)$$

Results and Discussions

The soils used in this study have the same texture and organic matter content. Our results indicated that the dry density of soils increased in compaction level for all PVC tubes, and the 25 hammer blows produced the highest density values. However, the optimum moisture content, which is the moisture content where the maximum dry density was reached, decreased as the number of hammer blows is increased.

Fig. 1 shows the relationship between moisture content and dry bulk density for one of the PVC tubes soils samples studied. As it can be seen, the dry density increased with increasing moisture contents until the maximum dry density was reached and decreased

after that point. The results of the analysis of variance showed that the efforts of soil type, and the number of blows on maximum dry density affect the porosity of the soil.

In general, soils with high amount of sand have the highest maximum dry density and the lowest optimum moisture content, but soils with finer textures have the highest optimum moisture and lowest dry density values (Smith et al, 1997). The effect of the number of hammer blows on soil porosity was very clear. While the mean porosity value was 54.43 (16 cm) at 5 hammer blows, it went to 50.62 (14cm) depth and 49.02 (12 cm depth) at 15 and 25 blows respectively.

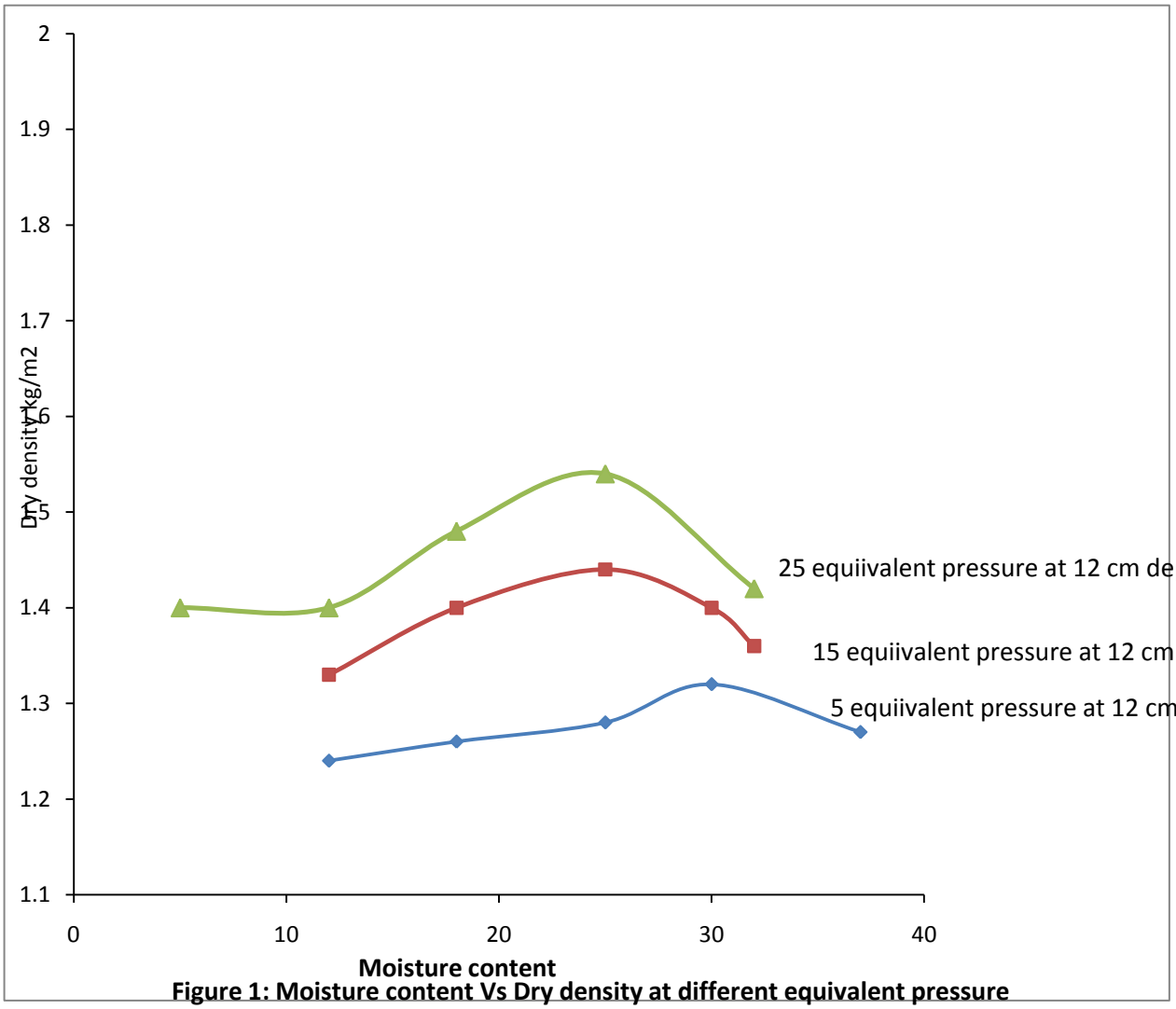

Figure 1: Moisture content Vs Dry density at different equivalent pressure

Conclusion

Our results indicated that the dry density of soils increased with increasing compaction level for all soils, and the 25 hammer blows produced the highest value of density. However, the optimum moisture content, which is the moisture content where the maximum dry density was reached decreased as the number of hammer blows increased.

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MEASUREMENTS OF CARBON MONOXIDE CONCENTRATIONS AND THE CREATION OF A UNIQUE GEOGRAPHICAL INFORMATION SYSTEM (GIS) LAYER MAP FOR CARBON MONOXIDE POLLUTION IN MINNA, NIGER STATE

By

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Abstract

Air pollution arising from the release of toxic gases during the process of combustion is commonly encountered in most households because the use of coal-powered and wood-fire hearths is widespread; the use of petrol- and diesel- powered generators is also becoming very popular. This study was undertaken in order to determine the trend of carbon monoxide concentrations in Minna, Niger State. Data acquisition procedure was facilitated by the use of the carbon monoxide meter, and about 6000 households were visited for this exercise. The data acquisition procedure was basically a house-to-house exercise whence the GPS unit and the CO meter were employed to gather geo-referenced data and CO pollution level data. The north-south axis of Minna from Maikunkele to Chanchaga and the east-west axis from Maitumbi to Kpakungu were covered in this investigation. All of the stations of interest occupied for this investigation showed insignificant levels of ambient concentrations of carbon monoxide, explaining the green dotted colour coding on the result maps. The major neighbourhoods of Minna township like Chanchaga, Maitumbi, Minna Central, Bosso, and Tunga have high green dot densities because of the high residence density of those areas. The insignificant values of carbon monoxide observed for this work is due to the fact the nearly all of the sources surveyed were outdoor sources that encourage rapid dispersion of the CO gas into the atmosphere. By use of the Geographical Information System (GIS) platform, a carbon dioxide pollution layer for Minna has been created, a novelty in itself. The final pollution map is a perfect guide to the overall CO pollution trend of Minna.

Keywords: Environmental pollution, geo-referencing, GIS, pollution map

Introduction

There is no doubt that air pollution arising principally from the release of toxic gases during the process of combustion is commonly encountered in most households. As a way out of the economic crunch, householders have now resorted to the use of coal-powered and wood-fire hearths thereby exposing families to pollution when these hearths are in use. Also the use of petrol- and diesel- powered generators by householders to generate their own electricity is a major source of air pollution. It is with this fact in mind that this project

was undertaken in order to determine the trend of carbon monoxide concentration in Minna, Niger State.

Carbon monoxide (chemical formula CO) is a colourless, odourless, tasteless, yet highly toxic gas. Its molecules consist of one carbon atom and one oxygen atom, connected by a covalent double bond and a dative covalent bond. It is the simplest oxo-carbon, and can be viewed as the anhydride of formic acid (CH_2O_2). Carbon monoxide is produced from the partial oxidation of carbon containing compound; it forms in preference to the more usual carbon dioxide (CO_2) when there is a reduced availability of oxygen, such as when operating a stove or an internal combustion engine in an enclosed space. Carbon monoxide has significant fuel value, burning in air with a characteristic blue flame, producing carbon dioxide. Despite its serious toxicity, it was once widely used (as the main component of coal gas) for domestic lighting, cooking and heating, and in the production of nickel. Carbon monoxide still plays a major role in modern technology, in industrial processes such as iron smelting and as a precursor to myriad products (www.carbon monoxide emission.com).

Environmental pollution is the disruption of the natural equilibrium between the living species and their natural environment. The degradation of the environment has resulted in increase in diseases, reduction of the average life spans and growth in infant mortality rates. Civilization appears to have gone berserk and the future of planet earth has never been in greater jeopardy than it is today (www.wikipedia.com).

Sources of carbon monoxide are numerous and prevalent in everyday life. In its natural state, carbon monoxide will usually dissipate quickly over a large area without posing any significant threat to human health. However, non-natural carbon monoxide emissions produced as a result of incomplete burning of carbon-containing fuels, including coal, wood, charcoal, natural gas, and fuel oil, are harmful to the body. The three main areas of carbon monoxide emissions are residential, industrial, and in the field of transportation.

Carbon monoxide concentration is measured in parts per million (ppm), a standard measurement unit in which zero is the lowest level on the scale. Typical concentrations are given below:

- 0.1ppm - natural background atmosphere level
- 0.5 to 5ppm - average background level in homes
- 5 to 15ppm - levels near properly adjusted gas stoves in homes
- 5,000ppm - chimney of a home wood fire
- 7,000ppm - undiluted warm car exhaust - without catalytic converter

The natural background atmosphere level is 0.1ppm (parts per million) which is very convenient to life in the environment. The average carbon monoxide levels in homes without

gas stoves vary from 0.5 to 5ppm (parts per million). Levels near properly adjusted gas stoves in homes are often 5 to 15ppm (parts per million) and those near poorly adjusted stoves are 30ppm or higher.

For healthy adults, carbon monoxide becomes toxic when it reaches a level higher than 50ppm (parts per million) with continuous exposure over an eight hour period. When the level of carbon monoxide becomes higher than that, a person will suffer from symptoms of exposure. Mild exposure over a few hours (a carbon monoxide level between 70ppm and 100ppm) include flu-like symptoms such as headaches, sore eyes and a runny nose. Medium exposure (a carbon monoxide level between 150ppm to 300ppm) will produce dizziness, drowsiness and vomiting. Extreme exposure (a carbon monoxide level of 400ppm and higher) will result in unconsciousness, brain damage and death.

Inhaled carbon monoxide will rapidly accumulate in the blood and deplete its ability to carry oxygen throughout the body. Depending on the amount of CO inhaled, the significant harmful effects caused by this gas can lead to carbon monoxide poisoning. Carbon monoxide can poison or kill an individual with little warning. There are a number of symptoms that are indicators of possible carbon monoxide poisoning. These symptoms vary depending on the amount of exposure to the actual poison. Recently, studies have been performed to show that chronic carbon monoxide poisoning can result in long term, residual effects on our bodies.

Because carbon monoxide is odorless and colorless it is not always evident when it has become a problem in the home. Often people who have a mild to moderate problem will find they feel sick while they spend time at home. They might feel a little better outside in the fresh air but will have re-occurring symptoms shortly after returning home. If other members of the family have re-occurring bouts with flu-like symptoms while fuel-burning appliances are being used it may be time to have the house checked by a professional. Besides having a professional come into your home to check your appliances a carbon monoxide detector can be used to keep a constant watch over the levels of carbon monoxide in the home throughout the year.

Persily (1996) has studied carbon monoxide (CO) dispersion in residential buildings. He noted that studies involving measurements of carbon monoxide concentrations in residential buildings have been concerned chiefly with single-family residences. These studies include CO exposure studies in which personal exposure monitors were used to determine CO concentrations associated with various activities and micro environments. There have also been a number of indoor air quality surveys of large numbers of residential buildings in which multiple indoor pollutants were sampled,

including CO. While these surveys have generally employed only a single CO sampling location in each building, they provide information on indoor levels and the sources associated with indoor CO. A limited number of studies have involved multi-point sampling of CO. Finally, there have been a number of investigations of the factors that impact CO concentrations and the spatial and temporal variation in these concentrations. While not all of the studies indicate where and at what height the CO concentration was measured, this information is provided when it is available.

There have been a number of studies designed to determine the levels of human exposure to CO. These studies have included personal monitoring studies in which occupants wore personal exposure monitors for 24 hours or more and recorded their activities and locations in diaries (Akland et al., 1985; Nagda and Koontz, 1985). These studies have provided information on CO exposure as a function of activity and micro environment, such as parking garages, motor vehicles, outdoors, and residential buildings. Some studies have focused on CO exposure in buildings, and in some cases on exposure in specific locations within buildings. One of these studies focused on men with ischemic heart disease, in which they wore personal CO monitors that recorded one minute average CO concentrations (Colome et al., 1992). The study participants also maintained written diaries of their activities, locations and symptoms. In addition to information on health symptoms, the results of this study included information on CO exposure as a function of occupant activity and location. The highest personal exposures were associated with driving automobiles and using small gasoline appliances for lawn care or cutting wood, and CO concentrations are reported for a number of indoor spaces including residential buildings by room type, e.g. kitchen, living room, and bedroom. In residential buildings, mean one-minute CO exposures ranged from 4mg/m^3 to 4.6mg/m^3 (3.5ppm and 4.0ppm) in family rooms, kitchens, dining rooms and living rooms, from 2.4mg/m^3 to 3.4mg/m^3 (2.1ppm and 3.0ppm) in bedrooms, bathrooms and laundry rooms, and 4.5mg/m^3 (3.9ppm) in garages or enclosed carports. However, maximum concentrations were above 100mg/m^3 (87ppm) in family rooms, kitchens and garages/carports.

A relatively recent study focused specifically on the factors that affect indoor CO levels in residential buildings (Colome et al., 1994; Wilson et al., 1993; Wilson et al., 1995). In this study, 48-h and 8-h average CO concentrations were monitored in about 300 homes in California and were related to a number of variables including the concentrations of other pollutants, house characteristics, ventilation rates, appliance type, and occupant activities. Statistical analyses were performed to determine the relationship between indoor CO concentrations and these variables. Of the 277 homes for which CO was reported, 13 had 8-h average concentrations above 10mg/m^3 (9ppm), and one house had a 1-h average of

about 40mg/m^3 (35ppm). These two values correspond to the EPA ambient air quality standard. The findings of this study include that indoor CO levels are correlated with outdoor levels, and that high indoor CO is associated with cigarette smoking, gas fuel for cooking, wall furnaces and smaller houses. Some high levels were also associated with using gas ranges for heating and with attached garages.

There have been a number of studies in which CO concentrations were measured in residential buildings, some of which have addressed the impact of specific sources on indoor CO concentrations. In a study in manufactured houses less than 10years old, CO exposure was monitored at a single location in each house during potable kerosene heater operation (Williams et al., 1992). The sampling locations were about 0.5m (1.6ft) above the floor and about 2m to 4m (7ft to 13ft) from the heaters. The measurement showed that three of the eight houses studied had 8-h average concentrations above or near 10mg/m^3 (9ppm), the EPA 8-h ambient air quality standard. Seven of the houses had significant increases in indoor CO levels during heater operation, and one routinely had levels of 34mg/m^3 to 57mg/m^3 (30ppm to 50ppm) for prolonged periods.

In one of the few studies of CO in multifamily buildings, concentrations were monitored in 60 small apartments with kitchen ovens operating continuously (Tsongas and Hager, 1994). Carbon monoxide was monitored every 5min over the oven exhaust port, in the kitchen, and in adjacent rooms, until the concentrations reached steady state, which in some cases took more than one hour. The sampling locations in the kitchen were about 1.5m (5ft) above the floor, and about 0.9m (3ft) above the floor in adjacent rooms. In about half of the kitchens, the steady-state CO levels were about 10mg/m^3 (9ppm). With respect to the maximum steady-state levels at any measurement locations in each apartment, about 15% were above 40mg/m^3 (35ppm), 5% were above 230mg/m^3 (200ppm) and the highest concentration was 400mg/m^3 (350ppm). A similar study was conducted in 87 randomly-selected households in Chicago (Conibear et al., 1995). About one-half of the sites were single-family residences, half were apartments, and three were town houses. In this study, indoor CO was monitored during the operation of various combustion appliances including ovens, stoves, furnaces, boilers, water heaters, clothes dryers and space heaters. Initial peak and steady-state CO concentrations were analysed. The results revealed that 89% of the initial readings were below 1.1mg/m^3 (1.0ppm) and all were below 17mg/m^3 (15ppm). Of the steady-state levels, with all appliances operating, 48% were below 1.1mg/m^3 (1.0ppm), 92% were below 11mg/m^3 (10ppm), and all were below 25mg/m^3 (22ppm).

In a study of ventilation and indoor air quality in multi-family buildings, Parker (1986) measured CO in three apartments in a two- story, four-unit buildings. Carbon dioxide

concentrations were measured in the main living areas of each apartment, away from windows and outside doors. The measured CO concentrations were all 1mg/m^3 (0.9ppm) or less except when there was cigarette smoking, in which case they were below about 5mg/m^3 (4ppm). Another study of air movement and indoor air quality in several multi-family buildings in Canada, ranging from four to twenty-one stories, included CO measurements. The measured levels were generally below 5mg/m^3 (4ppm) (Gulay et al.,1993). Levels above 5mg/m^3 (4ppm), up to 13mg/m^3 (11ppm), appeared to be associated with underground parking garages. The report on this study did not include much detail on the measurements, such as the sampling duration and location. These studies of CO levels in residential buildings have shown that indoor concentrations are generally low compared to ambient and occupational standards, which are based on averages over several hours. However, under some circumstances and in a relatively small number of buildings, these average values and short-term peak values can be significantly above the values in these standards.

Objectives of Study

The principal objectives of this project work are as follows:

(i) To help prepare the framework for a carbon monoxide pollution database for Minna; this project will be the substratum upon which subsequent studies would be laid.

(ii) To help build the nucleus for an environmental awareness advocacy programme to be funded and executed by the Niger State Government.

Methodology

Co-ordinate Identification: Whilst it would have been inconvenient doing full-scale house-to-house identification in the traditional manner because a significant portion of Minna town still remains in haphazard condition and street identifiers are conspicuously missing, co-ordinate identification for this project exercise was facilitated by the use of hand-held Global Positioning System (GPS) units. A GPS unit measures the geographical location (and elevation) of a place in terms of its longitude and latitude in units of degrees, minutes and seconds. The operation of this device is done in open spaces, away from trees, tall buildings, and high tension cables which could be sources of interference of the signals transmitted to satellites in space. As soon as the device is switched on, signals are sent from the device to a special network of geostationary satellites. When at least three or four of these satellites are located, the location or elevation of any point on the surface of the earth could be fixed within an acceptable margin of error. A typical GPS device is shown in Fig.1.

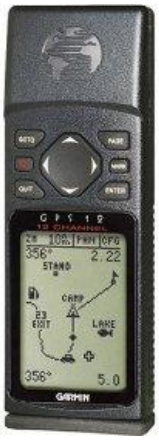


Fig.1. Typical GPS device

Field Equipment: The carbon monoxide gas meter was the core sampling equipment employed in the course of this project work. It is used to determine the ambient level of carbon monoxide concentration in the atmosphere. The sampling equipment is a potable handheld device which is easily carried around and used both indoors and outdoors, and measures the gas in a unit of parts per million (ppm). The device is powered by the use of two dry cell batteries; the power button is used to switch it on which later the screen is displayed with the manufacture brand name then the menu. When asked to display the reading the entre button is pushed and the reading is displayed which initially fluctuates until a steady value is gotten. A typical Carbon monoxide gas meter device is shown in Fig.2.

Fig.2. Typical carbon monoxide gas meter device

Data Collection Procedure: The data acquisition procedure was basically a house-to-house exercise whence the GPS unit and the CO meter were employed together to gather geo-referenced data and CO pollution level data. In all about 6000 homes were covered in this exercise. The north-south axis of Minna from Maikunkele to Chanchaga and the east-west axis from Maitumbi to Kpakungu were covered in this investigation.

Dataset of Study: About 6000 households strations were occupied for this study. The dataset collected from the field are usually presented in conformance with the Geographic Information System (GIS) protocol in terms of single static source representing a point

shape, their numerical IDs, latitude, longitude, conventional locations on the ground, sources of carbon monoxide, rated output of sources (where applicable), measured carbon monoxide values, and the presence or absence of carbon monoxide (determined from a comparison of the measured values with the threshold value). An abridged form of the dataset is presented as Table 1.

Table 1: Abridged Form of Dataset of Study

Shape	*ID*	*Coordinates*		*Location*	*Pollution Sources*	*Power Rating*	*C0 Value*	*Remarks*
		9.6406	6.5292	Okada Road	Charcoal		2	Absent
Point	1				Hearth			
		9.6407	6.5295	Okada Road	Charcoal		2	Absent
Point	2				Hearth			
		9.6394	6.5292	Okada Road	Firewood		3	Absent
Point	3				Hearth			
		9.6389	6.5299	Okada Road	Firewood		3	Absent
Point	4				Hearth			
Point	5	9.6388	6.5299	Okada Road	Generator		2	Absent
Point	6	9.6385	6.5299	Okada Road	Generator		3	Absent
Point	7	9.6384	6.5300	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	8	9.6385	6.5302	Okada Road	Generator	1.5kw/220v/50Hz	1	Absent
		9.6377	6.5303	Okada Road	Firewood		3	Absent
Point	9				Hearth			
Point	10	9.6375	6.5303	Okada Road	Generator	7.5kw/220v/50Hz	2	Absent
		9.6371	6.5305	Okada Road	Firewood		3	Absent
Point	11				Hearth			
Point	12	9.6366	6.5307	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6362	6.5308	Okada Road	Firewood		3	Absent
Point	13				Hearth			
		9.6361	6.5309	Okada Road	Charcoal		2	Absent
Point	14				Hearth			
		9.6361	6.5309	Okada Road	Milling	1200w/220v/50Hz	0.5	Absent
Point	15				Machine			
Point	16	9.6362	6.5309	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	17	9.6492	6.5229	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent

Point	18	9.6492	6.5230	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	19	9.6491	6.5231	Okada Road	Generator	1.5kw/220v/50Hz	1	Absent
		9.6490	6.5232	Okada Road	Firewood		3	Absent
Point	20				Hearth			
		9.6489	6.5233	Okada Road	Charcoal		2	Absent
Point	21				Hearth			
		9.6488	6.5233	Okada Road	Firewood		3	Absent
Point	22				Hearth			
Point	23	9.6488	6.5235	Okada Road	Stove		3.5	Absent
		9.6486	6.5236	Okada Road	Firewood		3	Absent
Point	24				Hearth			
		9.6485	6.5238	Okada Road	Milling	1200w/220v/50hz	0.5	Absent
Point	25				Machine			
Point	26	9.6478	6.5244	Okada Road	Generator	1.5kw/220v/50Hz	1	Absent
Point	27	9.6477	6.5245	Okada Road	Generator	1.5kw/220v/50Hz	1	Absent
		9.6476	6.5246	Okada Road	Firewood		3	Absent
Point	28				Hearth			
		9.6475	6.5247	Okada Road	Charcoal		3	Absent
Point	29				Hearth			
		9.6472	6.5243	Okada Road	Firewood		3	Absent
Point	30				Hearth			
		9.6469	6.5241	Okada Road	Charcoal		3	Absent
Point	31				Hearth			
		9.6468	6.5238	Okada Road	Firewood		3	Absent
Point	32				Hearth			
Point	33	9.6472	6.5249	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	34	9.6467	6.5252	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	35	9.6466	6.5253	Okada Road	Generator	2.0kw/220v/50Hz	2	Absent
		9.6464	6.5254	Okada Road	Firewood		3	Absent
Point	36				Hearth			
Point	37	9.6459	6.5251	Okada Road	Stove		3.5	Absent
Point	38	9.6459	6.5249	Okada Road	Stove		3.5	Absent
Point	39	9.6460	6.5245	Okada Road	Generator	11.5kw/220v/50Hz	1	Absent
Point	40	9.6461	6.5242	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	41	9.6458	6.5236	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent

Point	42	9.6457	6.5235	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	43	9.6478	6.5891	Mypa Road	Generator	7.5kw/220v/50Hz	2	Absent
Point	44	9.6479	6.5293	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	45	9.6507	6.5334	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	46	9.6509	6.5334	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	47	9.6482	6.5302	Mypa Road	Generator	7.5kw/220v/50Hz	2	Absent
		9.6487	6.5309	Mypa Road	Firewood		3	Absent
Point	48				Hearth			
Point	49	9.6488	6.5309	Mypa Road	Generator	7.5kw/220v/50Hz	2	Absent
		9.6509	6.5335	Mypa Road	Motor		3	Absent
Point	50				cycles			
Point	51	9.6479	6.5295	Mypa Road	Generator	11.5kw/220v/50Hz	3	Absent
		9.6479	6.5293	Mypa Road	Firewood		3	Absent
Point	52				Hearth			
		9.6492	6.5314	Mypa Road	Motor		2	Absent
Point	53				cycles			
		9.6465	6.5266	Mypa Road	Firewood		3	Absent
Point	54				Hearth			
		9.6469	6.5264	Mypa Road	Charcoal		2	Absent
Point	55				Hearth			
Point	56	9.6469	6.5271	Mypa Road	Generator	2.0kw/220v/50Hz	2	Absent
		9.6467	6.5265	Mypa Road	Charcoal		1	Absent
Point	57				Hearth			
		9.6472	6.5269	Mypa Road	Charcoal		3	Absent
Point	58				Hearth			
Point	59	9.6468	6.5264	Mypa Road	Generator	1.5kw/220v/50Hz	3	Absent
		9.6473	6.5266	Mypa Road	Firewood		3	Absent
Point	60				Hearth			
Point	61	9.6471	6.5271	Mypa Road	Generator		2	Absent
		9.6472	6.5261	Mypa Road	Charcoal	2.0kw/220v/50Hz	3	Absent
Point	62				Hearth			
Point	63	9.6474	6.5290	Mypa Road	Generator		2	Absent
Point	64	9.6474	6.5266	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
Point	65	9.6475	6.5268	Mypa Road	Stove		3.5	Absent
Point	66	9.6474	6.5267	Mypa Road	Generator	7.5kw/220v/50Hz	2	Absent

Point	67	9.6419	6.5264	Mypa Road	Generator	7.5kw/220v/50Hz	2	Absent
		9.6418	6.5266	Mypa Road	Charcoal		2	Absent
Point	68				Hearth			
Point	69	9.6417	6.5272	Mypa Road	Stove		3.5	Absent
Point	70	9.6419	6.5267	Mypa Road	Stove		3.5	Absent
		9.6420	6.5267	Mypa Road	Firewood		3	Absent
Point	71				Hearth			
Point	72	9.6421	6.5267	Mypa Road	Stove		3.5	Absent
Point	73	9.6424	6.5268	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6425	6.5268	Mypa Road	Charcoal		2	Absent
Point	74				Hearth			
		9.6427	6.5268	Mypa Road	Firewood		3	Absent
Point	75				Hearth			
Point	76	9.6428	6.5268	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6431	6.5268	Mypa Road	Firewood		3	Absent
Point	77				Hearth			
		9.6432	6.5268	Mypa Road	Firewood		3	Absent
Point	78				Hearth			
		9.6435	6.5269	Mypa Road	Charcoal		2	Absent
Point	79				Hearth			
		9.6438	6.5269	Mypa Road	Firewood		3	Absent
Point	80				Hearth			
		9.6438	6.5270	Mypa Road	Firewood		3	Absent
Point	81				Hearth			
		9.6429	6.5277	Mypa Road	Firewood		3	Absent
Point	82				Hearth			
		9.6417	6.5285	Okada Road	Diesel	14.kw/220v/50Hz	1	Absent
Point	83				Engine			
		9.6414	6.5288	Okada Road	Firewood		3	Absent
Point	84				Hearth			
Point	85	9.6411	6.5289	Okada Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6476	6.5277	Mypa Junction	Firewood		3	Absent
Point	86				Hearth			
		9.6472	6.5278	Mypa Junction	Charcoal		2	Absent
Point	87				Hearth			

Point	88	9.6496	6.5219	Mypa Junction	Generator	1.5kw/220v/50Hz	1	Absent
		9.6471	6.5278	Mypa unction	Charcoal		2	Absent
Point	89				Hearth			
		9.6483	6.5303	Mypa Junction	Charcoal		2	Absent
Point	90				Hearth			
		9.6502	6.5326	Mypa unction	Firewood		3	Absent
Point	91				Hearth			
Point	92	9.6476	6.5276	Mypa unction	Generator		3	Absent
Point	93	9.6494	6.5314	Mypa unction	Stove		3.5	Absent
Point	94	9.6413	6.5336	Mypa unction	Stove		3.5	Absent
		9.6475	6.5278	Mypa unction	Charcoal		2	Absent
Point	95				Hearth			
Point	96	9.6476	6.5271	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6477	6.5265	Mypa Road	Charcoal		2	Absent
Point	97				Hearth			
Point	98	9.6473	6.5261	Mypa Road	Generator	2.0kw/220v/50Hz	3	Absent
		9.6472	6.5264	Mypa Road	Firewood		3	Absent
Point	99				Hearth			
		9.6458	6.5273	Mypa Road	Charcoal		2	Absent
Point	100				Hearth			

Creation of a Unique GIS Layer of Carbon Monoxide Pollution Level Map for Minna

Concept of GIS: A Geographical Information System also known as GIS is a computer based system which is used to digitally reproduce and analyse the features present on the earths surface and the events that take place on it. It doesn't really matter whether the organisation is a small business, a multinational conglomerate, a governmental department or local authority, two very important facts stand out:

(a) A lot of the information will be geographically referenced and

(b) The more information one has, the harder it becomes to manage and interpret them.

Bearing in mind that up to 70% of all information in circulation possesses a common denominator of geography, it is now clear that GIS must be incorporated to help in decision-making based upon geographical information. Unlike any other type of information handling tool, GIS can understand the concept of location. GIS is a computer system capable of assemblying, manipulating and displaying geographically referenced information (i.e. data identified closely to

their location). Also the GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. Practitioners also regard the total GIS as including operating personal and the data that go into the system. A GIS would allow emergency planning to easily calculate emergency responsiveness in the event of a natural disaster.

Digitisation of Analogue Map of Study Area

Digitisation is a simplification process that converts all spatial data to a point (e.g., a well), a line (e.g., a stream), a polygon formed by a closed, complex line (e.g., a lake), or a grid cell. Digitisation reduces all spatial entities to these simple forms because they were easy to store in the computer. A GIS database cannot readily recognize features or entities as human map users do. For example, we cannot enter the entity "lake" into a GIS. Rather, we entered the spatial data coordinates for the lake's shoreline as a polygon. Later, the attributes of the lake will be entered into the GIS database and will be associated with the polygon. Following the digitization of map features, the user completes the compilation phase by relating all spatial features to their respective attributes, and by cleaning up and correcting errors introduced as a result of the data conversion process. The end results of compilation was a set of digital files, each accurately representing all of the spatial and attribute data of interest contained on the original map manuscripts. These digital files contained geographic coordinates for spatial objects (points, lines, polygons, and cells) that represent mapped features. Although we conceptualize the GIS as a set of registered map layers, the GIS actually stores these data at a much more primitive level. The digitised map of the study area on ArcView3.3 is shown in Fig.3.

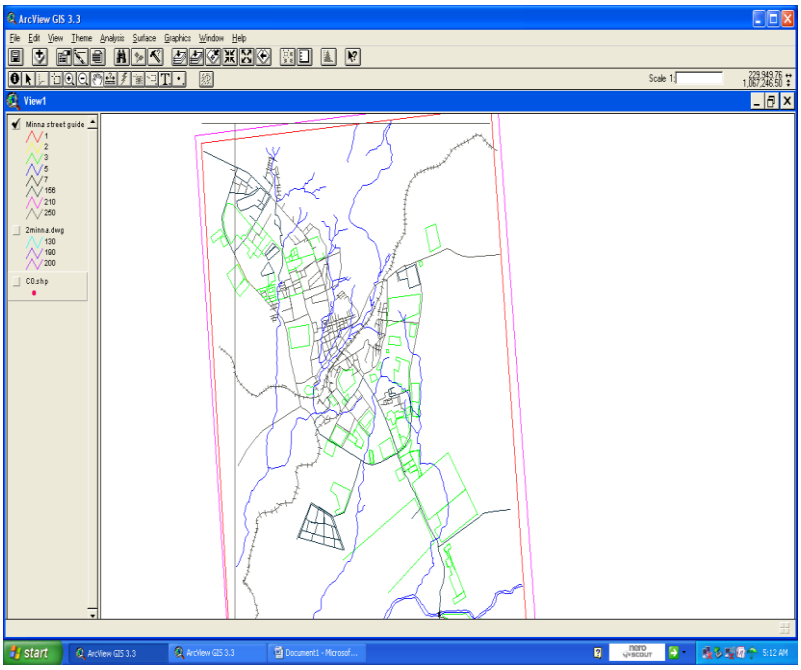
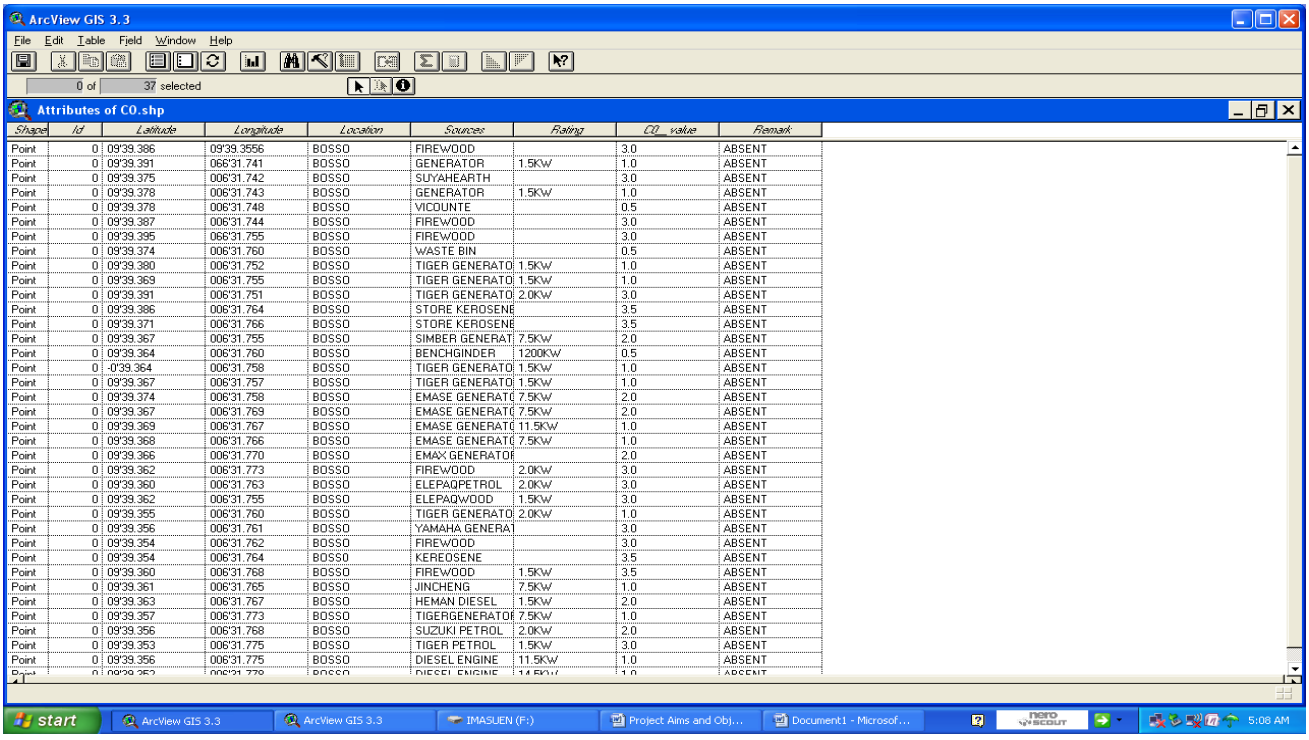


Fig.3. Digitised map of study area

Creation of a Database and Carbon Monoxide Pollution Layer Map ArcView3.3 Platform

The conventional database contains rows and columns, geographical coordinates of the locations of noise, sources of noise, rating, noise level, and pollution status (see Table 1). This same dataset on the ArcView3.3 is shown in Fig.4.



Shape	Id	Latitude	Longitude	Location	Sources	Rating	CO_value	Remark
Point	0	09'39.386	09'39.3556	BOSSO	FIREWOOD		3.0	ABSENT
Point	0	09'39.391	066'31.741	BOSSO	GENERATOR	1.5KW	1.0	ABSENT
Point	0	09'39.375	006'31.742	BOSSO	SUYAHEARTH		3.0	ABSENT
Point	0	09'39.378	006'31.743	BOSSO	GENERATOR	1.5KW	1.0	ABSENT
Point	0	09'39.378	006'31.748	BOSSO	VICOUNTE		0.5	ABSENT
Point	0	09'39.387	006'31.744	BOSSO	FIREWOOD		3.0	ABSENT
Point	0	09'39.395	066'31.755	BOSSO	FIREWOOD		3.0	ABSENT
Point	0	09'39.374	006'31.760	BOSSO	WASTE BIN		0.5	ABSENT
Point	0	09'39.380	006'31.752	BOSSO	TIGER GENERATO	1.5KW	1.0	ABSENT
Point	0	09'39.369	006'31.755	BOSSO	TIGER GENERATO	1.5KW	1.0	ABSENT
Point	0	09'39.391	006'31.751	BOSSO	TIGER GENERATO	2.0KW	3.0	ABSENT
Point	0	09'39.386	006'31.764	BOSSO	STORE KEROSENE		3.5	ABSENT
Point	0	09'39.371	006'31.766	BOSSO	STORE KEROSENE		3.5	ABSENT
Point	0	09'39.367	006'31.755	BOSSO	SIMBER GENERAT	7.5KW	2.0	ABSENT
Point	0	09'39.364	006'31.760	BOSSO	BENCHGINDER	1200KW	0.5	ABSENT
Point	0	-0'39.364	006'31.758	BOSSO	TIGER GENERATO	1.5KW	1.0	ABSENT
Point	0	09'39.367	006'31.757	BOSSO	TIGER GENERATO	1.5KW	1.0	ABSENT
Point	0	09'39.374	006'31.758	BOSSO	EMASE GENERATO	7.5KW	2.0	ABSENT
Point	0	09'39.367	006'31.769	BOSSO	EMASE GENERATO	7.5KW	2.0	ABSENT
Point	0	09'39.369	006'31.767	BOSSO	EMASE GENERATO	11.5KW	1.0	ABSENT
Point	0	09'39.368	006'31.766	BOSSO	EMASE GENERATO	7.5KW	1.0	ABSENT
Point	0	09'39.366	006'31.770	BOSSO	EMAX GENERATOR		2.0	ABSENT
Point	0	09'39.362	006'31.773	BOSSO	FIREWOOD	2.0KW	3.0	ABSENT
Point	0	09'39.360	006'31.763	BOSSO	ELEPAQPETROL	2.0KW	3.0	ABSENT
Point	0	09'39.362	006'31.755	BOSSO	ELEPAQWOOD	1.5KW	3.0	ABSENT
Point	0	09'39.355	006'31.760	BOSSO	TIGER GENERATO	2.0KW	1.0	ABSENT
Point	0	09'39.356	006'31.761	BOSSO	YAMAHA GENERA1		3.0	ABSENT
Point	0	09'39.354	006'31.762	BOSSO	FIREWOOD		3.0	ABSENT
Point	0	09'39.354	006'31.764	BOSSO	KEREOSENE		3.5	ABSENT
Point	0	09'39.360	006'31.768	BOSSO	FIREWOOD	1.5KW	3.5	ABSENT
Point	0	09'39.361	006'31.765	BOSSO	JINCHENG	7.5KW	1.0	ABSENT
Point	0	09'39.363	006'31.767	BOSSO	HEMAN DIESEL	1.5KW	2.0	ABSENT
Point	0	09'39.357	006'31.773	BOSSO	TIGERGENERATOR	7.5KW	1.0	ABSENT
Point	0	09'39.356	006'31.768	BOSSO	SUZUKI PETROL	2.0KW	2.0	ABSENT
Point	0	09'39.353	006'31.775	BOSSO	TIGER PETROL	1.5KW	3.0	ABSENT
Point	0	09'39.356	006'31.775	BOSSO	DIESEL ENGINE	11.5KW	1.0	ABSENT

Fig.4. Database of study area on ArcView3.3

The database was inputted and hot-linked to the spatial data (map and coordinate). Colour coding was specified whence red dots indicate presence of pollution and green dots points indicate insignificant pollution levels. The result of the process of hot-linking the database and the digitised map on ArcView3.3 to produce the pollution status map is shown in shown in Fig.5.

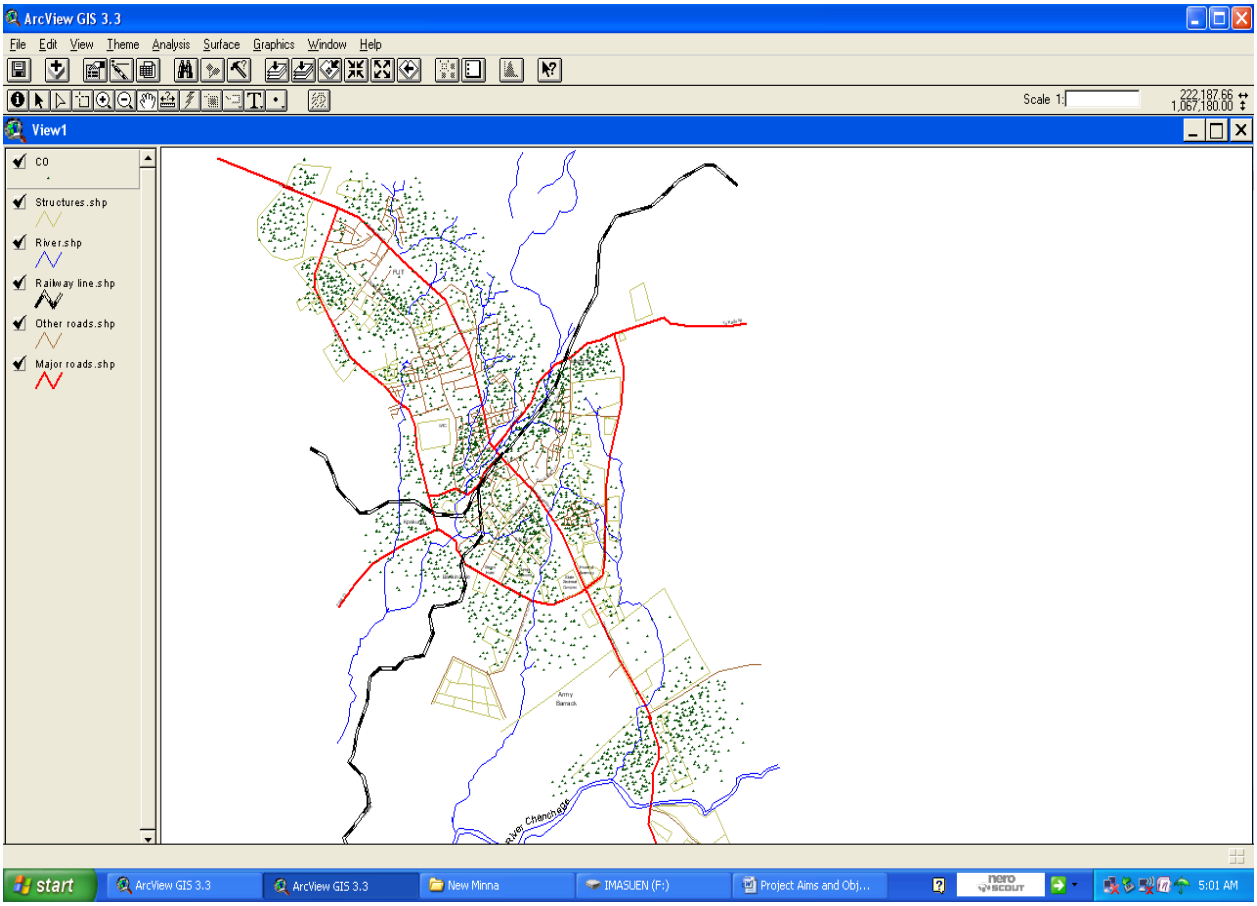


Fig.5. Result of hot-linking the database and the digitised map on ArcView3.3 to produce the pollution status map

Presentation of Carbon Monoxide Emission Layer Map

The CO emission layer map for Minna is shown in Fig.6.

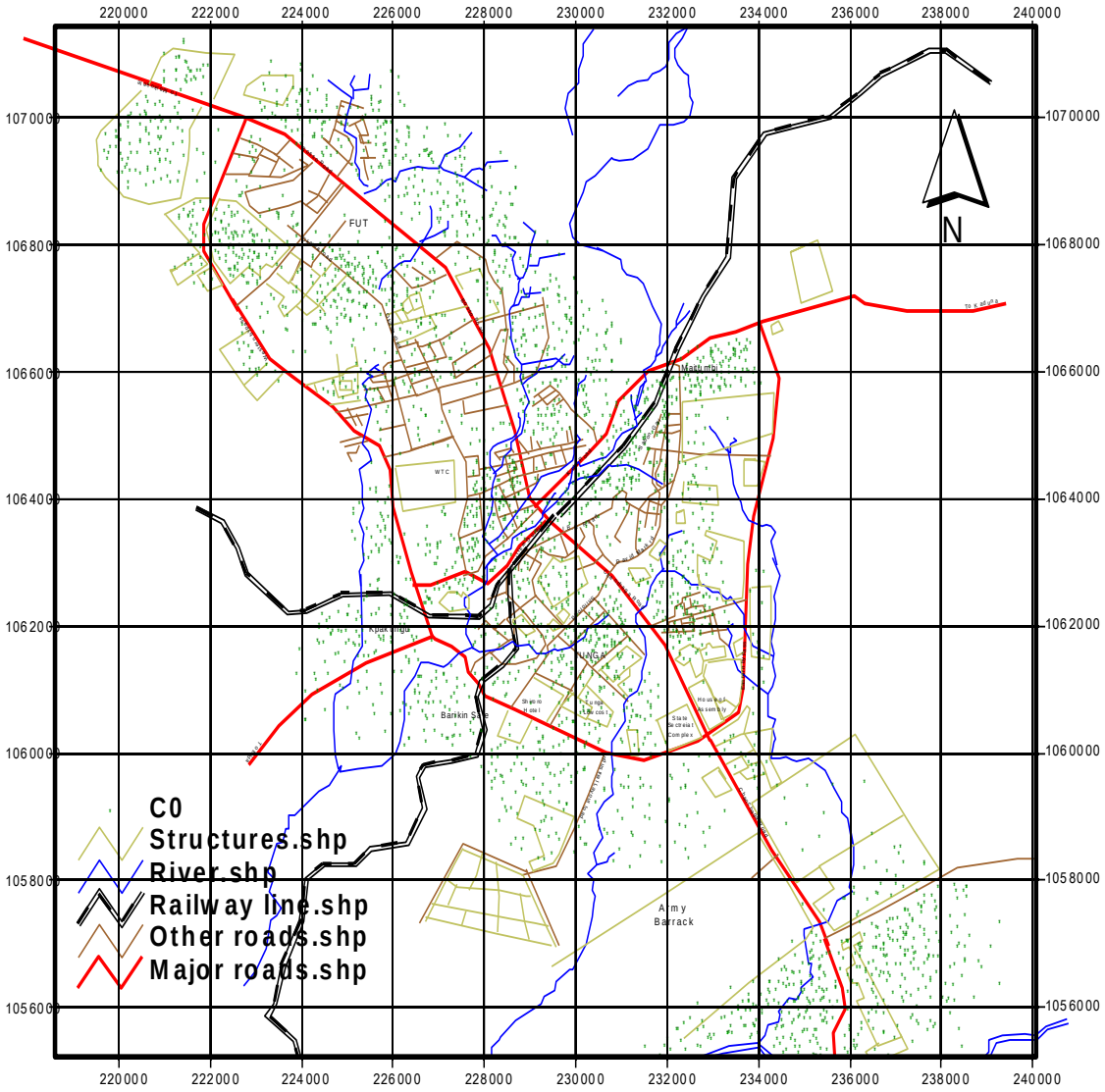


Fig. 6: The Carbon monoxide emission layer map for Minna

Results and Conclusion

All of the stations of interest occupied for this project work show insignificant level of ambient concentration of carbon monoxide, explaining for the green dotted colour coding. However, from Fig.6 we see that the major neighbourhoods of Minna township like Chanchaga, Maitumbi, Minna Central, Bosso, and Tunga have high green dot densities because of the high residence density of those areas. It also observed that the green dots are spread over the central region of Minna territory corresponding to residency patterns.

The insignificant values of carbon monoxide observed for this work is due to the fact the nearly all of the sources surveyed were outdoor sources that encourage rapid dispersion of the CO gas in the atmosphere. Nevertheless, the final pollution map is a perfect guide to the overall air pollution trend of Minna.

Recommendation

In spite of the fact that CO pollution is absent in all the household surveyed in Minna, the study group members recommend that public health awareness campaign should nevertheless be initiated to better educate the populace on the hazards of over-exposure to combustion products.

The result of this study is actually futuristic in its outlook, thus it is strongly recommended that a GIS host platform for Minna be created so that the interactive nature of the carbon monoxide pollution map of Fig.6 can be fully exploited.

It is also recommended that novelty studies of this kind be replicated in the major towns and cities of Nigeria.

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ARTICLES AND RESEARCH REPORTS ON TECHNOLOGY

PRODUCTION AND CHARACTERIZATION OF BLOOD TONIC CONSTITUENTS FROM LOCAL HERBS

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Abstract

This paper investigates the presence of blood tonic constituents in local herbs. Phytochemical analysis were carried out on each extract obtained from the barks of theobroma cacao, khaya senegalensis, treculia africana, magnifer indica; pod of parkia filicodea (African locust bean); chaff of sorghum bicolor and spectrophotometric analysis of the mixture extract of these herbs were also carried out. Phytochemical analysis shows that the above named herbs extract contain compounds of alkaloids, saponins, and tannin sesquiterpenes in different proportions. The spectrophotometric analysis shows that the mixture extract contains moderate quantities of vitamin B1 (thiamine), Vitamin B6 (pyridoxine), Vitamin B2-5 phosphate and low amount of ferrous gluconate. Through the characterization, it could be deduced that the above mentioned herb sample has important pharmacological effects and components that are suitable for blood tonic production.

Introduction

Medicinal plants are known to provide a rich source of raw materials for traditional medicine in Africa and other parts of the developing world. There is hardly any need to stress that about 85% of Africans living on the continent are forced to resort to traditional medicine and other practitioners for the continued preservation of their health and also to alleviate their diverse sufferings (Usman, 1990).

It is an established fact that many diseases were treated and still being treated in traditional medical practice with great success. From literature and oral tradition, the diseases which have been or claimed to have been treated with success include malaria, epilepsy, anemia, infertile convulsion, diarrhea, dysentery, bacterial and fungi infections, mental illness, asthma, diabetes, warm infestation, pains, colic and ulcers etc (Akinde, 1980). In addition, medicinal plants have been synthesizing a large variety of chemical substances since their first day of life on earth. These substances include, in addition to the basic metabolites, phenolic compounds, terpenes, steroids, alkaloids, glycosides and a host of other chemical substances referred to as secondary metabolites which are of no importance to the plant's own life but possess important therapeutic properties in the treatment and cure of human diseases (Sofowora, 1982).

In recent time, our traditional medical practice has been subjected to scientific studies. These studies have been mainly on the herbal substances used in the practice, in an attempt to validate the efficiency of such substances. The studies have been on the pharmacology and toxicology of extractives from the plants, isolation and chemical

characterization of the active principles, and to a limit extent, formulation of the substances as medicine (Okpaniyi, 1997). The scientist however who has the task of compiling and evaluating so many common used medicinal plants must establish their botanical profiles and their pharmaceutical potentials including where possible their dosage and uses (Balami, 1984). The extraction of the active constituents such as alkaloids, tannins, phylobatanins, sesquiterpenes etc. was accomplished by the use of phytochemical analysis (Trease & Evans, 1978). Medicinal plant parts had been used in recent times in the preparation of blood tonic mixture by boiling the herbs to a certain temperature to obtain the mixture (Usman, 1990).

Blood tonic mixture is a liquid mixture that effectively corrects deficient hematopoiesis. The vital constituents contained in blood tonic mixture includes; vitamins B - complexes, folate and iron compounds. Literature show that series of works had been done on extraction of important chemicals from parts of plants but little has bee done so far on the preparation of blood tonic mixture using deduction of local herbs. In this investigation, the extract of each of the herb samples was considered for phytochemical analysis to determine the active constituents present and their medicinal values. Also, spectrophotometric method of analysis was performed on specified volume of the prepared mixture in order to determine their stability for blood tonic production.

Methodology

Collection and treatment of samples

Certain portion of each of the herb samples considered was weighed and dried in an oven at about 60°c, a temperature at which no overheating occurred and which is known to be high enough to put an immediate check on enzymic and respiratory action. Drying was completed within 24 hrs.

Hot water extraction

Hot distilled water was employed as solvent. 250ml of distilled water was heated with 30g of each herb sample in a 500ml beaker by placing it on a heater at a temperature of 60°c with the use of a thermometer. The mixture were allowed to settle down and left over night in the refrigerator. The extracts were filtered through filter papers (No. 1, Whatman, U. K.), and the filtrate were used for further analysis.

Phytochemical analysis

Extraction of alkaloids

2ml of each extract was treated with l0ml of 1% HCL in a water bath for 30mins. The solution was then treated with a few drop of Dragendorff's reagent. A whitish substance

was precipitated which is then allowed to settle and the solution drained off (Trease & Evans, 1978).

Extraction of tannins

20ml of each extract was mixed with 20ml of distilled water, then few drops of Iron III chloride was added to the mixture. A blue-green substance precipitated, it was allowed to settle and the solution was drained off (Trease & Evans, 1978).

Extraction of sesquiterpenes

0.5ml of each extract was mixed with 0.1ml of methanol by shaking several times. 0.4ml of 5% H_2SO_4 containing 0.5% ferric chloride solution was added to the mixture. The mixture was boiled on a water bath for a minute. A brownish coagulated substance precipitated and the solution drained off (Trease & Evans, 1978).

Extraction of phylobatanns

2ml of each extract was boiled with 5ml of 5% HCL. A red precipitate was observed and allowed to settle after which the solution was drained off (Trease & Evans, 1978).

Spectrophotometric analysis of mixture extract

Spectrophotometric analysis was performed on the mixture extract as follow:

Mixture extract preparation

The blood tonic herbs were considered and mixed in the proportion shown below;

(i) 220g sorghum bicolor chaff
(ii) 240g magnifera indica bark
(iii) 240g theobroma cacao bark
(iv) 200g parkia filicoidea pod
(v) 240g khaya senegalensis bark
(vi) 20g potash
(vii) 240g Treculia Africana bark

The herbs were boiled together for 30 minutes. The mixture was allowed to cool and then decanted.

Assay: ferrous gluconate

Test: 5ml of the mixture was transferred into 500ml volumetric flask, 20ml of 1M H_2SO_4 was added and made up to mark with water.

Standard: 200mg ferrous gluconate was weighed into another 50ml volumetric flask. Little quantity of 1M H_2S0_4 was added, and made up to mark with water. 1Oml of both test and standard was transferred into 50ml flask each. 4ml of 20% citric acid and 5 drops of thioglicolic acid were added and shaken. The mixture was then made up to mark with dilute ammonia solution. Then the absorbance was read at 550nm.

Assay: vitamin B2-5 phosphate

Test: 10ml of test was transferred into 100ml volumetric flask and made up to mark with water.10ml of the standard was also transferred into 100ml volumetric flask and made up to mark with water. 10ml of both standard and test was transfer into 50ml flask each. 2ml each of 20% citric acid and of 45% $KMN0_4$ solution were added to the mixture and shaken; the mixture was then allowed to stand for 2 minutes. 1ml of H_2O_2 solution was subsequently added and the solution was allowed to stand for 5 minutes and the absorbency was read at 450nm.

Standard: 300mg of B2-5 phosphate was weighed into 1000ml flask and made up to volume.

Blank: 10ml of the mixture was used without B2-5 phosphate and treated as above.

Assay: vitamin B1 (thiamine)

Bromothymol Blue Solution: 62.44mg of Bromothymol blue was weighed into a 250ml volumetric flask. It was dissolved and made up to volume with chloroform.

Standard: 40mg of Vitamin B1 was weighed into a 100ml flask, dissolved and made up to volume with water. 10ml of the resulting solution was pipette into a 250ml volumetric flask and made up to volume with chloroform.

Test: 100ml of the sample was pipette into a repeating funnel and treated as the above standard. The absorbency of both the standard and test was read at 420nm using chloroform as the blank.

Assay: vitamin B6 (pyridoxine)

Standard: 100mg of pyridoxine previously dried was weighed accurately into a 1000ml flask. 10ml of 0.1N HCL was added and shaken to dissolve; it was then diluted to 1000ml with water. 10ml from the resulting solution was pipette into a 100ml flask and made up to mark with 0.1N HCL.

Colour development: This was performed in a dry test tube and the following reagents were added in succession mixing after the other. 200ml of the test was measured into 200ml volumetric flask.

Table 1: different reagents used during the experiment

	Standard blank	Test	Test blank	Standard
Test	-	2ml	2ml	-
Isopropyl	4ml	4ml	4ml	4ml
Ammonium buffer 10.9	2ml	2ml	2ml	2ml
Boric acid	1ml	-	1ml	-
Water	1ml	-	1ml	-
Standard	2ml	-	-	2ml

Results and discussion

Table 2: Phytochemical analysis of the extract

	Extracts					
AC	**MTB**	**MATB**	**SC**	**LBP**	**CTB**	**ABTB**
Alkaloids	**-**	**-**	**-**	**-**	**++**	**-**
Anthraquinones	**-**	**-**	**-**	**-**	**-**	**-**
Cardial glycosides	**+**	**-**	**-**	**++**	**-**	**-**
Saponins	**+**	**++**	**-**	**-**	**-**	**+**
Tannin	**+**	**-**	**-**	**++**	**-**	**-**
Sesquiterpenes	**+**	**-**	**-**	**++**	**-**	**-**
Phylobatannins	**+**	**-**	**++**	**+++**	**-**	**-**

Active constituents = AC; Mango tree bark = MTB; Mahogany tree bark = MATB; Sorghum chaff = SC; Locust bean pod = LBP; Cocoa tree bark = CTB; African breadfruit tree bark = ABTB.

+++ Abundantly present.

++ Moderately present.

+ Sparing present

\- Absent.

Table 3: Spectrophotometric analysis of the mixture extract

Mixture extract			
Assay	**Absorbance test**	**Absorbance standard**	**Potency (mg)**
Vitamin B1 (thiamine)	**0.039**	**0.040**	**1.95**
Vitamin B2-5 phosphate	**0.061**	**0.082**	**1.04**
Vitamin B6 (pyridoxine)	**0.049**	**0.030**	**2.0**
Ferrous gluconate	**0.024**	**0.576**	**8.33**

Discussion

Phytochemical analysis is the basis for the extraction of active constituents present in local herbs. Generally, the result of the phytochemical analysis of sample extracts obtained in this study (table 2) is close to those obtained in the literature (Oliver, 1960).

Compounds of alkaloids, tannins, cardiac glycosides, saponins, Sesquiterpenes and phylobatannins were found to be present in the sample extract (table 2) in different proportions and are soluble in water. While Anthraquinones were totally absent (although they are insoluble in water). The herbs samples collected contain some pharmacological components which are useful in medicine due to the presence of compounds of alkaloids and saponins. Alkaloids have a number of pharmacological properties which includes: central nervous system (CNS) and respiratory simulations, skeletal muscle stimulation, diuresis, cardiac stimulation and smooth muscle relaxation (Margaret & Brian, 1990). Saponins have low oral toxicity with potentially useful nutritive value. It reduces blood cholesterol levels in humans under conditions, which could be expected to induce high levels of blood cholesterol (Macrae, Robinson & Sadler, 1997).

The spectrophotometric method of analysis is used in determining the various vitamins and iron contents contained in mixture extract. The result obtained from the analysis of the mixture extract (table 3) shows that Vitamin B1 (thiamine), Vitamin B2-5 phosphate, Vitamin B6 (Pyridoxine) and ferrous gluconate were present in the extract. The Potency analysis of the mixture extract shows that Vitamin B1 (thiamine) is present in a moderate quantity with a value of 1.95mg, which falls within the specified range in the literature (1.8 - 2.4) mg (Macrae, Robinson & Sadler, 1997). The moderate value of Vitamin B1 in the mixture could be attributed to the labile nature of the nutrient. The Vitamin loss

noticed could be as a result of unprotected boiling that may be avoided through boiling in plastic bags. Thus, this shows that preparation technique does influence the loss (Bender, 1992). The potency of Vitamin B2-*5* phosphate is 1.04mg, this is in agreement with the ranges 1.3 - 1.7mg reported in the literature (Macrae, Robinson & Sadler, 1997). 8.33mg potency value obtained for Ferrous gluconate is very insignificant when compare to the specified value of 190 – 210mg reported (Macrae, Robinson & Sadler, 1997). The low value of ferrous gluconate in the mixture extract may be attributed to the unstable property of iron at a pH greater than 3.5 as earlier reported (Macrae, Robinson & Sadler, 1997) compared to that of the mixture extract that was read at a pH 7.0. Vitamin B6 (pyridoxine) could be considered as present in a moderate quantity with potency value of 2:0mg that falls within the range of 1.8 - 2.4 mg reported (Macrae, Robinson, & Sadler, 1997). The various Vitamins and Iron compounds have very useful pharmacological effects in blood tonic production. The presence of the various vitamins is necessary for normal cellular metabolism and the co-ordination of many vital intermediate chemical reactions and enzymes (Olaniyi, 1980).

Conclusion

The phytochemical analysis of the mixture extract from local herbs shows the presence of active constituents such as compounds of alkaloids, saponins etc. that has very useful pharmacological effects in blood tonic. It was also deduced that water is the best solvent that can extract almost all the active constituents extracted from the local herbs. The various vitamins and iron compounds contained in the mixture extract also proves the reliability of the local herbs combination for blood tonic production.

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TRANSPORT AND LOGISTICS MANAGEMENT EDUCATION IN NIGERIA: AN ENLIGHTENMENT AND EDUCATION APPROACH

By

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Abstract
This paper focused attention in educating and enlightening the policy makers and the general public especially students, teachers, parents and guidance counsellors to have an understanding of the role of transport and logistics in the socio-economic development of the nation, the career information and opportunities as well as the prospects while the educational requirements in building a career in transport and logistics management were also discussed.

Introduction

Transport and Logistics are very important in the overall development of any country and they are very crucial in production process which is not complete until the products are in the hands of the final consumers. Generally the importance of transport and logistics in the overall development of any country cannot be over emphasized since it is a key factor in all aspects of development. There is hardly any aspects of a nation's development in transport and logistics are not an essential ingredient since there is always the need to collect, assemble, transfer and distribute goods, services and people from one area to another. Their roles are very crucial and a phase in production process which is not complete until the the commodity are in the hands of the final consumer according to Adefolalu (1977), Ajiboye and Afolayan (2009) and Ajiboye and Ayantoyinbo (2009).

Transport and logistics industry in every society be it underdeveloped, developing and developed are both concerned with the safe and efficient movement of people and products from one geographical location to another. Millions of passengers travel by road, rail, air and water throughout the world in general and in Nigeria in particular every year while every product that is imported and exported passes through the logistics supply chain.

Researchers, such as Adefolalu (1977), Ajiboye,(1994, 1995, 2008), Ajiboye and Fapohunda (2008), Ajiboye and Afolayan (2009). have identified the availabilities of transport and logistics facilities as a crucial investment factor that stimulate economic growth through increased accessibility, its efficiency and effectiveness all of which affect the basic function of production, distribution, marketing and consumption in many ways and also influence the cost of commodity consumed and the purchasing power of the

consumers. When the transport and logistics facilities are in place, it will ensure an efficient movement of agricultural products, industrial raw materials, finished and semi finished products from the point of production to the market centres as well as people from their home to work, market, recreation and religious centres among other places.

Every mode of transport, from planes, helicopters, trains and luxurious buses to large goods vehicles, vans, ships, private cars and taxis, requires a driver or pilot. In addition, a vast number of people in these industries work in support roles, including: operational, distribution and transport managers, planners and schedulers all of whom are involved in co-ordinating people and goods ;safety specialists such as air traffic controllers, driving instructors and examiners, railway station assistants, conductors and signallers who all ensure that vehicle operators are following strict health and safety regulations; customer service personnel who take reservations, answer queries and act as the public face of the transport and logistics sector; warehouse personnel who select, package and prepare items for delivery.

The focus of the paper is to educate and enlighten the policy makers and the general public especially students, teachers, parents, guidance counsellors to have an understanding of the role of transport- logistics as well as to know the prospects and the requirements in building a career in transport and logistics management. It is against this background that this paper is structured into 5 sections. Section one is on the introduction of the paper as well as revealing the objectives and coverage of this paper. Section two examine the concept of transport-logistics management education and section three focuses on the requirements for studying transport and logistics while section four examines the opportunities in the field of transport and logistics in Nigeria. Section five concludes the paper.

An Overview of Transport and Logistics Management Education

Not much work has been done on transport and logistics management education across the globe in general and in Nigeria in particular. But for the purpose of this study and paper, there are certain concepts that need to be explained for better understanding. Among these are education and training, transportation, transportation and management, logistics, logistics management and transport and logistics management.

There is now a widespread realisation that adequate training and development of employers is necessary for rapid economic growth according to Oriabor (1993). Buckley and Caple (1990) define training as a planned and systematic effort to modify or develop knowledge, skill or attitude through a learning experience in order to achieve effective performance in an activity or range of activities while Oriabor (1993) see training as a

learning process by which employers acquire skill, knowledge and aptitude. Training therefore represents a viable investment that cannot be ignored and is one of management's most important means of achieving set objectives. It is not an end in itself, but essentially a part of the total framework of effective management.

A renowned educationalist, William Rouven observed that education is not a mere means to life… Education is life! This statement was made several years ago but it still stands till today even in the area of transport and logistics management. Education on the other hand is a process and a series of activities aimed at enabling an individual to assimilate and develop knowledge, skills, values and understanding that are not simply related to a narrow field of activities, but allow a broad range of problems to be defined, analyzed and solved according to Oyeneye et al (1996). The distinction between training and education is shown in Table 1 according to Osisioma (1995).

Table 1: Distinction between Training and Education

S/N	Training	Education
1	More precise, More job oriented	Less precise, More person oriented
2	Defined in a specific job context	Broader process of change
3	results in uniform behavior	Increased individual variability
4	Mechanistic process producing predictable responses	More organic process producing less predictable change in the individual
5	Knowledge and skills for specific tasks	Analytical and critical abilities generally. More theoretical and conceptual.
6	Observable in short time	More profound and long term effect.

Source: Osisioma, 1995

Transportation on the other hand, is the movement of people, goods, services and information from one geographical location to another through a specific mean or means for a particular purpose according to Ajiboye (1995). For instance, getting to and from office, school, religious or recreational centres require transportation, so does getting agricultural products from farms or industrial products from manufacturing companies into markets for the end users to purchase as observed by Adefolalu (1977), Ajiboye (1994,1995), Ajiboye & Afolayan (2009), Ajiboye and Fapohunda (2008).

Transportation is derived from the Latin word 'trans' meaning across and 'portare' meaning to carry. It creates time utility, which is getting a product to a destination on time and space utility which is the optimal utilization of space available for to carry large volumes of goods at a low cost. For instance, if a finished product is not moved to the market at the

right time, it ceases to have value. In other words, transportation is basically the movement of goods, people and services as well as information from one location to another.

Transport management is the technique, practice or science of controlling, planning, developing and maintaining adequate transport services that meet the individual and corporate needs. It is also the process of ensuring that people, freight services and information are delivered to the right place, at the right time and at the right price according to Ajiboye (1995, 2007), Nnadi (2008) while the Council of Logistics Management in United States of America (2003) see Transport Management as the art of managing inventory in motion for delivery to the right place, at the right time and in the right condition, choosing the right equipment and in the right direction while it encompasses management of inbound and outbound transportation. In broad terms, it also consists of the management of areas such as shipment scheduling, routing, freight cost management, shipment tracking and parcel management in optimal way. However, Ajiboye (2007) observed that the main objective of Transport Management is to provide a functional and sustainable transport services for the nation and this has to be done by providing a consistent general approach and realistic guide for the operation of transport sector which is described as the engine of the nation's economic growth and development.

Logistics is a common terminology but most often misused or misrepresented. However, each profession applies it according to its suitability. For instance, Helsinki (1996) looks at logistics from the business perspective and defines it as a business planning framework for the management of material, service, information and capital flows. It includes the increasingly complex information, communication and control systems required in today's business environment. The military according to JCS (undated) sees logistics as the science of planning and carrying out the movement and maintenance of forces.... those aspects of military operations that deal with the design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of material; movement, evacuation, and hospitalization of personnel; acquisition of construction, maintenance, operation and disposition of facilities; and acquisition of furnishing of services.

On the other hand, it is the science of managing inventory both in motion and in static condition. The Council of Logistics Management (CILM) of United States of America (1998) defines logistics as the process of planning, implementing and controlling the efficient, effective flow of storage of goods, services and related information from point of origin to point of consumption for the purpose of confirming to customer requirements.

The Canadian Association of Logistics Management (1998) see logistics as the process of planning, implementing, and controlling the efficient, cost effective flow and

storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of meeting customer requirements. In summary logistics is often referred to as supply chain management and focuses on the management and control of goods between people, companies and organizations.

Transport and logistics management is defined according to Chartered Institute of Logistics and Transport (CILT) International (2003) as any activity consistent with the general objectives of the institute as stated in the charter including prejudice to the generality there of: (i) the administration, management, planning, conduct or operation of any of the principal forms of transport, transit, traffic, locomotive, physical distribution, logistics or any activity related thereto and (ii), the research, development, study, education in or of the art and science of logistics and transport in all its branches.

Education Requirements for Training as a Transport and Logistics Professional in Nigeria

Modern transport and logistics use a battery of sophisticated methods and require a range of skills and personal qualities. These are summarized as good in general numerical skills, a grounding knowledge in statistics and sampling methods, some knowledge of computers and data analyses, good presentation and communication skills, organizational/administrative abilities, a flexible approach both in academic and practical as well as using one's own initiative. The need for increased efficiency and therefore continued human capital development has become even more urgent as mega cities – cities with more than 10million inhabitants emerge. In Nigeria, for instance Lagos, the economic and financial hub of the country is the largest metropolitan city area in sub-Saharan Africa. With a current population in excess of 15million, it is ranked the 8th largest mega city in the world according to Oyesiku (2002) and Nnadi (2008). Findings in a global research project on 25 of the world's mega cities including Lagos show transportation as the topmost mega city infrastructure challenge. There is no doubt a desperate need to keep up efficiency in the sector.

The role of human element in the production process cannot be compromised. Of all the factors of production, among all the inputs into the productive process, human capital remains the most strategic co operant factor according to Nnadi (2008). The manpower need of the nation can only be achieved through education and training to the extent that the people are guided, trained and directed according to their own interests and abilities as well as to the needs of the nation. Experience has shown according to Sofenwa (1982) that a lot of frustration and manpower wastage occur where people are either not sufficiently aware of their own capabilities or not able to utilise such abilities effectively within the

context of the society in which they live. The choice of subjects at school, the application of one self and the channelization of interests and abilities will be more purposeful and more rewarding if one is aware of one's own professional destination and the opportunities that exist for the realisation of personal ambitions. Regardless of the educational requirements of the job you are contemplating, start today to chart your future so that you make it happen.

In the Nigerian transport and logistics industry, human capital development has been vigorously pursued over the years, incorporating both training and education but it is still a far cry to the need of the industry while the most cogent rationale for human capital development in the transport industry is the need to keep performance efficiency at a satisfactory level. For instance, Ajiboye (2007) notes that the efficiency of transport has become the yardstick by which the socio and economic development of a country is measured.

A critical appraisal of the human resources available in the transport sector indicates an acute shortage of personnel among the professionals and technicians. This has resulted in an unduly high independence on foreign experts to carry out planning, design, construction and maintenance work in the transport sector while the artisans and operators are very large in number but are usually poorly trained and therefore ill equipped to carry out those minor but important functions in the transport sector as required by their trade or be part of a program of quality improvement within the sector.

Furthermore, there is also the demand created by expansion in the transport sector which must be met by well trained manpower. Here in lies a further rationale for human capital and development. The manpower needs of the nation can only be achieved through education to the extent. Currently, a student in Nigeria can enrol into transport and logistics management program at diploma's, bachelor's, master's and doctoral degree level.

The educational requirements for candidate coming in into transport and logistics management vary from one entry point to another. For instance, a diploma degree in transport and logistics prepare graduates for entry-level career in transportation and warehousing which are two key areas involved in the industry. However, a graduate of a bachelor's or master's degree program in the field is qualified to pursue managerial and administrative positions in transportation and logistics / supply chain management while a doctoral degree primarily prepares graduates for careers in transport and logistics research and teaching.

A diploma certificate in transport and logistics gives students an overview of transport- logistics and includes some business topics. General education courses are required as well as core courses in transport-logistics and business management. Some of

the topics usually covered in a diploma program in transport-logistics include introduction to transport and logistics, transport and logistics technology, commerce and e-business, business law, inventory management and international transport and logistics. Courses also introduce students to computer operation and common software programs used in transport and logistics operations.

A bachelor's degree program in transport-logistics prepares graduates for transport and supply chain management roles while some bachelor's degree programs allow students to specialize. The specialized areas of study may include transport operations and management, inventory and stock control management, international transport and logistics, material handling and management, packaging, routing and fleet management and data analysis. However, before a student can choose a concentration area, he or she must first complete core transport-logistics courses in areas such as principles of transport, modes of transport, marketing of transport and logistics, consumer and industrial sales, distribution channels, logistics technology, procurement and materials handling among other.

For admission into the diploma and Bachelor degree programmes of the transport-logistics offerings institutions are 5 credits at WASC,NECO, GCE O/L or SSCE or merit in Grade II or Technical certificate at not more than 2 sittings including English Language and Mathematics while at Olabisi Onabanjo University (OOU), Ago Iwoye, Lagos State University (LASU), Ojo, Tai Solarin University of Education (TASUED), Ijebu Ode, Redeemer University for all Nations (RUNS), Lead City University, Ibadan, The Polytechnic Ibadan and College of Technology, Yaba at least a social science subject like Geography and Economics are required. However at Federal University of Technology (FUTA) Akure, Federal University of Technology (FUT Mx.), Minna and Federal University of Technology (FUTO), Owerri as well as Ladoke Akintola University of Technology (LAUTECH), Ogbomoso and Bells University of Technology (The Bells), Otta all candidates are suppose to have passed science subjects like Physics and at least any two from the following Chemistry, Biology or Agriculture.

In addition to the general university requirements in above, 2 passes at GCE Advanced level including a social science subjects like Geography or Economics is required at OOU, LASU, TASUED, and Lead City or a science subject like Physics or Chemistry at LAUTECH, FUTO, FUTA, FUT Minna etc or at least Merit pass at NCE in any two teaching subjects including a social science at OOU, LASU, TASUED and Lead City or a science subject at LAUTECH, FUTO, FUTA, FUT Minna and the Bells or Diploma with not less than Lower credit in relevant disciplines as may be approved by the institution senate.

For the admission requirements into the Post Graduate Programmes in Transport and logistics candidates must have the general university requirements in addition to a very

good first degree academic programme in related fields such as Transport, Geography, Economics, Urban and Regional Planning, Engineering, Environmental Studies, Business Administration, Marketing and other allied subjects.

A master's degree program in transport and logistics may include a thesis option. Students who are planning on continuing their studies at the doctoral degree level are encouraged to complete a thesis and graduate with a PhD grade which is 3.5 in most universities but 4.0 at Federal University of Technology, Owerri while the goal of a master's degree program in transport and logistics is to equip students with the skills and knowledge necessary to manage a company's transport and supply chain operations. Critical thinking and problem solving ability are keys to succeeding as a transport or logistics manager and these skills are sharpened and tested while taking courses in transport, business logistics, operations research, information systems for transport-logistics and design of logistics distribution systems. Presently, the following universities offer MSc/ M Tech in Transport Studies / Management. They are Olabisi Onabanjo University Ago Iwoye (Pioneer in Post Graduate Programme in Transport), Federal University of Technology Owerri, Ladoke Akintola University of Technology, Ogbomoso, University of Lagos, Akoka- Lagos, Lagos State University, Ojo and Ahmadu Bello University Zaria.

The Doctor of Philosophy (Ph.D.) in Transport with option in logistics, shipping and maritime, land (road and rail), air and aviation and pipeline are presently been offered by the three pioneer universities in the field of Transport and logistics. They are Olabisi Onabanjo University Ago Iwoye , Federal University of Technology Owerri and Ladoke Akintola University of Technology, Ogbomoso. Students enrolled in a doctoral degree program in transport-logistics spend a majority of their time conducting research and working towards completing their dissertations. The first two years of enrolment focus on foundation transport- logistics courses. Topics covered include quantitative techniques, research methods, advanced transport and logistics management as well as information technology/ management while they are to offer elective courses in areas such as business ethics, transport/supply chain modelling and e-commerce. Many logistics doctoral degree programs also require that students teach while enrolled Graduates who hold Ph.D.s in Transport-logistics sometimes enter the private sector but generally conduct research and have teaching positions with universities.

Career Information and Opportunities in Transport and Logistics Management in Nigeria

One can pursue many different occupations within the field of transport and logistics generally in any part of the world and in Nigeria in particular. Graduates of bachelor's and

advanced degree programs are best suited for managerial, marketing and consultancy positions while students who have completed a diploma certificate in the field may work in airline, aviation, documentation, shipping, transportation and warehouse operations. Employment change in the transport and logistics industry is heavily influenced by the state of the nation's economy. For instance, the United States Bureau of Labour Statistics (2010) (*www.bls.gov*) reports that overall employment of in the transport-logistics industry will grow 11% for the 2008 to 2018 period. The BLS reported that the average hourly wage in 2008 for non-supervisory warehouse and truck transportation positions was $18.08. Meanwhile, *Payscale.com* reports that logistics managers with 1-4 years of experience were earning annual salaries of about $41,000-$59,000 in 2010.

Ajiboye (2007) observed that the outlook for transport and logistics planners, managers and engineers in Nigeria in 2000's continues to be promising despite the meltdown episode. This growth depends upon a number of factors such as the fact that transportation and logistics management profession is relatively young and small while the transport and logistics industry is expanding at a rapid rate and has resulted in an ever increasing demand for professionals with balanced knowledge of the various aspects of transport and logistics management to meet the current challenges and future changes while the success of any nation's transport and logistics development is very much depends on the quality and quantity of human resources available to assist in formulation and implementation of transport and logistics policy.

In transport and logistics sector, three of categories of such human resources can be recognised. The first are the professionals who consist of transport and logistics managers, planners or engineers who are mainly the ones who possess the basic qualifications in the field according to Filani (2003). They are those whose job demands substantial familiarity with experience and expertise in the art and science of transport. The second are the technicians who qualified in specialised technical knowledge in transport and they include National and Higher National Diploma graduates from the mono and polytechnics in such fields as transport technology, traffic/ highway engineering and transport planning while the last group are the artisans and operators which are the largest and consist primarily those whose work involve knowledge and skills which are acquired by training either in technical colleges and trade centres or through private master – craftsmen. The master-craftsmen include the auto- electricians, auto mechanics, driver-mechanics, motor painters, panel beaters, spare part and accessory dealers, vulcanizers, welders etc.

An appraisal of the human resources available in the transport and logistics sector in Nigeria according to Filani (2003) also indicates an acute shortage of personnel of the first

and second category. This has resulted in an unduly high dependence on foreign expert to carry out planning, design, construction and maintenance work in the transport and logistics sector. For the third a category, the size is very large and are usually poorly trained and therefore ii equipped to carry out those minor but important functions in the transport and logistics sector as required by their trade or be part of a programme of quality improvement within the sector. Nevertheless all the three categories of transport and logistics personnel required training and retraining in order to cope with the ever changing technology in the sector.

Despite the high level of development in transport and logistics industry in United Kingdom with over two million people in England working in the transport and logistics sector while over 570,000 people work in passenger transport according to Salvatore (1976). There is currently a shortage of skilled workers in some areas and jobs can be found throughout the United Kingdom. This shows that there are opportunities to work both at home and abroad with proper training.

In an attempt to introduce the prospective transport and logistics managers to a field that offer both variety and specialisation as well as opportunities for work in the private / public sector, local or international companies. It is observed that employers range from small companies to international logistics organisations and transport providers operating fleets of vehicles. Among such organisations are airlines, courier firms, oil and gas marketing and distribution companies, shipping companies, truck and haulage companies, railways, public transits, pipeline industry, manufacturing and processing companies, armed forces, road safety commission, paramilitary, travel agencies, tour and tourism companies, air, river and seaports, government agencies and ministries, higher institutions, consultancy firms, post and telecommunication companies, electricity and gas industries, warehouse management, air and ship broking, air traffic control and so on. See appendix I for the list of likely working places in transport and logistics management for the professionals in Nigeria.

Furthermore a vast number of people in the transport and logistics industries work in supporting roles. This includes operational, distribution and transportation managers, planners and schedulers all of whom are involved in co-ordinating people and goods; safety specialists such as air traffic controllers, driving instructors and examiners, railway station assistants, conductors and signallers who all ensure that vehicle operators are following strict health and safety regulations; customer service personnel who take reservations, answer queries and act as the public face of the transport and logistics sector as well as involve in documentation; warehouse personnel who select, package and prepare items for

delivery. See appendix II for various job titled the professional in transport and logistics management.

The transport and logistics industry operates a 24-hour service, part-time work and shift rotations are common. In many jobs, it may be necessary to work early morning, evening and night shifts, as well as at weekends. Jobs are based in a wide range of locations, including airports, railway and bus stations, warehouses and offices while many workers consider the inside of their vehicle as their main working environment. They may involve a mixture of indoor and outdoor work while most involve some degree of travelling within and outside your location.

Concentration and safety awareness are essential in this industry, especially for those operating vehicles and other machinery. Employers normally look for people with good communication and customer service skills while many jobs require people with problem-solving skills, who can remain calm in a crisis. Jobs involving driving and operating machinery may have age restrictions.

Most organisations provide training for new entrants, followed by regular in-house courses to update knowledge and skills and many large employers offer graduate training schemes. It is possible to study for relevant qualifications, such as Chartered Institute of Logistics and Transport (CILT) International and NVQs while health and safety training is regularly provided by employers. Many specialist jobs such as air traffic controller or railway signaller involve regular performance checks and ongoing training both locally and abroad while structured opportunities for promotion to supervisory and management levels are often available with large employers. Self-employment may be an option for some drivers and instructors and many jobs offer opportunities for overseas work.

Conclusion

The nation‘s vitality has always been linked to mobility- from rural dwellers to the urban centres, to trailers wagons moving north, luxurious buses moving from west to east and north and east to north planes fanning across the ocean and within the country as well as the ships carry good from one continent to another while the vehicles racing into space. Transportation is an engine for economic growth and a link between the regions and the businesses and the people of the nation and the world. This demonstrate the importance of transport and logistics to the socio- economic of the nation as there is constant need to move, assemble, transfer people and goods from one location to another.

An appraisal of the human resources available in the transport sector indicates an acute shortage of personnel among the professionals and technicians. This has resulted in an unduly high independence on foreign experts to carry out planning, design, construction

and maintenance work in the transport sector while the artisans and operators are very large in number but are usually poorly trained and therefore ill equipped to carry out those minor but important functions in the transport sector as required by their trade or be part of a program of quality improvement within the sector. There is therefore need to encourage the institution offering transport- logistics courses to be able to produce excellent graduates who will be able to solve all the challenges facing transport and logistics industry and also to encourage the students by providing them with grant and scholarship that will motivate them.

In conclusion, the choice of subjects at school, the application of one self and the channelization of interests and abilities will be more purposeful and more rewarding if one is aware of one's own professional destination and the opportunities that exist for the realisation of personal ambitions. Regardless of the educational requirements of the job you are contemplating, start today to chart your future so that you make it happen. Do not be discouraged.

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APPENDIX I
LIST OF WORKING PLACES FOR TRANSPORT AND LOGISTICS PROFESSIONALS IN NIGERIA

Airlines (Local and Foreign)
Airport Management (NAMA, NCAO, FAAN)
Armed Forces (Army, Air Force, Navy)
Breweries and Bottling Companies
Bureau Public Enterprises (BPE)
Car Rental Agencies/ Companies
Cargo Handling Companies (NAHCo, SAHCo)
Central Bank of Nigeria
Courier firms (DHL, UPS etc)
Distribution Companies
Electricity and Gas Supply Companies (PHCN)
Federal Ministry of Aviation
Federal Ministry of Transport
Federal Ministry of Works
Federal Road Safety Commission
Financial Institution (Banks, Insurance Companies)
Freight Forwarding Associations (ANCLA, IFFN, NGAFF)
Freight Forwarding Companies (Local and Foreign)
Government (Federal, State, Local)
Import and Export Companies
International organisations and agencies
Joint Maritime Labour Industrial Council
State Traffic Management Authority e.g. LAMATA
Leisure and Recreation Companies
Logistics Companies (Local and Foreign)
Manufacturing Association of Nigeria
Manufacturing and Processing Industries (Transport and Logistics Department)
Marketing and Sales Companies
National and State Assemblies
National Food and Drugs Addiction Agency
National Inland Waterway Authority
National Export Promotion Council
National Union of Road Transport Workers
Newspapers and Newsmagazines
NEXIM – Nigeria Export
Nigerian Maritime Administration and Safety Agency (NIMASA)
Nigerian National Petroleum Corporation (NNPC)
Nigerian Ports Authority
Nigerian Railway Corporation
Nigerian Shipper Council
Oil Marketing and Distribution Companies
Para – Military (Police, Customs, Immigration, NDLEA)
Polytechnics (Ibadan Poly, Yaba Tech, NMA Oron)
Research Institutions (NISER, NITT)
Seaport Management
Shipping Companies (Local and Foreign)
Standard Organisation of Nigeria (SON)
Telecommunication Companies (MTN, GLO, Airtel, Multilink, Starcom etc)
Television / Radio Broadcasting Houses
Tour and Tourism Companies
Transport Companies (Bus / Haulage)
Travel Agencies
University (Private/ Public – Federal or State)
Warehousing Companies (Private/ Public)
Wholesale and Retail Enterprises/ Companies

APPENDIX II
LIST OF TRANSPORT AND LOGISTICS MANAGEMENT RELATED JOB TITLE ACROSS THE GLOBE.

Academician/ Lecturer/ Researcher

Air Cabin Crew (Air hosts / Hostesses)

Air Traffic Controller

Aircraft Dispatcher

Airline Pilot

Airport Baggage Handler

Bus/Coach Driver

Captain

Car Fleet Manager
Carrier
Chauffeur
Circulation Officer/ Manager
Community Transport Driver
Community Transport Operations Manager
Community Transport Passenger Assistant
Contraceptive Logistician
Courier
Custom Inspector / Patrol Officer
Depot Officer / Manager
Distribution Officer / Manager
Documentation officer / Manager
Driving Examiner / Instructor
Drivers Mate
Flight Attendant / Dispatcher
Freight Forwarder
Helicopter Pilot
Humanitarian Logistician
Import / Export Officer / Manager
Large Goods Vehicle Driver
Large Goods Vehicle Training Instructor
Lift Truck Operator
Logistician
Logistics Assistant/ Executive/Manager
Logistics Planner /Manager
Long Distance / Local Truck Bus Driver
Marine Officer / Manager
Marketing / Sales Officer / Manager
Material / Warehouse Supervisor/ Manager
Merchant Navy Deck Officer
Merchant Navy Engineering Officer/Rating
Meteorologist
Motorcycle Courier
Operation Officer/ Manager
Packer
Passenger Carrying Vehicle Driver Trainer
Passenger Check in Officer
Passenger Services Supervisor/ Manager
Port Operative
Postman/Woman
Public Relations Officer/ Manager
Purchasing/Procurement Officer/Manager
Radio/ Telecommunication Operator
Rail Track Maintenance Worker
Railway Station Assistant
Railway Train Conductor/ Driver
Ramp Service Officer/ Manager
Removals Operation Officer/ Manager
Revenue Protection Officer
Road Transport Officer/ Manager
Road Safety Officer
Route Manager
School Crossing Patrol Warden
Service Station Superintendent/ Supervisor/ Manager
Signaller
Stock Controller/Stores Assistant
Taxi Driver
Terminal/ Station Officer/ Manager
Ticketing and Reservation Officer/ Manager
Tour and Guide Officer/ Manager
Traffic Officer/ Manager/ Controller
Transport/ Aviation/ Maritime Correspondent
Transport / Logistics Assistant/ Executive/Manager
Transport / Logistics Planner /Manager
Transport Scheduler
Travel Agent/ Officer/ Manager
Van Driver
Vehicle Rental Agent
Warehouse Worker/Manager
Waterways Operation Officer/ Manager

EFFECT OF MIXING TIME ON THE COMPRESSIVE STRENGTH OF CONCRETE

By

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Abstract
The paper presents the effect of production time on the compressive strength of concrete. Before designing the concrete mix, laboratroy tests were carried out to determine some essential properties of the sand and crushed stones. A designed concrete mix of 1:2:4 was used in the test and the mixing time for the mechanical mixer was varied for 2, 5, 8, 11 and 14 minutes respectively in producing concrete cubes of size 150mm. All the cubes were cured in a clean water tank and their compressive strengths were measured at 7, 14, 21 and 28 days age of curing respectively. One hundred (100) cubes were cast and average of five cubes was determined in each day of crushing, for a particular mixing time. The mixing time was recorded from the time when all the solid materials have been put into the mixer. The results showed that the compressive strengths of cubes increased appreciably with increase in mixing time from 2 to 11 minutes and decreased beyond 11 minutes for all the ages tested. Satisfactory compressive strengths were not measured at mixing times below 5 minutes.

Key Words: Compressive Strength, Concrete, Cubes, Curing, Mixing-Time.

Introduction

Concrete is a structural material widely used in construction industry and it consists essentially of cement, fine aggregate (sand) and coarse aggregate (natural gravels or chippings). These constituent materials properly proportioned are mixed together with water to form the concrete. The cement serves as binder to the aggregate while the aggregate serve as the filler materials that give strength to concrete. Concrete has the unique distinction of being the only construction material manufactured on the construction site, whereas other materials are merely shaped to use at the work site (Neville, 2000). The aggregate occupy the larger proportion in the volume of concrete.

The compressive strength of concrete depends on the aggregate grading, aggregate/cement ratio as well as the water/cement ratio. Also (Chi, Huang, Yang & Chang, 2003) reported that the properties of lightweight aggregates and water/binder ratio are the two significant factors affecting the compressive strength and elastic modulus of concrete. Sang-Hum, Jin-Keun and Yong-Dong reported that concrete with water/binder ratio larger than 0.40 increases limit relative compressive strength and initial apparent activation energy.

The freshly mixed concrete should be workable to be properly placed and the hardened concrete needs to be durable and attain a specific compressive strength. The aim of concrete mix design is to achieve a mean strength that is greater than the strength specified (Raju, 1996). The most important variables affecting the strength of concrete at a given age are the water/cement ratio and the degree of compaction. Workability, durability, resistance to compressive stress and ability to protect steel against rusting are the four most important properties of concrete (Raju, 1996).

To develop these potential properties fully requires concrete to be proportioned appropriately and an efficient production method is required in order to produce good concrete with the above properties.

The relationship between the compressive strength of concrete and the duration of mixing has to be established to ensure production of workable concrete with adequate strength. It is necessary to carry out this research so as to save a lot of capital, labour and time wasted as a result of structural failures due to improper mixing of concrete, which results in low strength. Development of adequate compressive strength when hardened is one of the major requirements for good quality concrete. This strength depends on some factors of which this study is among and inability to achieve the target strength in concrete will seriously affect the structure negatively (Aguwa, 1999). Some of the objectives of this research are; to establish, based on practical experiment, the minimum mixing time required in producing concrete of adequate strength that might not cause failures encountered in construction industry in Nigeria. Secondly, to have good comparison of the compressive strengths achieved for various specified mixing times and to recommend the minimum mixing time required by a mechanical mixer to produce a good workable concrete with adequate compressive strength.

Materials and Method

Sand: The fine aggregate used in the study is sand collected from a river in Bosso village, Minna, Nigeria. It is clean, sharp, and free from clay and organic matter and well graded in accordance with (BS 882, 1992).

Cement*:* The cement used was Ordinary Portland Cement (OPC) bought from a cement depot at Bosso road Minna, Nigeria and it conformed to [7].

Crushed Stones: Coarse aggregate used was crushed stones with 20mm maximum size supplied from Triacta Quarry in Minna, Nigeria and it conformed to [6] recommendation.

Water: Tap water was used for the mixing and it was visuallly examined to ensure that it was clean, free from contaminants either dissolved or in suspension and good for drinking as specified in (BS 3148, 1980).

Laboratory Tests

Laboratory tests on the sand and crushed stones for the purposes of characterization and classification include determination of particle size distribution, natural moisture content and specific gravity, were carried out in accordance with (BS 1377, 1990). The determination of bulk densities and water absorption of the sand and crushed stones was carried out in accordance with (BS 812 Part 2, 1975) and (BS 812 Part 101, 1984).

Preparation of Specimens

A batch mix of 1:2:4 by volume of materials as designed was mixed by means of a mechanical mixer. The mixing time was varied for 2 minutes, 5 minutes, 8 minutes, 11 minutes and 14 minutes. A small amount of water was fed into the mixer first and then all the solid materials were fed uniformly and simultaneously into the mixer (Neville, 2000). Greater part of the water was fed during the same time. The remaining small part of water was added after the solids. For a particular mixing time, twenty (20) cubes of 150mm size were cast and cured for 7 days, 14 days, 21 days and 28 days compressive strengths. Five (5) cubes were crushed in each day for a particular mixing time and the average strength was calculated. All the 100 cubes were cured in the same clean water tank in the laboratory in order to gain higher strength. This is in agreement with the report of (Zain, Safiuddin & Mahmud, 2000) that concrete under water curing offers the best results and that data collected also revealed that under controlled curing conditions, it is possible to produce high performance concrete (HPC) at relatively high water/binder ratios.

The mixer was loaded according to the capacity that was found to be $0.07m^3$ and the speed was found to be 5 revolutions per minute. This was done by marking chalk on the drum and counting the revolutions (Obande, 1990). About 25 revolutions were required to produce concrete uniform in composition and of satisfactory strength. This speed of 5 revolutions per minute was maintained throughout the mixing period.

Slump Test

Before mixing the concrete for casting the cubes, a trial mix was carried out to determine the slump. Slump test is very useful in detecting variations in the uniformity of a mix of a given nominal proportions (BS 1881: Part 116, 1983). It is a popular method used all over

the world on the day-to-day, hour-to- hour variation in the materials being fed into the mixer or mixing platform if by hand.

Compressive Strength Test

An electrically operated Seidner compression machine was used for the crushing test on the concrete cubes in accordance with (BS 1881 Part 1116, 1983), at the curing ages of 7, 14, 21 and 28 days. Five cubes were crushed in each day for each mixing time and the average compressive strength was determined. In crushing test, care was taken to ensure that the cubes were properly positioned and aligned with the axis of the thrust of the compression machine to ensure uniform loading on the cubes (Neville, 2000).

Design of Concrete Mix

The aim of mix design is to consider the most economical use of available materials to produce concrete of desirable workability, durability and strength. The goal of mix design is achieve a mean strength greater than the specified strength but variations in the actual strength achieved are inevitable. The most important variables affecting the strength of concrete at a given age are the water/cement ratio and the degree of compaction (Raju, 1996).

In this mix design, American Concrete Institute Standard (ACI/211.1-77) was used. This method recommends a suitable degree of workability for concrete in the form of slump. This slump depends on the type of construction and the maximum sizes of aggregate varying from 10mm to 150mm. To improve the workability, reduce permeability and bleeding, air entrained was used in the mix design. The specified works cube strength was 150kg/cm^2 which is equivalent to 14.7N/mm^2 at 28 days.

Exposure

From Table 7.3, ACI/211.1-77 mild temperatures rarely below freezing or rainy in air, Air entrained concrete should be used under mild exposure conditions to improve workability of the mixture. The maximum size of aggregate allowed is 20mm.

Water/Cement Ratio

(a) From strength consideration Table 7.4, ACI/211.1-77 (150kg/cm^2), W/C = 0.71

(b) From durability consideration Table 7.3, ACI/211.1-77, W/C = 0.53

Adopting the smaller ratio = 0.53

Water: The appropriate mixing water Table 7.5, ACI/211.1-77 for the desired workability of slump 30mm – 50mm and maximum size of aggregate =165kg.

Air: Recommended average total air content Table 7.5, ACI/211.1-77 present = 6%.

Cement: The cement content was calculated from the water content and water/cement ratio.

Cement = 165/0.53 = 311kg.

Coarse Aggregate

The coarse aggregate content was estimated from Table 7.6, ACI/211.1-77 from the maximum size of aggregate and fineness modulus of sand. Volume of dry rodded coarse aggregate per unit volume of concrete is 0.62

Dry rodded weight of coarse aggregate as determined = 1855kg/m^3

Weight of Coarse Aggregate required $= 0.62 \times 1855 = 1150kg$

Table 1: The quantity of sand by Absolute volume method

Item no	Ingredients	Weight (Kg)	Solid volume (cm^3)
1.	Cement	311	$\frac{311}{3.15} \times 10^3 = 98.73 \times 10^3$
2.	Water	165	$165 \times 10^3 = 165 \times 10^3$
3.	Coarse aggregate	1150	$\frac{1150}{2.68} \times 10^3 = 429 \times 10^3$
4.	Entrapped air (6%)		$\frac{6}{100} \times 1000 \times 10^3 = 60 \times 10^3$

Total volume of ingredients except sand $= 752.83 \times 10^3 cm^3$

Solid volume of sand $= (1000 \times 10^3 - 752.83 \times 10^3) = 247.17 \times 10^3 cm^3$

Weight of dry sand required $= 247.17 \times 10^3 \times 2.64 = 652528.8 = 653kg$

Estimated batch quantities per m^3 of concrete

Cement = 311kg

Water = 165kg

Coarse aggregate = 1150kg

Sand = 653kg

Density of fresh concrete = 2279kg/m^3

Mix ratio by weight.

Cement		Sand		Coarse aggregate		Water
1	:	2.1	:	3.70	:	0.53
1	:	2	:	4	:	0.53

Mix Proportion

A mix of 1:2:4 as designed was used with a water/Cement ratio of 0.53 in calculating the quantities of constituent materials to be mixed, absolute volume method was used. This method assumes that the volume of compacted concrete is equal to the sum of the absolute volumes of all ingredients [17].

Mathematically, $\frac{W}{1000} + \frac{C}{1000G_c} + \frac{A_1}{1000G_1} + \frac{A_2}{1000G_2} = 1m^3$ of concrete

Where W, C, A_1 and A_2 are the weights of water, cement, fine aggregate and coarse aggregate per m^3 of concrete respectively, G_c, G_1 and G_2 are the specific gravities of cement, fine aggregate and coarse aggregate respectively.

Cement = 1 part, Sand = 2 parts and Crushed stones = 4 parts, water/cement ratio (W/C) = 0.53

$w = 0.53C$ ..... (1)

$\frac{W}{1000} + \frac{C}{1000G_c} + \frac{A_1}{1000G_1} + \frac{A_2}{1000G_2} = 1m^3$ ..... (2)

Cement/Aggregate ratio:

Sand $= \frac{1}{2} = \frac{C}{A_1}, A_1 = 2c$ ..... (3)

Crushed stone $= \frac{1}{4} = \frac{C}{A_2}, A_2 = 4C$ ..... (4)

Substituting (1), (3), (4) into (2),

C = 320.9 kg

Volume of mould used = 0.003375 m^3

1 m^3 of concrete = 320.9 kg of cement

0.003375 m^3 of concrete $= 0.003375 \times 320.9 = 1.083kg$ in 1 cube of concrete

For 40 cubes of concrete,

Weight of cement $= 1.083 \times 40 = 43.32kg$

Weight of sand $= 2 \times 43.32 = 86.64kg$

Weight of crushed stones $= 4 \times 43.32 = 173.28kg$

Weight of water $= 0.5 \times 43.32 = 21.66kg$

Results and Discussion

Identification of the Aggregates

The properties of sand and crushed stones used for the study are summarized in Table 2 while Figures 1 and 2 show their particle size distribution. The sand was well graded and

classified in zone 1 in accordance with (BS 882, 1992) classification for aggregates. The properties of the aggregates are in good agreement with the recommendation of (BS 882, 1992) for clean quartz and flint sands. Also Shirley (BS 1881 Part 116, 1983) reported that normal-density aggregates generally have specific gravities between 2.5 and 3.0. The bulk density of the crushed stones is 1855kg/$m^3$and it conforms to (BS 882, 1992) recommendation for aggregates from natural sources for concrete.

Table 2.0: Properties of Cement, Sand and Crushed Stones

Property	**Cement**	**Sand**	**Crushed Stones**
Natural moisture content (%)		21.15	0.54
Water absorption (%)		1.5	0.25
Finenesss modulus	-	2.81	3.36
Specific Gravity	3.15	2.64	2.68
Bulk density (kg/m^3)	1472	1660	1855

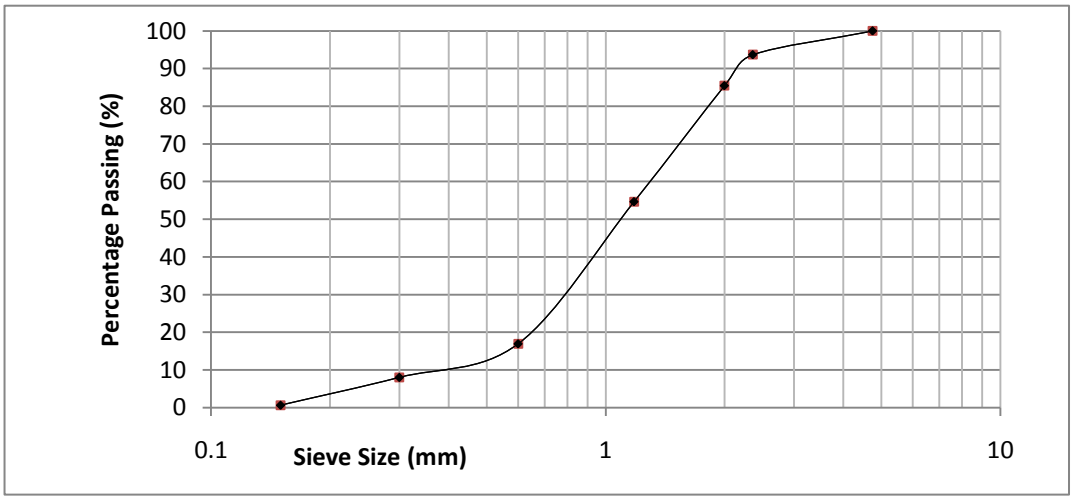

Figure 1.0: Particle Size Distribution of Sand used.

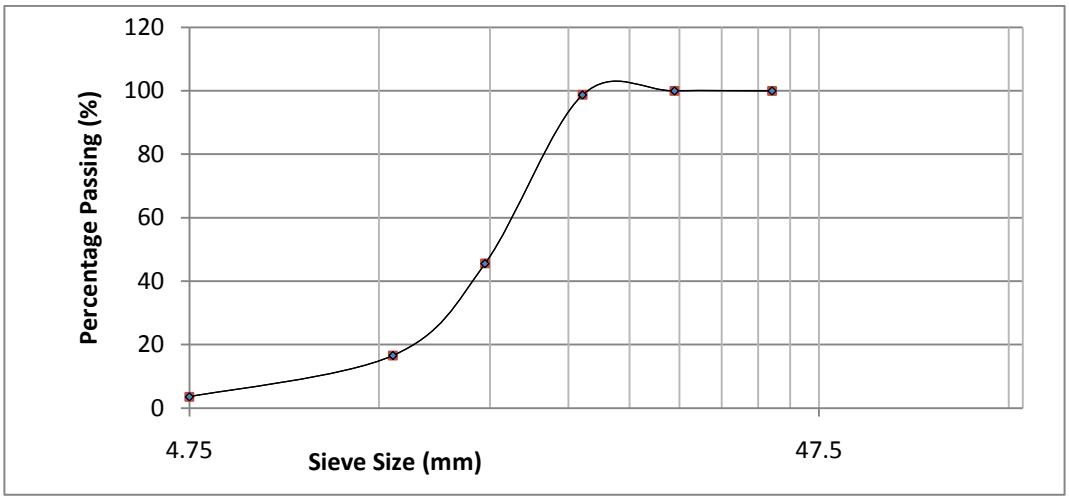

Figure 2.0: Particle Size Distribution of Crushed stones used.

Slump: In this study, a slump of 40mm was measured in accordance with (Kraina, 1960) and it satisfied the value adopted in the design.

Compressive Strength

The results of the effects of time on concrete compressive strength are presented in Figure 3.0 and adequate strength of 17.41N/mm^2 was measured at 28 days after five minutes of continuous mixing. The strength continued to increase with the increase in mixing time from five to eleven minutes. This result is in good agreement with (Aguwa, 2010), which reported that compressive strength of concrete cubes appreciably increased with increase in number of turnings from one to foru times. At fourteen minutes, there was a decrease in compressive strength. A low strength of 12.78N/mm^2, which is below the characteristic strength of 13.54N/mm^{2,} was measured at 28 days for mixing time of two minutes. This indicates that at two minutes, concrete uniform in composition and of satisfactory strength cannot be produced.

The greatest increase in strength was recorded at the age of 14 days for all the mixing times and this indicates that concrete gains greater percentage of its strength at the age between 7 and 14 days (Aguwa, 1999). This behaviour is clear for mixing times from two to eleven minutes. The greatest increase in strength was recorded at the mixing time of 5 minutes and this is applicable to all the curing ages of 7, 14, 21, and 28 days. This is a confirmation that adequate strength of at least 13.54N/mm^2 cannot be achieved at a mixing time below 5 minutes. There was a slight decrease in compressive strength at a mixing time of 14 minutes, confirming that mixing beyond 11 minutes is not helpful.

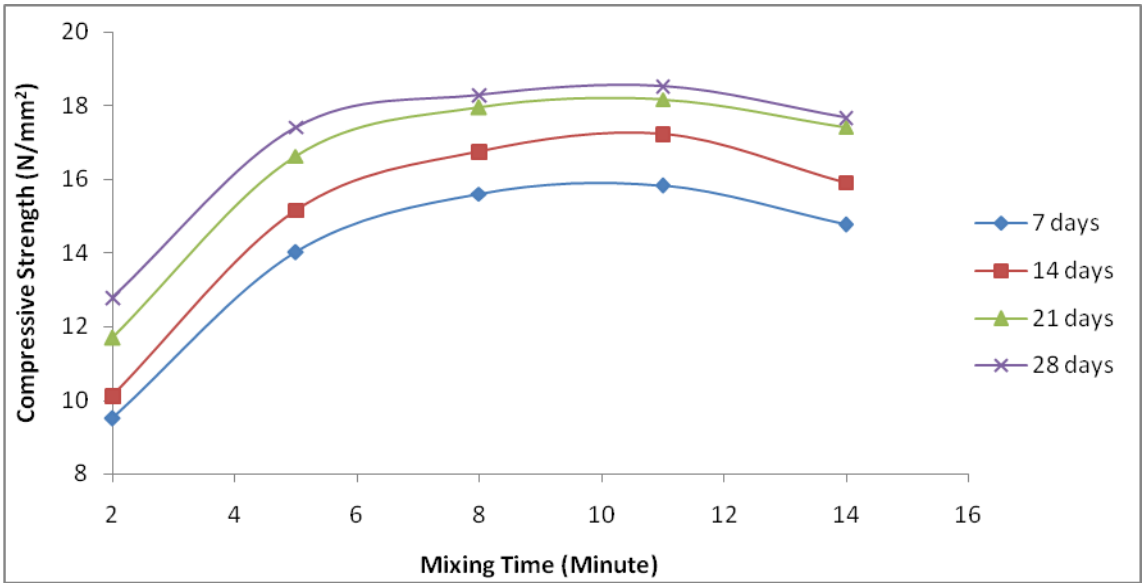

Figure 3.0: Compressive Strength-Mixing Time Relation for Concrete at 7, 14, 21, 28 days of Curing.

Figure 4.0 shows the relationship between compressive strength and the age of curing for various mixing times. There was a clear increase in compressive strength with increase in age for all the mixing times studied and this behaviour is in good agreement with reports in other literature.

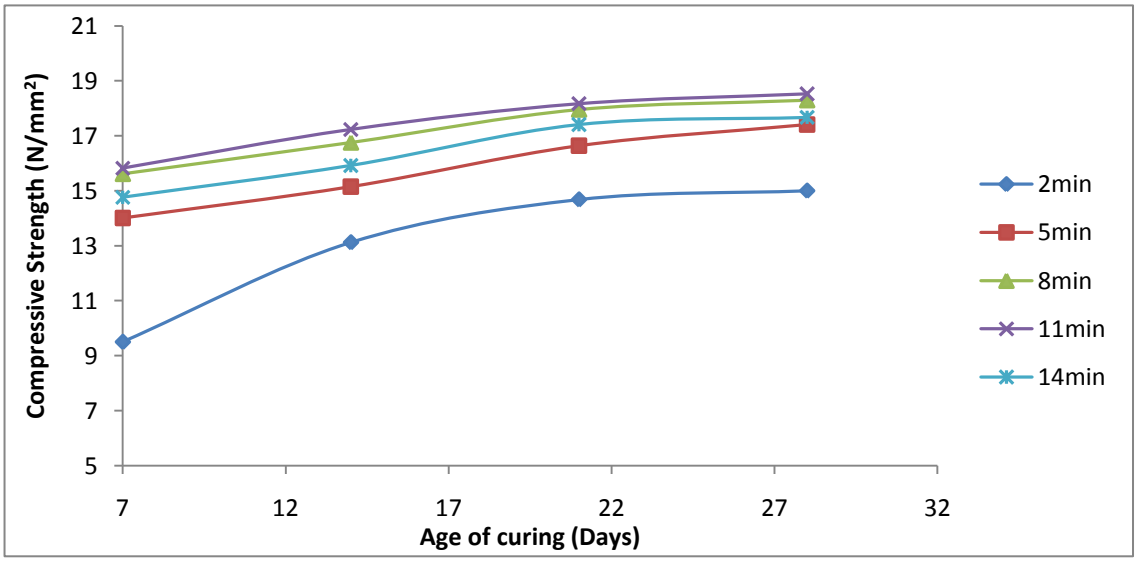

Figure 4.0: Compressive Strength-Age of Curing Relation for Mixing Time of 2, 5, 8, 11 and 14 minutes.

Conclusions

The over all conclusions emerging from this study are that:

1. Compressive strength of concrete increases with increase in mixing time from 2 to 11 minutes but not beyond 11 minutes.
2. Satisfactory compressive strengths were developed for mixing times 5, 8, and 11 minutes at the age of 28 days.
3. Low compressive strengths were gained at all the ages for a mixing time of 2 minutes concluding that mixing time below 5 minutes is not advisable.
4. There is a slight decrease in compressive strength of concrete at a mixing time of 14 minutes, confirming that mixing concrete by machine for more than 11 minutes is not necessary.

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AN APPRAISAL OF PUBLIC HOUSING DELIVERY IN NIGERIA TOWARD THE ACHIEVEMENT OF THE HOUSING FOR ALL POLICY

By

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Abstract
This paper examined the conventional mass housing approach adopted as a public policy in Nigeria over the years. The consequences of the espouse and implementation of this policy option, which was based on the assumption that only the government had the instrumentalities and competence to "house the masses", is also examined. The data source for this write up is basically secondary data source. Findings revealed that over several decades, prototype housing has always been the target of every administration. Imbibing culture of indigenous approach to housing provision is one of the recommendations made.

Keywords: Housing, Public Housing Delivery, Policy, Conventional Mass Housing

Introduction

The consensus of opinion in this country is that rapid urban growth has seriously aggravated the shortage of dwelling units in Nigeria, resulting in over-crowding, high rent, slum and squatter settlements. Unfortunately, the conviction that we are faced with an acute housing problem in our cities is not based on adequate statistical evidence. As clearly indicated in the third National development plan, Nigeria's housing problems have not been comprehensively studied; the available data are of questionable value and relevance- (Federal Ministry of Economic Planning, 1975) as quoted in Onibokun (1990). Overcrowding as indicated above is a manifestation of housing inequality and is a hidden form of homelessness. In 2003, approximately 20 percent of the developing world's urban population, or 401 million people, lived in houses that lacked sufficient area, i.e. with three or more persons sharing a bedroom. Two thirds of this urban population resides in Asia, half of them or 156 million in South Asia. The report shows how living conditions, including overcrowding and poor ventilation, are related to increase in rate of illness, child mortality and negative social behaviours. It stresses that the risk of disease transmission and multiple infections becomes substantially higher as the number of people crowded into small, poorly ventilated spaces increases. In spite of shelter importance there is unfortunately a universal shortage of desperately needed dwelling units. The situation is particularly serious in the developing countries of the world where population and

urbanization are progressing more rapidly and where the gap between need and effort is greatest, Nigeria belongs to this category of countries.

Conceptual and Literature Review

Shelter represents the most basic human needs and has a profound impact on the health, welfare, and productivity of individuals. It is more than merely the dwelling unit (see The Federal Capital City Nigeria Master plan, 1973).It is a complex product made of a combination of services indoor living spaces, land, utilities location situations (with respect to work and community services), outdoor living space, and relationship to neighbors, family members and friends. In addition, housing is the largest land consumer.

In Nigeria today, as in most developing countries, the mix of the elements constituting housing varies widely, ranging from spacious, well-serviced homes accessible to a wide range of jobs and community services, to unserviced slums, housing shortage or both.

Many housing programs fail because they are not tailored to a target population's income level and the household's ability to pay. Housing program have met with little success when based on needs translated into arbitrary (and in affordable) standards rather than on "affordability" and Nigeria, like several developing countries, has emphasized public housing schemes, but with little success. This coincides with global paradigm shift from direct public provision of housing to the enablement of private shelter initiatives and housing production.

The primary components of residential construction costs are land, infrastructures, shelter and construction management: land-usually the most inflexible cost of the four, is uniquely less problematic owing to Federal ownership of the land.

Infrastructures- which include public utilities such as water, sewerage, electricity, and roads and surface drainage, typically account for 20 and 45percent of the total residential development costs.

Shelter- building costs are the major component of residential development costs, equaling 50 to 60 percent of total cost. Variations result from a mix of construction standards, building materials labour and construction management. As a formal government program, sites and services have been successfully tested in Kenya and Upper Volta, Botswana, Zambia and many other countries. Despite other shortfalls it has been demonstrated as a viable means of proving individual home ownership for low income groups. In addition the combination of self-help techniques and reliance on local building materials can further reduced costs by almost

50% and provided important opportunities for self expression and the encouragement of the development of indigenous building styles.

Subsidy policies

A key variable in housing program options is subsidy policy. These policies ranged from effective subsidies to large external contributions to the housing program, from higher income groups to lower groups. While average incomes are higher and death rates lower in cities, urban poverty is a as pervasive as rural poverty. Secure, well-paying jobs are scarce, even for those with considerable education. Food is typically expensive.

Housing. too, is costly despite its rudimentary quality, prompting the poor to build basic houses in shantytowns. Sewage disposal systems in most cities are also basic or primitive, and polluted streams, wells, roadside drains, and other bodies of water increase the risk of infectious disease. Industry, automobiles, and the burning of fuel wood further pollute air and water.

No country is yet satisfied that adequate housing has been delivered to the various economic groups that make up its populace. Thus, most nations, in one form or another, continue to claim a housing problem.

Housing in economically developing countries is typically inferior in quality and space to that found in economically developed nations.

Government efforts to upgrade housing conditions are evolving slowly. In the 1950s, slum demolition was effected on a large scale in many cities, such as Manila in the Philippines and Baghdad in Iraq. In the 1960s, new town development, such as Brasilia in Brazil, became commonplace. These strategies often proved ineffective; demolitions were not usually accompanied by housing replacement, and the new towns sometimes proved to be islands in a sea of slums.

In the 1970s, some developing nations turned to self-help housing. Families were given plots of land and building materials to construct or to improve their own shelter. This housing approach is commonly referred to as a "sites and services" program; so far it has been implemented on a large scale in India and many South American countries. Numerous organizations assist housing development and the upgrading of housing standards. These include the International Bank for Reconstruction and Development-IBRD, the United Nations Commission on Human Settlements- UNCHS, and the U.S. Agency for International Development- USAID. Over the last three decades, these organizations discuss private housing

development features and dynamics and the factors affecting the sector. It argues for the creation of an enabling environment, including support of housing initiatives and investment by householders, small-scale providers, and entrepreneurial private firms. It was identified that the implications of enabling strategy for housing finance, access to land, residential infrastructure, institutional regulations and building materials and related industry particularly in the light of the need for the private sector to play greater roles in housing. It draws some aspects of empirical study and some review of housing policy-related issues.

The oil boom period in Nigeria accentuated rapid urbanization as well as the proliferation of overcrowded "slums" and informal human settlements on the fringes of the big cities. Furthermore, the Federal Government for the first time adopted a national policy in which the provision of mass housing "for the low income households" featured prominently. Public policy and programmes, however, defined the country's housing problems mainly in terms of numerical shortages and physical standards and proceeded to attempt to meet these "quantitative and qualitative" deficiencies centrally.

As opined by Ademiluyi (2010), in spite of the fundamental role of housing in the life of every individual and the nation, and in spite of the United Nations' realization of the need to globally attain adequate shelter for all, the housing crisis remains one of the global problems and a grave and rising challenge facing both urban and rural residents, particularly in most developing countries. It is generally estimated that the world needs to house an additional 68 million to 80 million people (Awake, 2005). According to the United Nations Population Fund (Wikipedia, 2003), world population passed 6.1 billion in 2001 and it is expected to reach between 7.9 and 10.9 billion by 2050. Over 90% of the growth during the next two decades is forecast to occur in the developing countries.

Those estimates represent a formidable housing challenge. The situation even becomes more serious and worrisome when one realizes the fact that despite a number of political, social, and religious initiatives taken in the past in some of these developing countries, a large proportion of their population still lives in sub-standard and poor housing and in deplorable and unsanitary residential environments. This is particularly so in Nigeria, where housing provision by government commenced before political independence in 1960 and where, despite various government interventions and huge investments in housing provision, the housing problem in the country still remains intractable as many rural and urban populations in Nigeria do not have

access to decent, safe and affordable housing. This, according to Onibokun (1990), is as a result of the government to provide housing to the populace.

The level of production of housing in a developing country like Nigeria is only 2 dwelling units per thousand people, compared to the required rate of about 8-10 dwelling units per 1,000 population as recommended by the United Nations (Anthonio, 2002).

A study by Onibokun (1990) estimated that the nation's housing needs for 1990 to be 8,413,980; 7,770,005 and 7,624,230 units for the high, medium, and low income groups, respectively. The same study projected the year 2000 needs to be 14,372,900; 13,273,291 and 12,419,068, while the estimates for the year 2020 stands at 39,989,286; 33,570,900; and 28,548,633 housing units for high, medium and low income groups, respectively (Agbola, 1998; Olokesusi & Okunfulure, 2000), Again, the national rolling plan from 1990 to 1992 estimated the housing deficit to increase between 4.8 million to 5.9 million by 2000 The 1991 housing policy estimated that 700,000 housing units needed to be built each year if the housing deficit was to be cancelled. The document, in fact, indicated that no fewer than 60 percent of new housing units were to be built in the urban centers (Ogu & Ogbuozobe, 2001; Federal Republic Nigeria, 1991). This figure had increased at the time the 1991 housing policy was being reviewed in 2002. In 2006, the Minister of Housing and Urban Development declared that the country needed about ten million housing units before all Nigerians could be sheltered. Another estimate in 2007 by the president put the national housing deficit at between 8 and 10 million (Yar'adua, 2007).

Despite this confusion as to the number of new additions, it has been quite obvious that a critical gap exists between the housing supply and demand; the reasons why successive governments have made policy statements, enunciated, and have made efforts to actually deliver new housing units. However, out of their targeted provision, a very minute percentage is always met. This could be attributed to the fact that most government housing programs have been frustrated by corruption, politicization, insufficiency of technical staff at building sites, and lack of infrastructure (Olokesusi & Okunfulure, 2000).

Housing conditions, especially those portrayed by the availability and efficiency of facilities and utilities, have been worsening since 1980 (Olokesusi & Okunfulure, 2000). Toilet facilities, for instance, have more pit constructions than other better and more ideal provisions. This is evident from the construction quota, which increased from 25.6 percent in 1980/81 to 63.3 percent in 1993/94 and 62 percent in 1995/96. Existing data shows that while 72.4% of

urban households were connected to electricity in 1980/81, this proportion declined to 54.34% in 1995/96 (Federal Office of Statistics, 1999). The same trend existed for most neighborhood facilities and utilities within the country, especially those concerning water supply road construction, sewage, etc. In response to these housing challenges, Nigerian governments, since pre-independence, have shown a remarkable concern for housing. Also, successive governments in Nigeria have intervened in a number of ways in the housing sector in order to bring about the much needed improvement and transformation.

An Overview of the Nigeria Government Housing Programmes over the Years

In 1970, Nigeria's urban population was estimated as 16.3% of the total population. This rose to about 20.2% in 1980. The county's Third National Development Plan (1975-1980), however, noted that the housing problem was essentially an urban one during the period of 1970-1980. Although almost no statistics have been, or are, available with regards to the quantity and quality of the housing stock in Nigeria.

The decade 1970-1980 started with both the Federal and State governments gave very low priority to the housing sector in their Development Plans. The advent of the oil boom era (1973-1976), however, changed this. The tremendous increase in revenues as a result of this led to a greater public intervention in the housing sector. A series of actions, programmes, reorganization and creation of institutional frameworks and policies which had a direct impact on housing supply throughout the country was taken by both the Federal and State governments.

It was noted that amongst the major factors that were responsible for the ineffectiveness of public policy and programmes, two stood out prominently. These were: lack of incentives for the private sector to participate actively in the housing sectors; and, the inadequacy of mortgage finance institutions in Nigeria.

In the colonial eras, well fortified houses were built for the colonial administrators in choice areas called government reserves in almost all divisional headquarters. With each individual houses occupying a vast land area. Infrastructures like roads, water and electricity accorded top priority. After the independence most of the houses are then occupied by top government officials.

In early 70s the administration established the federal government low cost houses which were built in the local government authority of the then 12 administrative states of

Nigeria this houses mostly 2-bedroom semi detached bungalows were occupied by middle cadre, government officials.

This was followed by the low cost houses of 1980's these scheme was embarked upon across the local government head quarters of the 19 states of the federation .The buildings are prototypes intended for single family and for the very low income groups, presently most of the buildings are never completed and some vandalized due to their remoteness, lack of will by subsequent administrators to complete them or political and cultural criticisms. Some that were favored by urban growth are sold and remodified to individual taste.

Creation of Federal Mortgage banks by the Babangida administration. In the late 80's has led to the massive wide spread of federal mortgage institutions all across the nation, with people receiving loans to enable them build houses, the emergence of this mortgage institutions brought about massive employments in the mortgage bank sector after long period of establishment its impact was not really felt by low income groups as elites seized opportunities to divert the loans to other purposes that they considered more beneficial to their businesses, within no distance period the sector became grounded and loans recovery became a tedious task, many workers were invariably sacked.

The almost collapsed of the established Federal Mortgage Banks led to the emergence of the National Housing Fund and the public private partnership in the housing sector, whereby private real estate developers are engaged in the provision of befitting shelters in locations that they considered more profit worthy, as the case of Lagos and Abuja. Thus the Federal Mortgage Bank becomes a regulator and intermediary for securing loans and development.

The National Housing Fund established in 1992, Housing policy of the Federal Government of Nigeria. According to Nigerian economist (1992) Decree No.3 of 1992, became obligatory for government and individuals to contribute certain percentages of earnings with a view to offer a realistic and affordable houses, also by giving priority to low income earners and encouraging households to own their houses. The workers are to borrow anytime for building purposes or to withdraw their savings at the age of 60 or at retirement (see Anugwom, 2000)

Despite all these policies trust initiated by the Federal Government and Private Partnership very little is achieved, a lot need to be done considering the fact that over 80% of Nigerian populace resides in rural areas and most job seekers that troupe into the cities live in shanty accommodations.

By the present population of Nigeria of over 130 million and estimated 46 million total labour force (see world development report, 1995). In otherwords about 31% of the total population is in the labour force (see, UNDP, 1993). There is need for the citizens to be encouraged to cultivate an indigenenous culture of housing provision.

In conclusion, shelter provision for all as a policy of the Nigerian government (incremental model) is a good tool for solving housing problem in Nigeria if it will be properly implemented and monitored by agencies concern. The government should be aware that when production of housing stops from the government or private sector then the prices/rents of the available houses keeps increasing to the level that even the rich will not be able to afford. All urban centers will become slum because of overpopulation or what can be described as homelessness. Olateju (1990) was of the view that the increasing high rent is a pointer to the fact that there is a decrease in housing stock.

Recommendations

There is need for the citizens to be encouraged to cultivate an indigenenous culture of housing provision. This could range from simple approach to houses in an established environment, by carefully substituting imported material to local ones, for potential house owners to learn the skill of either building or production of building materials. *Building materials are believed to constitute about 55% to 65% of total cost of construction input. To achieve sustainable housing delivery in Nigeria, housing developers should shift from over-dependency on imported materials to the use of local materials, such as walls, roofing, and floor materials that are affordable and durable (Ademiluyi,ibid).* In most local settings in the country particularly in the local areas and some religious institutions there is communal participation in housing developments, skills and labour are often employed to save cost and time of construction, on most instances beautiful structures are built to the joy and participation of communities.

On another facet the private sector can be encouraged to massively produce modular houses or patented building components, from our waste recycled products, of which metal scraps and plastics are abundant.

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CAPACITY BUILDING FOR BLOCK MOULDING INDUSTRY: SOME DESIRABLE INPUTS FOR SUSTAINABLE DEVELOPMENT

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Abstract
Sandcrete block moulding ordinarily should be a thriving building construction material production business in most cities and urban cities in Nigeria, striving to meeting its demand as a cladding material in housing delivery schemes. Literature findings however reveals that block moulding firms produced below below optimal levels, innovations and strategic market positioning are low resultant of financial inadequacies.,. . Using firms in Jos metropolis, a city situate in North central region of Nigeria as case study, the paper examines and reports the activities of sandcrete block moulding firms. Research findings using a statistical tool of regression establish as follows: (i) production and sales have a strong positive relationship, indicating an R-Square value of 99.36%. (ii) a weak negative relationship exist between production and breakages, recording an R-square value of 46.12%. (iii) production and breakages were found to be influenced by seasonal variations, as shown by a T-test recording differentials in the mean values of production during the rainy and dry seasons. Also there were differences in the values of the mean sales during the two seasons. It concludes that running a sustainable block moulding industry detects the adoption of the variables of capacity building and skills acquisitions; innovations and entrepreneurship competencies and strategic market positioning as desirable inputs, for the emergence of mega and world class block moulding industries. It advocates public-private initiatives, engineered by micro-finance as complementary procurement strategies for these firms.

Key Words: (i) Sandcrete Block Moulding (ii) Entrepreneurship (iii) Capacity Building and Skills Acquisitions.

Introduction

The above scenario depicts a block moulding industry that appears to have low optimal productive levels, high levels of machine inefficiency engineered by relatively inexperienced, not so educated personnel who have low capacity.

Needs (2003a), identifies a Nigerian private sector that is dogged by weakness in its inherent skewed structure; multi-nationals who depend heavily on imports as enclaves with little or no linkage to the multi-nationals and a private domestic sector that is stagnant. This occurrence creates a private sector that does not induce competitive environment, large due to poor state of physical infrastructure, the high cost and limited access to appropriate financing.

High cost of imported raw materials, equipment and spare parts and lack of skilled labour are some other challenges.

Aim

The research intends to examine the dynamics of the production of hollow sandcrete blocks in Jos metropolis (a city situate in the North central region of Nigeria) with a view to identifying all trends and contributory variables, advance and review appropriate measures, inputs and strategies that are likely to improve the efficacy of their operations and thus alleviate poverty; enhancing the livelihood of the merchants, other stakeholders employees of the industry in a sustainable manner.

Objectives

The following are the objectives of the research:

(i) Advance innovative measures and tactics that will enhance production, sales and income levels.

(ii) Attempt to create atleast a state of equilibrium between demand and supply.

(iii) Attempt to delimit the activities of these firms beyond the confines of local and national boundaries; make them global actors among other national equals.

(iv) Advance measures that would increase skills and build up ultimately leading to increased revenue, alleviate poverty, enhanced eco-system and sustainable development.

(v) Use the outcome of findings as future guidelines for operations.

Scope

Some sandcrete block moulding firms in Jos metropolis were randomly chosen as samples for the study based on a period. The mode of production – is machine; the Rosacmeter. The materials considered for production; are cement and sand, without any form of additives. The research emphases and focuses on the dynamics of management of resources of block moulding industry.

Assumptions

In order that the empirical validity of the research findings are upheld within the bounds of its scope, the following are made:

(i) The cost of production – (material ratios, machines and equipment efficiency and labour inputs are the same for all the firms studied).

(ii) The same level of management, production and entrepreneurship capacities are obtainable and remain in existence for all firms studied.

(iii) The same quality and mix of cement and sand is maintained for all firms.

(iv) The economic situation in the country is relatively stable during the study period.

Justification of Study

The UN millennium development goals are action plans that are targeted towards the eradication of extreme poverty and hunger, this it hopes to achieve through capacity building that will bring about sustainable developments through investments.

The UN millennium project (2005) and (Needs 2004b) recognize the important roles private businesses could play towards the realization of the goals. Sustained economic growth in developing countries is a function of a vibrant private sector. A sector that drives informal employment to formal employment in an internationally competitive manufacturing and services; creating productive jobs, enhanced productivity and improved quality of life is most desirous. The achievement of the above is a function of the private sector's ability to meet social responsibility through investment, taking opportunities for rapid and sustainable growth that create international competition through quality products and services, using skills and professionalism of local human resources.

Fullerton (1979), (Seeley 1995), identified wall as a very important component of building construction. Walls may be required to divide space into areas of convenient size, keep out dust and rain and yet let in air, provide shade, coolness, privacy, shelter and protection. Provide aesthetically pleasant sight and in certain cases provide support for the upper floors or roof (i.e. to be structurally load bearing) and provide spaces for windows and doors. The predominant usage of sandcrete blocks as walling material in the study location, grants impetus to study.

Literature Review

Sandcrete blocks are undoubtably one of the predominantly used materials for building construction in Nigeria. Its percentage composition in cost profile analysis is between (6-8%) for building not exceeding 5 storeys. Seeley (1993) and Mac-Barango (2003).

The production process involves machine moulding, vibrated or through hand moulds. The common machine used is the rosacometer machine. The common used materials are cement and said mixed to some acceptable standards. The quality of the sandcrete block produced is influenced by the batching of the mix and the right quantity of water to enhance

hydration of the cement. The curing and drying process after the mould has formed also affect quality of blocks. The storage and the stacking process are other potent variables that influence quality.

The management variables of capital, land, labour and entrepreneurial functions, have high propensities to influence the production outputs of the firms. The effective utilization and blending of these factors of production within the right mix is likely to engineer desired optimal production levels.

In a related manner Bassey (1994) commenting on the variables that influence the efficiency and effectiveness of plants and machines identifies obsolesce and depreciation levels as factors that need serious and critical appraisals during production operations. Absence of a critical appraisal could lead to low production output, idle time of machines, to long drying time, in the case of block moulding industries. Mechanical plants make work more efficient and the mechanical plant manager must have efficiency in mind while selecting the plant to be used for construction.

Holmes (1995), contends that plant is an important construction resource. Deriving the full benefits of its efficiency and effectiveness detect that cognizance be given to issues of outputs, continuity of work, training of operatives, maintenance and repair of plant as a major factor must appraise the age and condition of plant, cost of spares, labour and overhead cost and desired care of plant by the operator.

The resultant outcome of short falls in any of the observed variables is likely to induce a disequilibrium in demand and supply of sandcrete blocks. Seasonal variations further exacerbate the situations, leading to low income and poverty. In an emerging global trend, building materials merchants are expected to deliberately attempt to take activities and products beyond their national boundaries, adopt proactive measures inorder to survive and grow.

The paper identifies *strategic positioning, competitive, intelligence, capacity building of personnel skills and the activities of these firms* as modus operandi for the achievement of globally sustainable firms.

Entrepreneurship

Businesses are becoming more global and national boundaries less relevant. Firms need to create and sustain a strategic market positioning using the tool of competitive intelligence.

In a similar vein (Hasagawa & Shimizu, 1988) opined that the successful performance of world class companies in the global arena detects that they create a strategic position, allocating adequate resources to the effort and ensuring that everyone in the firm, particularly top management is committed to the position created.

Porter (1991) contends that strategic positioning, carves out a niche and establishes an obvious differential in the activities of firms who are strategically positioned and others. This vantage position leads to profitability, necessitated by trade-offs of opportunities in machinery, equipment, skills and operational activities.

In a related manner, Porter (1996) observed that firms to be strategically positioned, they need the usage of the tool of competitive intelligence, which ensures that strategic position is done within the limits and confinement of some operational scope, activities which detect what, when and how firms activities are configured. This eliminates logical in consistencies in pursing several types of advantages or different scopes simultaneously. Positioning trade-offs are essential because they avoid inconsistencies in among others, machinery, equipment, skills and management systems. Highly developed competence in a particular sub-sector enable firms to pursue opportunities and create some others wherever conditions allow and create strategic positioning in a global context.

Soubra (1989) and OECE (1992) observed and advanced the conditionality of acquaintance, with the potential local client, within the context of strategic positioning stating that despite their global pedigree they should concurrently provide optional and customized services to the client. These would be outside core service areas.

Teece *et-al.* (1997) and Ngowi (1997) suggest that once a strategic positions is created a firm needs to continuously innovate valuable new service features before competitors, take advantage of them, producing imitation by incumbents who are likely to copy it by repositioning themselves.

Ngowi *et al* (2000) contends in a summative manner that to create and sustain a strategic position a firm needs global information about the intended or created position, the local clients needs which lead to a demand driven decisions and operations, continuously innovate in materials, equipment and the general direction of firms. Others include a competitive intelligence scheme that is research orientated providing answers to inherent challenges, risks, opportunities and market threats, the potentials and weakness and the external treats from competitors.

Fuld (1985) views intelligence gathering as sorting out numerous bits of data and assembling them into a cogent and usable form of information or intelligence. It is a process of data collection that relates to target evaluation, analysis and the utilization of outcome for decision making.

According to Gilad and Gilad (1988) business competitive intelligence is all about data ranking, collection and its usefulness and currency. Storage, organization and analysis of data and dissemination, the use of the resulting intelligence for decision making. The majority of the information are got from field and published sources with continual appraisal by the Research and development (R & D) units of firms, bordering on issues like what other say about the competitors and what others say about the competitors relying on information from books, business periodicals, company and industrial research and technical journal. These processes are done with a critical appraisal of firms projections. Forward movement proposals and position taking into cognizance firms inherent challenges and risk with the sole objective of preventing surprises that could jeopardize a business, also assessing opportunities and market threats.

In the arena of business, competitive intelligence gathering is nobody's exclusive right and monopoly. It is imperative to take note and be aware of the potency of other competitors capacity on intelligence gathering and targets at the firm. Other competitors may deliberately plant misinformation targeted to keep the firm pre-occupied and off-balance (Mc Gonagle & Vella, 1990).

Capacity Building

Capacity building and skills acquisition serve as a corollary and an aftermath of efficient and effective competitive intelligence report that induces a strategic market position. Competitive intelligence detect the level, extent and direction of capacity building and skills acquisition; this enhances innovative strategies and tactics; which accords firms and personnel the leverage to venture into new in roads to production operations and methodologies. New effective and efficient machines' and equipment utilizations and materials are the manifestations of capacity building and skills acquisitions. Capacity building brings with it rightful skills, enhance financial analysis, material procurement, sales and production analysis and marketing strategies. It propels improvement and enhances organizational and/or individual ability towards its mission; adopting and providing coaching and training, management development funds, assisting individuals and organization towards the general upgrading in performance, with a likely propensity to attainment of world class skills.

The attainment of world class skills that are relevant and useful at specific period makes capacity building a continual process, updated to reflect and meet organizational needs. Murphy (1983) contended that the attainment of world class capacity and skills detect that the operations must be within the global arena and context, if a strategic market is to be attained, revealing further that such world class skills invoke innovations.

Methodology of Study

The work is majorly effected by field work that examines the dynamics of the production of hollow sandcrete blocks in Jos.

(i) The parameters of interest are production, sales and breakages for a two year period, (January to December each year).

(ii) A sample population of 10 (Ten) block moulding industries were randomly selected, five each from the North and South ends of the city. Firms chosen form the Northern end include Farin Gada, Gada Biyu, Ring Road, Liberty Boulevard and Bauchi Road. The southern end include firms within the areas of Wholshe, Dogo Karge, Favwel and Rayfield. The mean values of the totals of each of the parameters (production, sales and breakages) figures for the ten firms are collated; this forms the basis of analysis.

(iii) Tools (Analysis Technique): the statistical tool of regressional analysis (both simple and multiple determine the relationship existing between variables). Analysis of variance tests the differences and the factors that account for those differences along seasonal lines (Dry and Rainy Seasons).

(iv) The co-efficient of determination (R^2), determines the extent of relationship existing between two or more of the parameters of interest. The Fcal, Ftab and P-values establish significance levels of the relationship, put at 50%. It also determines the decision to accept the Null hypothesis.

(v) Statistical computer package (SPSS), analysis the data. Logarithmic and other exponential transpositions of the parameters are also evaluated.

(vi) Descriptive analysis: Graphs and charts illustrate and establish trends and pattern between the parameters, during the study period.

Table 1: Regression Analysis Between Average Production and Average Sales of Hollow Sandcrete Block (225mm) in Jos Metropolis

Analysis No.	*Variables*		Type of Model	Results Of Experiment					*Inferences*	
	x	Y		Regression Equation	R^2 (%)	F_{tab}	F_{cal}	P_{value}	Strength of Relationship	Remark
Analysis. 1a	ASales9	AProd9	Linear	AProd9 = 1499.56 + 0.97Asale9	99.36	4.96	1551.85	0.00	Very Strong	S.S
Analysis. 1b	ASales9	AProd9	Log.	AProd9 = -180782 + 20385.69Asale9	99.37	4.96	1585.53	0.00	Very Strong	S.S
Analysis. 1c	ASales9	AProd9	Quad.	AProd9 = -3460.82 + 1.45Asale9 – 1.12E-05^{2}Asale	99.43	4.26	777.88	0.00	Very Strong	S.S
Analysis. 1d	ASales9	AProd9	Cubic	AProd9 = -3460.82 + 1.45Asale9 – 1.12^{2}Asale9 + 2.83^{3}Asale9	99.43	4.26	777.88	0.00	Very Strong	
Analysis. 1e	ASales9	AProd9	Exp.	AProd9 = 8516.76 + 4.4E05Asale9	98.85	4.96	861.21	0.00	Very Strong	

Key: **SS** = Statistically Significant

NS = Not Significant

Observation and Inferences

The regression equation of the analysis (AProd9 = 1499.56 + 0.97A sales 9) shows a positive linear relationship between the variables tested with a positive base value of 0.98. This indicates that both variables moves in the same direction i.e. as the independent variable increases the dependent variable also increases. The analysis has an R-sq value of 99.36%, this indicates that this percentage accounts for variables that impact on sale of 225mm block are due to production factors. The Ftab value of 4.96 is less than the Fcal value of 1551.85 and a P value of 0.00 which is lower than 0.05 level of significance used in this study. The research therefore, establishes a very strong relationship.

Table 2: Regression Analysis between Average Production and Average Breakage in Hollow Sand Crete Block (225mm) in Jos Metropolis

Analysis No.	*Variables*		Type of Model	*Results of Experiment*					*Inferences*	
	x	y		Regression Equation	R^2 (%)	F_{tab}	F_{cal}	P_{value}	Strength of Relationship	Remarks
Analysis 2a	AProd9	ABreak9	Linear	ABreak9 = 171.96 – 0.00Aprod9	46.12	4.96	8.56	0.02	Weak	S.S
Analysis 2b	AProd9	ABreak9	Log.	ABreak9 = 865.26 – 76.90Aprod9	49.59	4.96	9.84	0.01	Weak	S.S
Analysis 2c	AProd9	ABreak9	Quad.	ABreak9= 778.13 – 0.06prodA9 - 1.27E-06^{2}Aprod9	75.79	4.26	14.08	0.00	Very Strong	S.S
Analysis 2d	AProd9	ABreak9	Cubic	ABreak9= 778.13 – 0.06prodA9 - 1.27E-06^{2}prodA9 – 1.03^{3}Aprod9	75.79	4.26	14.08	0.00	Very Strong	S.S
Analysis 2e	AProd9	ABreak9	Exp.	ABreak9= 202.02 – 3.39E-05Aprod9	45.68	4.96	8.41	0.02	Weak	S.S

Key: **SS** = Statistically Significant

NS = Not Significant

Analysis 2: The regression equation A break 9 = 171.96 – 0.00 A prod 9, shows a negative linear relationship between the variables tested with a negative value base of 0.00. The equation indicates that the variables move in different directions i.e as the independent variables increases the dependent variable decreases. The R-Sq value of 46.12% indicates that, only (46.12)% of the total variation in production of 225mm block can be explained by variations in breakages. The equation and significances a strong relationship. The Fcal value of 8.56, which is greater than Ftab of 4.96 suggest that there is statistical linear relationship production and breakage, the P value of 0.02, which is lower than 0.05, also necessitated rejecting the null hypothesis.

Table: 3: t-Test for Seasonal Production of 225mm Hollow Sand Crete Blocks in Jos

Analysis	Zone	Season		T_{tab}	$T_{cal.}$	P_{value}	Remark
		Raining	Dry				
3	Aprod9	20137.75	25515.50	1.812	-4.95	0.00	S.S

Key: **SS** = Statistically Significant
NS = Not Significant

Observation and Inference

From experiment 3 above, the t-test shows that the mean production in dry season is higher than the mean production in rainy season. The T-calculated value of -4.95 is lower than the T-calculated value of 1.812 which indicates that the difference is statistically significant. Also the P value of 0.00 which is below the boundary of 5% (0.05) confirms the remark. Thus the null hypothesis is rejected.

Table 4: t-Test For Seasonal Sales of 225mm Hollow Sand Crete Blocks in Jos.

	Zone	*Season*		T_{tab}	$T_{cal.}$	P_{value}	Remark
		Raining	Dry				
4	ASales9	19280.88	24758.29	1.812	-4.78	0.00	S.S

Key: **SS** = Statistically Significant
NS = Not Significant

Observation and Inference

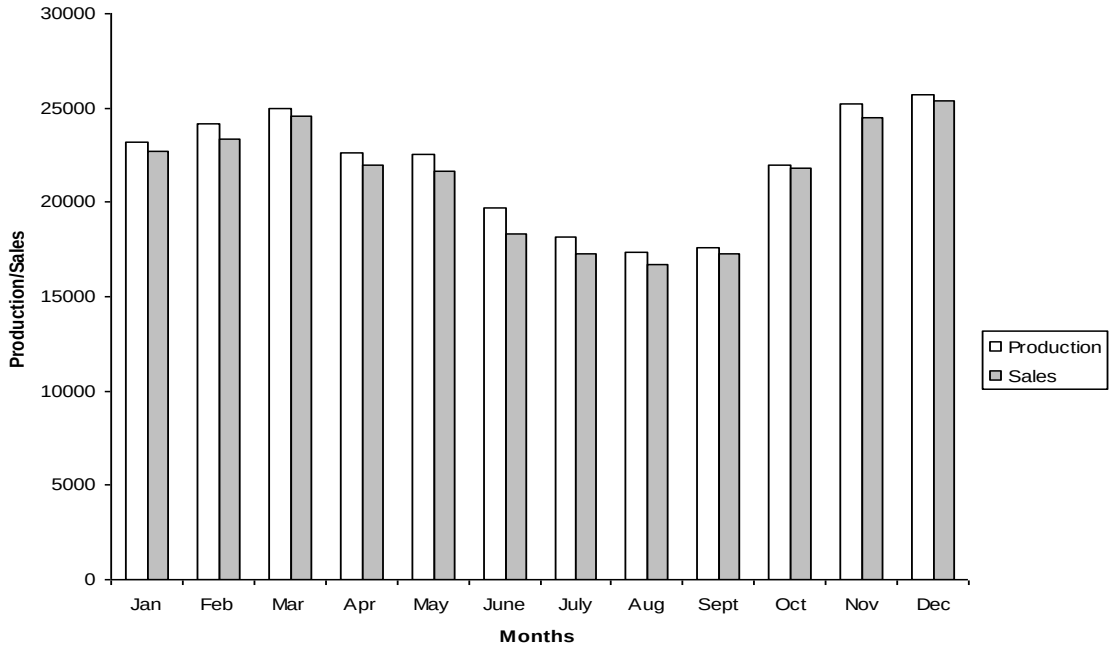
From experiment 4 above, the t-test shows that the mean sales in dry season are higher than the mean sales in rainy season. The T-calculated value of - 4.78 is lower than the T-calculated value of 1.812 which indicates that the difference is statistically significant. Also the P value of 0.00 which is below the boundary of 5% (0.05) confirms the result.

Description of Charts

The descriptive charts shows the pattern and trends of the average production and sales levels of hollow sandcrete blocks. It is observed that the period April to September has the lowest production and sales level, with the contrasting higher levels during the period (October

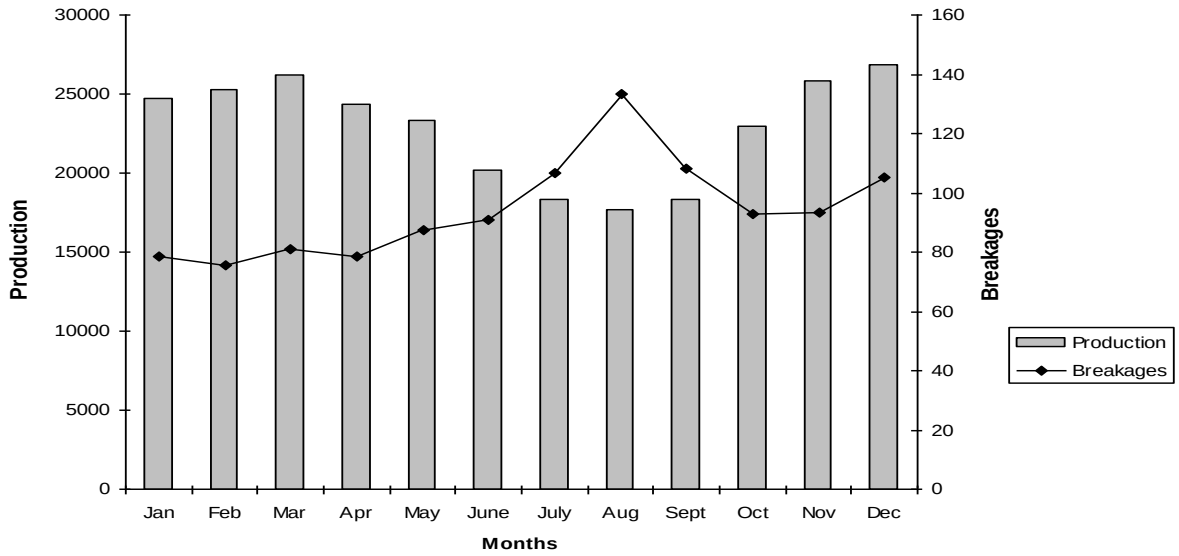
to December) and January to March. The trend of average production and breakages levels, indicate that the highest number of breakages were recorded between the months of June to September while the months of January to March recorded the lowest level of breakages.

Fig 1.



Average monthly production and sales of hollow sandcrete blocks (9") in Zone A

Fig. 2.



Average production and breakages of hollow sandcrete blocks (9") in Jos Metropolis

Discussion of Results & Implications

The research findings establish that (1) strong positive relationship between production and sales (2) a weak negative relationship between production and breakages (3) Also both production and breakages were found to be influenced by seasonal variations.

Implication of Results Outcome:

Analysis No. 1:

Production and sales: This is indicative that for every unit of sales made a corresponding increase is demand of production level. This tends to explain the issue of low production output. The implication of this outcome therefore tends to manifest the need for capacity building and skills, that should be able to march and operate desired production inputs, sequel to innovations in (machines and equipment) and materials. It is most desirable that demand levels are met, for sustainable development of the firms by way of enhanced profit margins.

Analysis No. 2:

Production and breakages: The outcome of this analysis establishes that as production level increases, the breakage reduces. The occurrence of breakages with respect to this analysis do indicate or suggest that should improvement be recorded in production techniques and skills, breakages occurring from production will tend to be infinistimial. This further amplifies the need for capacity and skills acquisition as it concerns the dynamics of sandcrete block production. This would lead to increase in profit level.

Analysis No. 3:

Production and seasonal variations. The outcome of result establishing the difference between production in the dry season and wet season, indicates that the mean production in dry season is higher than the mean production in wet season. The t calculated value was lower than the t-tabulated, which shows that the difference is statistically significant. Also the P-value was below (0.05). It is likely that improvement in capacity and skills, innovative production techniques and entrepreneurship skills is likely to bridge differential in production levels during the dry and wet seasons. The impact of weather is likely to be reduced, when these variables are enhanced.

Analysis No. 4: Sales and Seasonal Variations:

The outcome of result establishing the difference between sales levels in the dry and wet season, indicates that the mean sale in dry season is greater than the mean sale in rainy

season. The t-calculated value was lower than lower than t-tabulated, which indicates that the difference is statistically significant. Also the P-value was below (0.05). It is likely that improvement in capacity and skills, innovative production techniques and entrepreneurship skills is likely to bridge differentials in the sales levels necessitated by seasonal variations.

Conclusion

Sandcrete blocks, is the predominant material used in cladding in walls construction in Jos Metropolis. The dynamics of its production establishes that the production techniques with respect to materials, machines entrepreneurship and personnel skills appear to have stagnant innovative strategies and inputs appear infinistimal. Research findings established that (i) production is highly influenced by the level of sales; increases in sales induce a corresponding increase in production level. (ii) breakages during production showed a weak relationship, also establishing that breakages during the rainy season were higher, while dry season recorded higher production levels. (iii) Higher levels of sales occur during the dry season, with the wet season recording lower sales levels.

Recommendations

Block moulding industry to survival and grow in a boundaries less dimension detect that they create and sustain a stratetic market position, necessarily adopting the tools of competitive intelligence, capacity building and skills acquisition (world class skills at that, be acquired). This leads to innovate strategies and measures that begets enhanced production methodologies and subsequently high productivity. It is necessary that the tools of management are integrated in the production process, this leads to high profitability and a concomitant enhanced income, that logically leads to poverty alleviation of the firms, personnel, and the immediate environment were the firms are situated.

Specifically, the observed shortfalls in production, recorded high levels of breakages and low sales during the wet seasons are likely to be reduced to barest minimum, resultant of firms that adopt and integrate the variables herein before highlighted in the earlier segment of the paragraph.

Implementation Strategies

The Study advocates the following:

(i). Expansion of business and production activities, to be achieved through the adoption of some form of pu8blic-private initiates, engineered by micro-finance to boost capital base of firms obtaining some micro-finance to boost the capital base of firms.

(ii). The adoption of indoor production during the wet season, building sheds for mixing and moulding and then curing and drying done in an auto clave or klin.

(iii). Firms should employ highly skilled personnel, optimally using them through the purchase of modern equipment and machines.

(iv). Firms to adopt improved marketing strategies; visiting construction sites and convincing prospective customers.

(v). Quality assurance of blocks, to be maintained through laboratory testing of samples.

(vi). Some form of discounts could be offered prospective customers based on quantity of block purchased.

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RISK ASSIGNMENT PATTERNS OF SMALL SUBCONTRACTING FIRMS IN THE NIGERIAN CONSTRUCTION INDUSTRY

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Abstract
This paper is concerned with the appraising the patterns of risk assignment in construction works undertaken by small subcontracting firms. The aim of this study was to establish the prioritization of risks by small construction subcontracting firms, by (i) determining which risks were identified and assigned in construction contracts handled by SMEs, (ii) ranking the assigned risks based on their frequencies. The scope of the study covered completed or ongoing public and private sector construction projects within the F.C.T. Abuja and Niger State. Information realised from an extensive literature survey was filtered and modified to derive 29 risk events, which formed the basis of the survey questionnaire employed by the study. The findings of the study revealed that in about 54% of subcontracts, between 11 and 20 risk events were identified and assigned between the contract parties. This was below the number of risk events assigned under common construction contracts such as that of the Joint Contracts Tribunal (JCT). Sixty-eight percent (68%) of all identified risk events were assigned to the subcontractor. The top five risk events that were most frequently identified and assigned in construction subcontracts were all potential events that lay outside the influence of the subcontractors. The study recommended that on very small and simple jobs, the risk events to be covered by subcontracts could be limited to the 10 events presented in this paper. Special notice should be taken of (i) Inflation, (ii) Poor quality of procured material, because these risks were the least likely risks to be assigned.

Keywords: Assignment, Construction, Risk, SME, Subcontracting

Introduction

Risk in construction has different meanings and interpretations. Hertz and Thomas (1983) regarded risk is uncertainty and the result of uncertainty. Any exposure to the possibility of loss or damage to people, property or other interest has also been considered as risk. Risk as a concept varies according to viewpoint, attitudes and experience; engineers and contractors view risk from the technological perspective; lenders and developers tend to lean more to the economic and financial side; health professionals, environmentalists, chemical engineers take a

safety and environmental perspective. Risk is therefore generally seen as an abstract concept whose measurement is very difficult.

The Nigerian construction industry consists of a few very large multinational companies and a multitude of companies that run the gauntlet from very small to fairly big in size. Most of the subcontracting firms fall into the category of very small to small firms. Small and Medium Enterprises (SMEs) in Nigeria are defined as any enterprise with a maximum asset base of N1.5 billion (excluding land and working capital), and with no lower or upper limit of staff (Central Bank of Nigeria 2009). While the activities of large firms impact significantly on the industry's financial turnover, income redistribution and construction innovation on a wide scale is carried out by SMEs. Problems that affect the SMEs in the industry are thus important, and worthy of research.

Risk assignment may be defined as the process of identifying project risks and determining how they may be realistically shared by all of the parties in a construction project. Assignment of construction risks to the construction parties through proper contractual arrangements has a significant impact on the total construction costs paid by owners, according to the Association of General Contractors of America and American Council of Engineering Companies, (2007). Construction projects usually strive to meet targets established for cost effectiveness, time efficiency and performance quality; the most important risks in construction are those that prevent attainment of these targets. Construction projects are complex in nature and have many inherent uncertainties arising from the diversity of resources and activities they require to bring them to fruition; this is the origin of construction risk.

Finding workable solutions to the 'fundamental, serious, complex, and pressing structural problems' of the Nigerian construction industry (Ofori, 1993) will require detailed research into the ways and manner that SMEs are involved in construction. Risk assignment has become an important part of construction in recent years, and how it operates in SMEs will have an impact on the performance of the construction industry. This will be due in part to the ubiquitous nature of subcontractors, who are found on almost all projects. The study of risk assignment in subcontracting firms is also necessary in order to reduce extreme problems of the industry such as project abandonment.

The research problem addressed in this paper is how risk assignment is resolved in construction SMEs. The aim of this paper was to establish the prioritization of risks by small construction subcontracting firms. Specifically, the paper focused on (i) determining which risks

were identified and assigned in construction contracts handled by SMEs, (ii) ranking the assigned risks based on their frequencies. The scope of the study covered the sampling of completed or ongoing public and private sector construction projects within the study area, which included the F.C.T. Abuja and Niger State. The study did not take into account the type of construction, ownership of the project, methods of finance, or the specific location of the projects. Data employed in this study was limited to that collected using the research instrument (questionnaire) only.

Literature Review

Risk is a multi-faceted concept within the context of construction industry. A lack of predictability about outcome or consequences in a decision or planning situation (Hertz and Thomas, 1983), the uncertainty associated with estimates of outcomes – there is a chance that results could be better than expected as well as worse than expected or the likelihood of occurrence of an event during the construction process to the detriment of the project (Faber, 1979) are all referred to as risk. In this research, the more general and broad definition of risk as presented by Faber (1979) has been adopted. In addition to the different definitions of risk, risk may be categorized in various ways for different purposes. Examples are external risks and internal risks as a category, while political risk, financial risk, market risk, intellectual property risk, social risk, safety risk comprise another, more detailed category (Songer, Diekmann, & Pecsok, 1997).

Risk typology is the study or systematic classification of types of risk. The typology of the risks appears to depend mainly upon whether the project is local (domestic) or international, (Flanagan and Norman, 1993). It is possible to classify all risks specific to construction into three broad levels, (country, market and project levels) as done by Hastak and Shaked (2000). They viewed country level risks as a function of the political and macroeconomic stability of the country in which the project will be executed. Construction market level risks included technological advantage over local competitors, complexity of regulatory processes, and attitude of local and foreign governments towards the construction industry. Project level risks are specific to construction sites and include logistic constraints, improper design, site safety, improper quality control and environmental protection, etc (Thobani, 1999).

Risk Assessment and Classification in Construction

The assessment and classification of risks follows many approaches in the literature. In

Perry and Hayes (1985), an extensive list of factors was assembled from several sources, and classified in terms of risks retainable by contractors, consultants and clients. Cooper and Chapman (1987) employed two major groupings of risks associated with construction according to their nature and magnitude (primary and secondary risks). Tah, Thorpe and McCaffer (1993) used a risk-breakdown structure to classify risks according to their origin and to the location of their impact in the project. Wirba, Tah and Howes (1996) adopted a synergistic combination of the approaches of Tah et al. and Cooper and Chapman. Tah et al.'s approach was used to classify all risks exhaustively and then Cooper and Chapman's method was used to segregate risks into primary and secondary risks.

Risk Management Approaches

Risk management in the construction industry consists of three main stages: (a) risk identification; (b) risk analysis and evaluation; and (c) risk response. The first stage of the risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. Risk analysis and evaluation generally concentrate on risks with high probabilities, high financial consequences or combinations thereof which yield a substantial financial impact. Contractors need to decide how to handle each risk through the formulation of suitable risk treatment strategies or mitigation measures. Within a framework of risk management, the main objective is to remove as much as possible its potential impact, (Perry and Haynes, 1985).

The management of risk in construction projects has been written on extensively. For example, Bajaj, Oluwoye, and Lenard (1997) found that the most frequently used method of risk identification is the top-down approach technique, where the project is analysed from an overall point of view. Baker, Ponniah, and Smith (1999) listed personal and corporate experience, engineering judgement, and brainstorming as effective ways for identifying new risks. Ramcharran (1998) identified the risks usually faced by the engineering/construction service providers in a foreign country, while Kalayjian (2000) identified further the risks that are specific to the developing countries.

Risk response or handling refers to the action taken to avoid risks, to reduce the probability of risks occurring, or to mitigate losses arising from risks. Risk response methods are classified into four categories; (i) risk avoidance, (ii) risk transfer, (iii) risk mitigation, and (iv) risk retention. Risk avoidance simply means avoiding some hidden risk through the adoption of some other alternative. For example, to avoid schedule delay due to rain, a contractor could

adopt a construction method that will not be influenced by rain.

Risk transfer means the switching of risk responsibility between contracting parties in a project. Risk transfer can be classified into three types: -

(i) *Risk transfer type 1* involves insurance: parts of the financial losses resulting from risk events are compensated by insurance companies.

(ii) *Risk transfer type 2* involves subcontracting: the contractor will transfer parts of the risks to the subcontractor.

(iii) *Risk transfer type 3* involves claims to the owner for financial losses or schedule delay resulting from risk events. Risk mitigation means reducing the probability of some potential risk occurring or reducing the expected losses due to the occurrence of such risks.

Risk mitigation can be classified into two types: -

(i) *Risk mitigation type 1* is to reduce the probability that a risk event would happen.

(ii) *Risk mitigation type 2* is to reduce the attendant schedule delay or financial losses when a risk event happens.

Risk retention involves absorbing the impact of the risk event, and is of two types: -

(i) *Unplanned risk retention*, where no action is taken for some risk whether known or unknown, and

(ii) *planned risk retention*, where after cautious evaluation, it was decided to take no action for some risk.

Project Risk Management through Risk Assignment

Contractors often have to bear most of the construction risks, including those over which they have little control (Baloia & Price 2003). This is most commonly observed in developing countries. Traditionally, contractors have used high mark-ups to cover construction risks, but as their margins have become smaller, mostly due to competition, this approach is no longer effective. In the past twenty years, innovations in contracting within the construction industry have resulted in significant changes. Such changes have particularly been most noticeable in procurement methods; clients now tend to allocate greater risks to contractors.

Evidence from the literature reveals that there is a gap between the existing risk management techniques and their practical application by construction contractors (Perry & Hayes, 1985; Flanagan & Norman, 1993). This makes the study of risk assignment an even more pressing and urgent subject of research in developing countries such as Nigeria. The

dominant reason behind the adoption of risk assignment by clients is to improve the cost performance of construction projects. Poor cost performance in construction projects were traced to price fluctuations, fraudulent practices and 'kickbacks' in Nigeria by Okpala and Aniekwu (1988). Further research by Jahren and Ashe (1990); Elinwa and Buba, (1993) found similar variables as the most influencing factors of project cost overruns.

Threats to the timely completion of construction projects on budget usually arise from the (i) uncertainty about objectives and priorities (Kelly & Male, 1993); (ii) uncertainty about fundamental relationships between project parties, (Ward, 1999); (iii) uncertainty about the basis of estimates, (Project Management Institute, 2000); and (iv) variability associated with estimates, (Ward & Chapman, 2003). In this regard risk assignment has been used to reduce or neutralise potential threats.

At times, the interpretations of risk assignment implied by standard contract clauses may differ between contracting parties. Before the contract is awarded, owners already allocate project risks through contract clauses in projects; such advance allocation of risk is typically not within the sphere of influence of contractors or subcontractors. Under such risk allocation by owners, only parts of the risks are actually distributed by the contract, while other risks are appointed simply through common practice, (Wang, 1994).

Research Methodology

The research instrument of this paper was a questionnaire titled 'Risk Assignment Patterns of Construction Subcontractors'. This was based on information on potential problems in construction projects (called risk events) which were gleaned principally from Healy, (1981); Perry and Hayes, (1985); Shen et al, (2001) and Shen et al, (2004). Twenty-nine risk events were included in the questionnaire, which consisted of two parts. Part 1 sought information on professional and educational profiles of respondents. Part 2 was on the risks identified and assigned on the construction project currently being handled by the respondents.

The research required primary data, which was sourced directly from subcontractors within the study area, through a purposive sampling procedure. This was a non-probability sampling technique in which samples were purposely selected because of the following: -

(i) their relevance to the investigation, and

(ii) suitable research subjects were few, and efforts had to be made to reach as many as possible.

One hundred questionnaires were distributed to senior management staff of identified

subcontracting firms in the following proportion: -

1. 70 questionnaires in Abuja,
2. 10 questionnaires in Minna,
3. 10 questionnaires in Bida and
4. 10 questionnaires in New Bussa.

Seventy-one questionnaires were successfully retrieved; ten questionnaires had to be rejected on the grounds of incompleteness. The number of correctly completed questionnaires used for the study was thus 61, representing a response rate of 61%. Considering the fact that the work of Wang, Dulaimi and Aguria (2004) was based on a 7.75% response rate, a 61% response rate was considered realistic and reasonable for this paper.

Results and Findings

Demographic Profile of the Research Sample

The subcontracting firms sampled by this study ranged from very small firms to quite large firms. The size of the firms was inferred from the value of the last (or current) job handled by the firms. There was a preponderance of larger firms, able to handle projects between N20 million and N40 million (38%). Very small firms that handled projects below N1 million constituted only 3% of the sample (Figure 1).

Of the 61 senior management staff of the SMEs who responded to this study, 50% had worked for between 6 and 10 years. 20% of the sample had worked for over 15 years. Fresh entrants into the construction industry made up 15%, while those with 3 to 6 years of experience made up 10% of the sample (Figure 2).

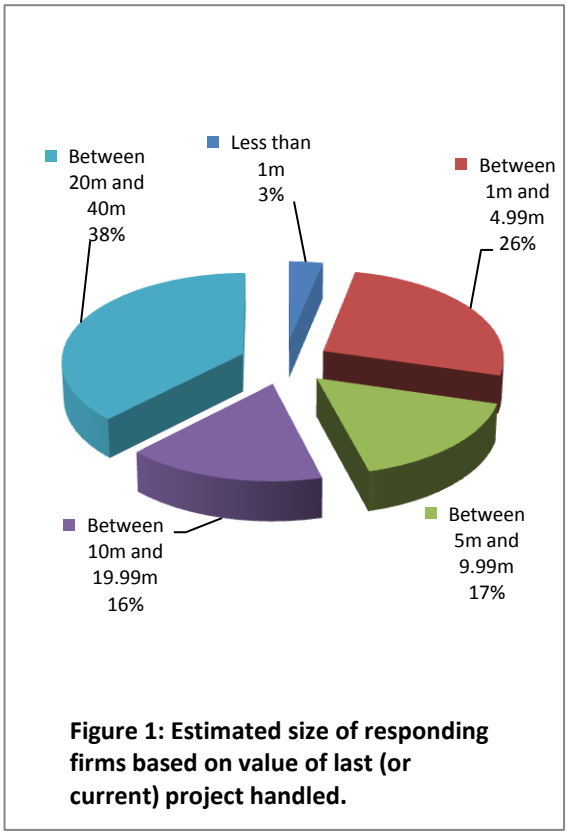

Figure 1: Estimated size of responding firms based on value of last (or current) project handled.

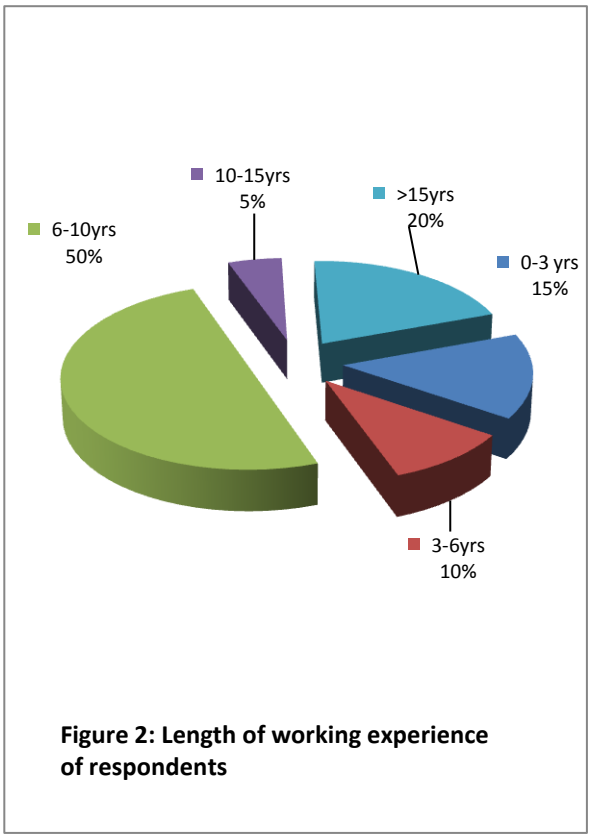

Figure 2: Length of working experience of respondents

Number of Assigned Risks in Construction Subcontracts

In 12% of the research sample, subcontracting firms had to contend with only a maximum of five risk events. The larger proportion, 44% of subcontracting firms, had 11 to 15 risk events assigned to the contract parties. Only 10% had between 15 and 20 risk events identified in their contracts (Figure 3). Overall, based on the responses received and analysed from 61 subcontracting firms, 68% of all identified risk events was assigned to the subcontractor. The client bore 32% of the identified risk. This is displayed in Figure 4 below.

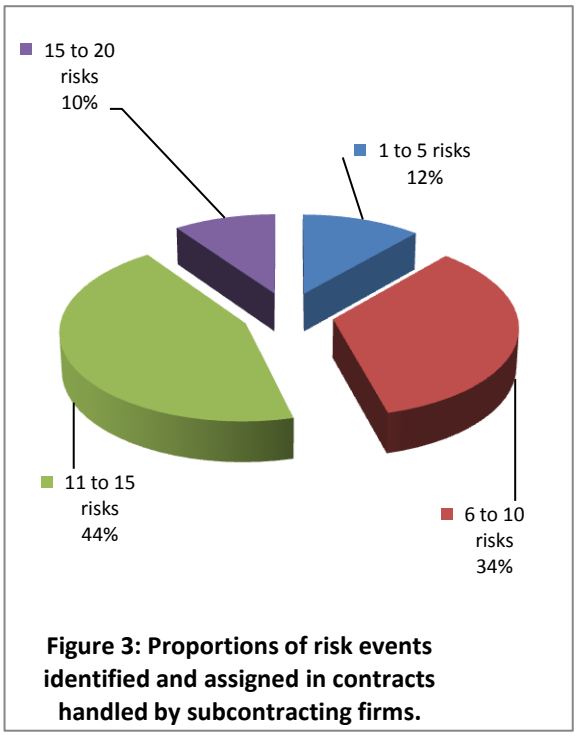

Figure 3: Proportions of risk events identified and assigned in contracts handled by subcontracting firms.

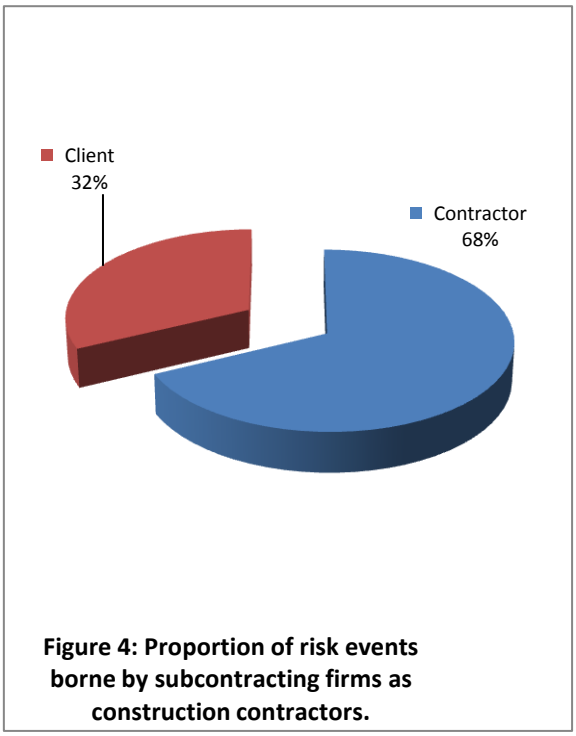

Figure 4: Proportion of risk events borne by subcontracting firms as construction contractors.

Types of Assigned Risks in Construction Subcontracts

The 29 potential risk events which were included as part of the research questionnaire were not divided into categories, since the research was interested in patterns of risk events which were assigned across the sample of small subcontracting firms, and not in the grouping of the risk events themselves. Ranking of risk events based on their frequency of inclusion in subcontracts facilitated the extraction of the top ten risk events that were most frequently identified and assigned in construction subcontracts entered into by subcontracting firms. These risk events were displayed below.

Table 1: Ranking of risk events based on frequency of inclusion in construction contracts

S/No	Risk	Frequency of risk event	Ranking of risk event
1	Delayed payments	46	1
2	Project delay	42	2
3	Design changes	37	3

4	Variations due to changes in the scope	35	4
5	Variations due to faulty design	33	5
6	Poor construction workmanship	31	6
7	Inadequate supply of relevant amenities on site (water, electricity, etc.)	31	6
9	Faults in tender documents	30	7
8	Accidents on site	30	7
10	Shortage of skillful workers	29	8
11	Inflation	27	9
12	Poor quality of procured materials	25	10
13	Loss due to interest rate	23	11
14	Force majeure	22	12
15	Loss due to bureaucracy for late approvals	22	12
16	Incompetent Nominated Subcontractors	22	12
17	Fluctuation	21	13
18	Increase in site overheads	21	13
19	Materials shortage	21	13
20	Cost increase due to changes of policies	18	14
21	Unavailability of skilful workers	14	15
22	Equipment failure	13	16
23	Improper selection of project location	12	17
24	Materials Unavailability	11	18
25	Loss incurred due to change in Government	9	19
26	Obsolescent of building equipment	9	19
27	Breach of contracts by participants	8	20
28	Equipment Inadequacy	8	20
29	Materials pilfering	5	21

Subcontractor Perception of Assigned Risks

It becomes evident that the five most frequently assigned risk events in construction contracts handled by subcontracting firms are all events outside the control of the subcontractor. The subcontractors interviewed opined that clients and main contractors should

assume the burden of these risk events, as well as for 'faults in tender documents'. The rest six risk events they felt, ought to be borne by the subcontracting firms. One of these, 'inflation', is actually not within the control of the subcontracting firms.

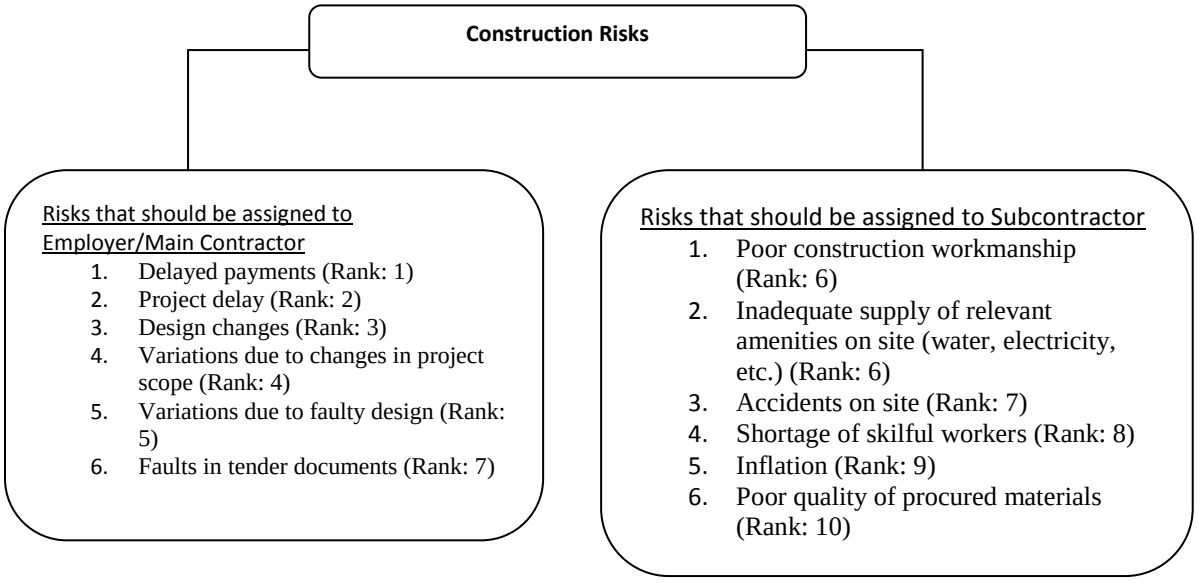

Fig. 5: Subcontractors' preferred distribution of risks

Implications of Findings

In about 54% of subcontracts, between 11 and 20 risk events were identified and assigned between the contract parties (Figure 3). This was below the number of risk events assigned under common construction contracts such as that of the Joint Contracts Tribunal (JCT). The fact that 68% of all identified risk events (Figure 4) was assigned to the subcontractor implied that subcontractors were expected to be fully in control of the jobs they were hired to perform. The judiciousness of the assignment of risk events was not included as part of the scope of this paper.

The top five risk events that were most frequently identified and assigned in construction subcontracts were all potential events that lay outside the influence of the subcontractors. This has implications for subcontract design in Nigeria.

Conclusion

This research paper concluded that the majority of subcontracting firms had to contend with between 10 and 20 risk events. In addition, based on the responses received and analysed from 61 subcontracting firms, 68% of all identified risk events was assigned to the contractor.

It was further concluded that all of the five most frequently assigned risk events in

construction subcontracts consisted of events that lay outside the control of the subcontractor. The five top-ranked risk events were: (1) Delayed payments, (2) Project delay, (3) Design changes, (4) Variations due to changes in the scope, and (5) Variations due to faulty design.

Recommendations

Consequent upon the conclusions arrived at in the preceding section; the following recommendations were proffered as means of improving risk assignment practices involving construction subcontractors in the study area.

(i) Clients, project managers and main contractors could restrict the risks they include in contracts for construction to the twenty-nine risks that this paper covered. For very small and simple projects, the nature of which does not necessitate complex legal drafting of contracts, the risk events to be covered by subcontracts could be limited to the first 12 events (ranked 1 to 10, in **bold face** type) that were presented in Table 1 of this paper.

(ii) It was also recommended that special notice should be taken of the following risk events during risk assignment processes: (i) Inflation, (ii) Poor quality of procured materials. This might be necessary because these risks were the least likely risks to be assigned, going by the ranking developed by this study.

(iii) Special emphasis should be placed on the three top ranked risk events, because they have the potential of resulting in the extension of the planned project period (i.e. time overrun).

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FUZZY LOGIC MODELLING OF MUNICIPAL SOLID WASTE GENERATION

By

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Abstract

The amount and factors that affect generation of municipal solid waste are important for solid waste management. This paper presents a model for the estimation of municipal solid waste using fuzzy logic. Fuzzy logic is a multivalued logic developed to deal with imprecise or vague data. Several parameters of waste generation were taken into consideration. A weighting system was used in analyzing all the aspects and this ensured an integrated and interrelated classification method. The obtained results established the success of the designed system in the evaluation technique of the best number of waste bins in each area.

Keywords: *Fuzzy logic, modeling, municipal solid waste, waste generation*

Introduction

Fuzzy logic is a form of multivalued logic derived from fuzzy set theory to deal with reasoning that is approximate rather than precise. The fuzzy logic variables may have a membership value of only 0 or 1, or between 0 and 1. In fuzzy logic, the degree of truth of a statement can range between 0 and 1 and is not constrained to the two truth values {true (1), false (0)} as in classic predicate logic (Novák et al, 1999). Fuzzy logic allows for partial membership in a set, values between 0 and 1, and introduces the concept of the fuzzy set. When the approximate reasoning of fuzzy logic is used with an expert system, logical inferences can be drawn from imprecise relationships.

The term "fuzzy logic" emerged as a consequence of the development of the theory of fuzzy sets. Fuzzy logic is used to optimize automatically the wash cycle of a washing machine by sensing the load size, fabric mix, quantity of detergent and has applications in the control of passenger elevators, household appliances, cameras, automobile subsystems, and smart weapons.

Municipal solid waste (MSW) generation data are used in the planning of waste management systems (Ogwueleka, 2003), including personnel and truck utilization (Matsuto and Tanaka, 1993); land demand for facilities (Leao et al, 2001) etc. They serve as a basis for further improvements and optimization in terms. The estimation and the prediction of municipal

solid waste generation play an important role in solid waste management. The population growth and migration, underlying economic development, household size, employment changes, as well as the impact of waste recycling are factors that influence solid waste generation interactively. The design and development of a fuzzy model for calculating and forecasting the aggregate impact of economic trends, population changes, and recycling impact on solid waste generation was noted to be very useful in the application of solid waste management.

The issue of determining a suitable procedure of analysis for municipal solid waste quantities has been investigated in many research approaches. Certain aspects of MSW management and policies are found in the literature based on the correlation among socioeconomic data, solid waste composition and quantities. The main objective in these cases is to simulate the multivariate problem of MSW in a mathematical form by using deterministic models (mostly regression models) and trend analysis (Karadimas et al, 2005). Matsuto and Tanaka (1993) have normalized values of waste amounts and subsequently have estimated moving averages. Several studies have documented the use of time series on an annual (Beigl et al, 2004), monthly (Chang and Lin, 1997), or daily (Navarro-Esbri et al, 2002) basis using waste data, census and economics data in addition to waste management related information. Sircar et al (2003) proposed horizontal and vertical factors for the prediction of waste management quantities. Horizontal factors describe the processes of interchanges between different waste types. Vertical factors are due to change of the total sum of all waste streams depending on demographic, economic, technical and social developments. Parfitt et al (2001) used five collection infrastructure related variables as cluster criteria for a successive group comparison. Skovgaard et al (2005) provided forecasts for all necessary predictors for MWS forecasts to potential users. Chen and Chang (2000) proposed a grey fuzzy dynamic model without the use of any independent variable.

The main objective of these models is to provide a prediction tool. Most of these models are often unusable due to the lack of underlying data for the model parameters. These traditional forecasting methods need a complete socioeconomic and environmental database to build an essential mathematical model. Many cities may not have sufficient budget and manpower to perform such a long term and large scale sampling and analysis program (Liu and Yu, 2007). Nearly all statistical estimation models, such as the least-squares regression method and the curve extension method are designed based on the configuration of semi-empirical

mathematical models but the fuzzy logic modeling handles the estimation issues under uncertainty.

Study Area

Abuja is the capital city of Federal Republic of Nigeria. Abuja lies between longitude 6^0 $45^/$ to 7^0 $38^/$E and latitude $8^0 25^/$ to $9^0 29^/$N. The study area is located on the North-eastern quadrant of Federal Capital Territory (FCT). Abuja has an area of 250 km^2 with population of about 450,000 by 2006.

Abuja phase 1 has central business area and residential districts with few businesses: Garki, Wuse, Asokoro and Maitama. The Garki District is the area in the southwest corner of the city, having the Central Area District to the north and Asokoro District to the east. The District is sub-divided into units called Areas. The District is numbered Areas 1-11 and Garki II. Wuse District is the northwestern part of the city, with Maitama District to its north and Central District to its south. The District is numbered Zones 1-8 with Wuse II. Maitama District is to the north of the city, with Wuse and Central District lying to its southwest and southeast respectively Maitama is mainly residential district with few commercial activities. Maitama has about 310 waste bins. The collection trucks must visit all bins in order to complete its collection. Asokoro is located on the east of Garki District and south of Central District.

The average waste generation rate in Abuja is 0.55-.58 kg per person per day (Solid Waste Audit Report, 2004). Abuja Environmental Protection Board (AEPB) is responsible for collecting waste from municipalities, and has made containers (120-L and 240-L plastic bins, and 1.1 m^3 metal bins) available to every household (Imam et al, 2007). There is no sanitary landfill in Abuja. Solid waste is transported to a dumpsite at Mpape.

Fuzzy set theory defines fuzzy operators on fuzzy sets. As there may be a problem of not getting the appropriate fuzzy operator, fuzzy logic rules of IF-THEN was used in this study. The rules was expressed in the form of IF *variable* IS *property* THEN *action,* as seen in the sample of the collection program which determines the level of waste bin collection in the study area.

Fuzzy reasoning is the process of deriving conclusions from a set of IF–THEN fuzzy rules using an inference procedure. Through fuzzy reasoning, the truth of the consequent is inferred from the degree of truth of the antecedent. The concept of fuzzy set theory, IF–THEN rules, and fuzzy reasoning together constitute a computing framework usually called fuzzy inference

system (FIS). In this study, the FIS is made up of the rule base, a database and a reasoning mechanism.

Factors considered during the evaluation of the whole solid waste generation process in an area under study are land use, real-estate commercial values, are of study in square meters, maximum building density factor, and electricity bills. These factors are grouped into two main groups of estimation of the daily residential waste generation and commercial-industrial generation of solid waste in the study area. The residential waste coefficients include real estate commercial values (RECV), maximum building density factors (MBDF), size of area in square meters (SAS) and electricity bills of each residential property (EBRP); while the commercial coefficient includes factors related to commercial traffic (CCT), land use (LU), size of area in square meters (SAS) and the electricity bills (EBCP) of each commercial property.

This study aims to develop prediction model based on fuzzy logic to estimate municipal solid waste generation and consequently to the calculation of the optimal number of waste bin as well as their position in a pre-defined area. The model was applied to Maitama district, whose urbanistic structure is similar to that of the whole town.

Materials and Methods

This study developed a system that uses the fuzzy sets in describing uncertainties in the different factors involved in solid waste estimation. These factors were individually denoted by a variable representing the required values for both the residential and commercial property. The fuzzy based design methodology first step was to understand and characterize the system behaviour by using our knowledge and experience. The second step was to directly design the control algorithm using fuzzy rules, which describe the principles of the controller's regulation in terms of the relationship between its inputs and outputs. The last step was to simulate and debug the design. If the performance was not satisfactory during testing and implementation, then there will be need to modify some fuzzy rules and re-try. This fuzzy-based methodology substantially simplifies the design loop and this resulted in some significant benefits, such as reduced development time, simpler design and faster time to market.

The fuzzy rule base drives the inference system. The designed rule base consists of rules that describe the various supports of these factors on the study area total solid waste generation as shown in Figure 1.

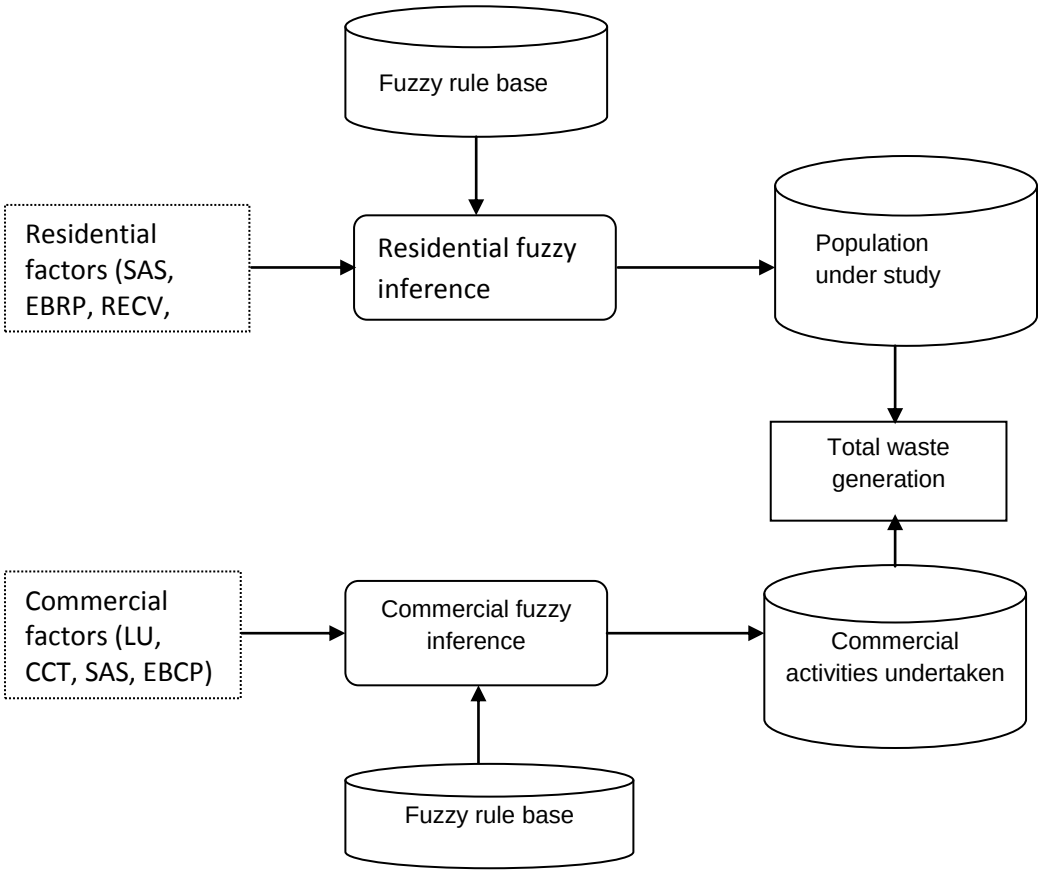

Figure 1: Fuzzy inference system (FIS) for solid waste estimation

The fuzzy inference system (FIS) that was modeled maps input characteristics to input membership functions; input membership functions to rules; rules to a set of output membership functions; and a decision associated with the output. This FIS is shown in Figure 2.

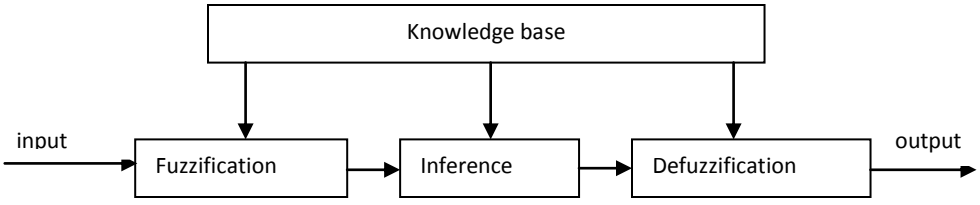

Figure 2: FIS model

The stages taken in the modeling approach used are: first, hypothesizes of a parameterized model structure relating inputs to membership functions to rules to outputs to

membership functions; collection of input/output data in a form that will be usable for training; training of the FIS model to emulate the training data presented to it by modifying the system training the membership function parameters according to a chosen error criterion; and validation. A validation data set was used to check and control the potential for the model overfitting the data. After presenting the checking and training data to the system, the FIS model was selected to have parameters associated with the minimum checking data model error.

The structure of the designed fuzzy inference system consists of three major parts, namely a rule base that holds the fuzzy IF–THEN rules used in the inference process; a database that contains the membership functions that characterize the fuzzy sets, and a reasoning mechanism that performs the inference procedure and derives conclusions depending on a set of rules and facts. The fuzzy inference process consists of five steps including fuzzification, application of the fuzzy operators, fuzzy implication, fuzzy aggregation, and defuzzification. The last step uses a defuzzification method to produce a single crisp number for each output variable. These procedural steps are shown in Figure 3.

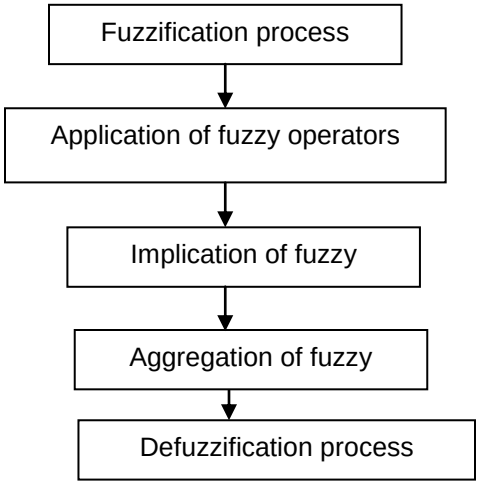

Figure 3: Steps in fuzzy inference process

The total solid waste generation was expressed as a weighted sum of all the listed factors. Linguistic values were used for the residential waste coefficient as well as for the commercial coefficient. Due to the kind of required representation of the fuzzy rules used in this study, Mamdani model was used in the system development. The Mamdani model was proposed by Mamdani in 1975 to control a steam engine and boiler combination.

The designed model was represented by the consequents of its rules using fuzzy sets. The aggregation of the outputs of all rules generated a single fuzzy set output. The defuzzification process was performed to extract a value from the output fuzzy set. The final output was given after defuzzification of the aggregated outputs, for both residential and commercial fuzzy inference, using the centroid method as described in Equation (1).

$$\text{Def}_y = \frac{\int_y \mu_B,(y) y d(y)}{\int_y \mu_B,(y) d(y)} \quad 1$$

After the defuzzification of each group of the coefficients the equation (2) was used to calculate the final solid waste generation. The equation was able to calculate the total solid waste generation on a given area, based on the population, the waste generation coefficient of the pre-defined area, the number and waste generation of the industrial and commercial activities accurately.

$$Total\ waste = \sum_{i=1}^{m} (a_i\ x_i + \sum_{j=1}^{n} b_{ij}\ y_{ij} \quad 2$$

where a_i is the population of the examined area i, x_i is the value of the daily waste generation per person in the area i, produced by the defuzzification method. Also, b_{ij} is the total area (in m^2) of every commercial activity j in the particular segment area i, and y_{ij} is the coefficient related to waste generation of the commercial activity j in the area i produced by the defuzzification method. The m stands for the distinct set of areas, used for the calculation of the total solid waste generation, while n is the total number of commercial activities in each predefined area. The estimates, that is, x_i and y_{ij} coefficients was used to construct the prediction equation waste production and to generate predicted scores on a variable for analysis.

In this study, fuzzy logic rules were programmed using the fuzzy logic programming (FLP) language. The multi-adjoint logic program (FLP) was made up of the fuzzy logic and the logic programming. In the prototype tool, the system was implemented with the appropriate Prolog clauses. The generated Prolog code was also asserted in the system and saved into a ".pl" file. Both the fuzzy and Prolog are listed and have options of clean, stop and quit. The program provided two implementation techniques, namely compilation to Prolog code (run),

which led to its simplicity, transparency, and complete evaluation of goals; and low-level representation (debug) where it gives the detailed data and other powerful manipulations.

Results and Discussion

Fuzzy logic is a paradigm for an alternative design methodology, which can be applied in developing both linear and non-linear systems for embedded control. By using fuzzy logic, designers can realize lower development costs, superior features, and better end product performance. With fuzzy logic, rules and membership functions can be used to approximate any continuous function to any degree of precision. Fuzzy sets and fuzzy logic deal with the concept of uncertainty.

The linguistic values used are ≠310, >310, <310, and normal. The linguistic values and the universe field of discourse on which these values are defined are called linguistic variables. The three basic operations on a classical set of union, intersection and complement were used. Through fuzzy reasoning, the truth of the consequent was inferred from the degree of truth of the antecedent.

The input variables in the designed fuzzy control system are mapped by sets of membership functions known as the fuzzy sets through the process of converting the crisp input value to a fuzzy value called fuzzification. This control system have the "0-1" and "ON-OFF" types of switch, which also have inputs of a truth value equal to either 1 or 0. With the given mappings of the input variables into membership functions and truth values, the microcontroller then makes decisions for what action to take based on the set of "rules", each of the form:

IF waste bin IS > 310 THEN stop collection program

The system decision was based on a set of rules:

(i) All the rules that were applied are invoked, using the membership functions and truth values obtained from the inputs, to determine the result of the rule.

(ii) This result was then mapped into a membership function and truth value controlling the output variable.

(iii) These results are combined to give a specific answer through the procedure of defuzzification.

The fuzzy controllers used consist of an input stage, a processing stage, and an output stage. The input stage mapped all inputs to the appropriate membership functions and truth values. The processing stage invoked each appropriate rule and generated a result for each, then combines the results of the rules. Finally, the output stage converted the combined result

back into a specific control output value. The processing stage was based on a collection of logic rules in the form of IF-THEN statements, where the IF part is called the "antecedent" and the THEN part is called the "consequent". The fuzzy rule sets have several antecedents that are combined using fuzzy operators, such as AND, OR, and NOT, where AND uses the minimum weight of all the antecedents; OR uses the maximum value; while the NOT operator subtracts a membership function from 1 to give the complementary function.

There are different ways to define the result of a rule, but the "max-min" inference method, in which the output membership function is given the truth value generated by the premise, was used in this study. The centroid method in which the center of mass of the result provides the crisp value was also used instead of the height method, which takes the value of the biggest contributor. The centroid method favoured the rule with the output of greatest area.

The fuzzy control system design was based on empirical methods known as trial and error. The process used was:

1. Documentation of the system's operational specifications and inputs and outputs.
2. Documentation of the fuzzy sets for the inputs.
3. Documentation of the rule set.
4. Documentation of the defuzzification method.
5. Running through test suite to validate system and adjust details as required.
6. Completion of documentation and release to production.

The design of a fuzzy controller for the waste generation has rule set of

Rule 1: IF waste bin IS ≠310 THEN speed up waste collection

Rule 2: IF waste bin IS <310 THEN continue waste collection

Rule 3: IF waste bin IS > 310 THEN stop collection program

Rule 4: IF waste bin IS normal THEN maintain collection rate

The controller accepts the inputs and maps them into their membership functions and truth values. These mappings are then fed into the rules. If the rule specifies an AND relationship between the mappings of the two input variables, the minimum of the two was used as the combined truth value and if an OR is specified, the maximum was used. The appropriate output state was selected and assigned a membership value at the truth level of the premise. The truth values are then defuzzified through centroid defuzzification.

The model error for the checking data set tend to decrease as the training takes place up to the point where over fitting begins and then the model error for the checking data suddenly increases. During training, back propagation was used. It was noted from the error tolerance used to create the training stopping criterion, which is equally related to the error size, that the training will stop after the training data error remains within the tolerances, which was left set to 0 as there is no prediction of how the training error will behave. The training was run 38 times.

Two experimental examples are used in checking and training of the data. Two identical data sets are used for checking and training. It was observed that the checking data set was corrupted by a small amount of noise and so the fuzzy inference system was used with the checking data to reduce the effect of model overfitting. The training data set that was presented to fuzzy inference system was different from the applied checking data set.

Checking data helps model validation so by examining the checking error sequence over the training period, it was clear that the checking data set was not good for model validation purposes. The fuzzy inference system graphical user interface was used to compare the data sets using the MATLAB. The training and checking data sets are loaded into the MATLAB workspace.

```
load fuzex1trnData.dat
load fuzex2trnData.dat
load fuzex1chkData.dat
load fuzex2chkData.dat
```

Data set fuzex1trnData for training was loaded from the workspace. The training data appeared in the plot in the center as a set of circles. The horizontal axis was marked data set index, which indicates the row from which that input data value was obtained. Checking data fuzex1chkData was loaded from the workspace. The data appeared as pluses superimposed on the training data. This data set was used to train the fuzzy system by adjusting the membership function parameters that best model this data. An initial fuzzy inference system was specified for training. Figure 4 shows the fuzzy inference system plotted against training data

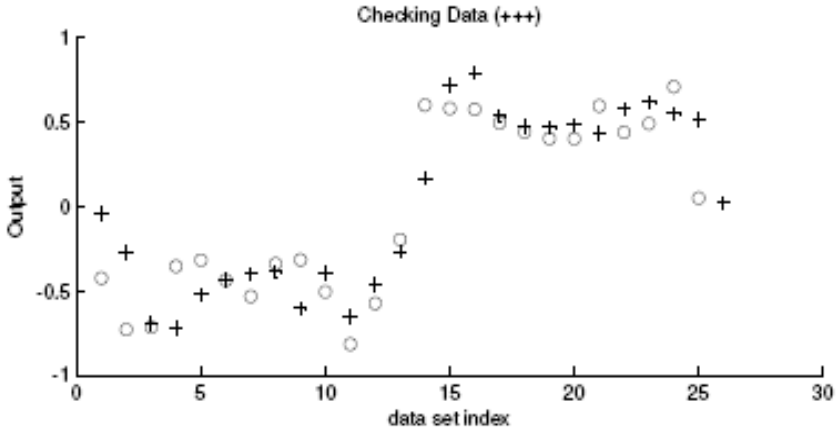

Figure 4: Fuzzy inference system plotted against training data

The number of inputs used is 1, number of outputs is 1 and number of input membership function is 3. Number of check data pairs is 26. The checking data was loaded and the fuzzy inference system grid partition was generated. The fuzzy inference system was trained using the optimization method. The observed error tolerance was 0 and the epochs are 3. The fuzzy inference system was tested and plotted against the training data.

During the fuzzy inference system training, two parameter optimization method options were made available. These are the hybrid and backpropagation. The error tolerance was used to create a training-stopping criterion, which was related to the error size. The training stops after the training data error remain within this tolerance, which was set to 0. The training was run for 40 epochs. The checking error decreases up to a certain point in the training and then it increases. This increase represents the point of model overfitting. The fuzzy inference system chooses the model parameters associated with the minimum checking error. Figure 5 shows the plotting of error against epochs.

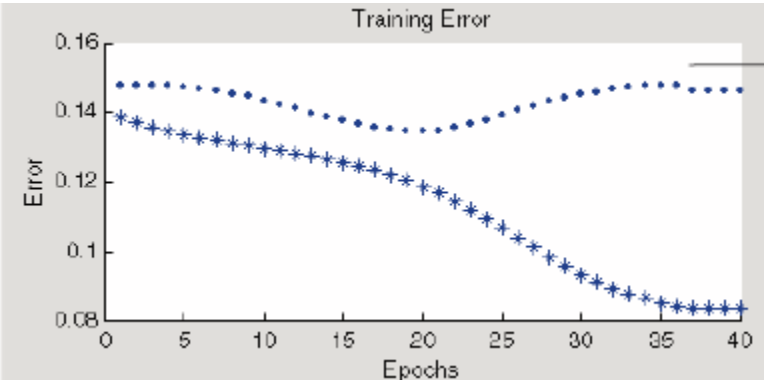

Figure 5: Error plotted against epochs.

The training error is represented with *** and checking error with **....** The number of input is 1, number of output is 1 and the number of input membership functions is 4. The training will stop after the training data error remains within the error tolerance. The number of training epochs is up to 40.

The checking error decreases up to a certain point in the training and then it increases. This increase represents the point of model overfitting. The fuzzy inference system chooses the model parameters associated with the minimum checking error.

In testing the fuzzy inference system against the checking data, the result is obtained shown in Figure 6.

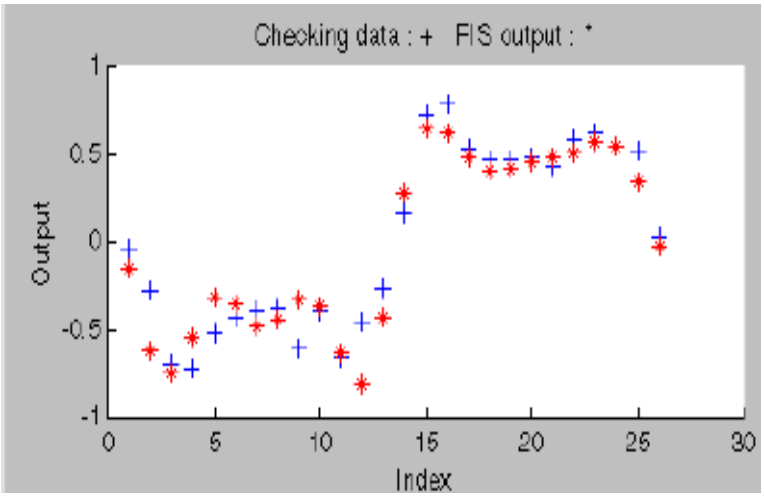

Figure 6: Fuzzy inference system against checking data

The number of input is 1, the number of output is 1 and the number of input information is 4. The checking data is loaded and the grid fuzzy inference system generated. The inference system is trained using the optimization hybrid method. Error tolerance is 0 and the epochs are 40. The fuzzy inference system is then trained and tested by plotting against the checking data. The average testing error is 0.15.

Loading the checking data, it was examined to make sure it does not validate the model. The result obtained is shown in Figure 7.

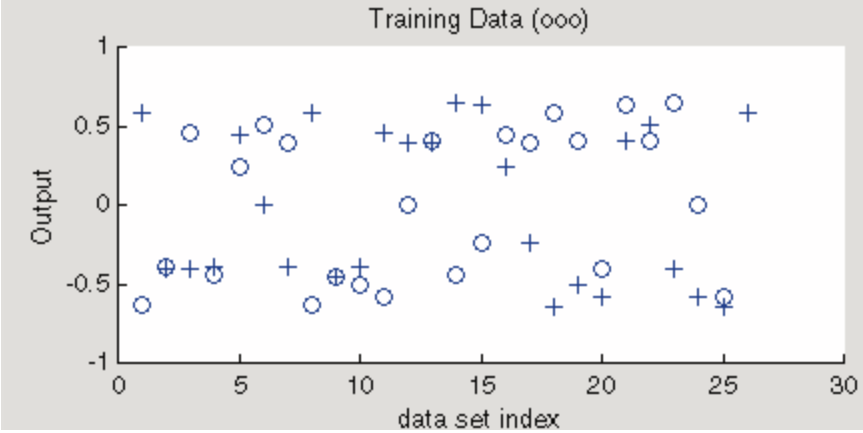

Figure 7: Fuzzy inference system plotted against the checking data in loading check data

The training data was loaded. Checking data was represented using '+' and training data 'o'. The number of inputs was 1, the output was 1, and the input membership function was 4. The number of train data pairs was 25.

Training for 60 epochs gives the observation was that the checking error was quite large. It appears that the minimum checking error occurs within the first epoch. The checking error was sufficiently large to indicate that either more data needs to be selected for training, or there is need to modify the membership function choices, that is, both the number of membership functions and the type, otherwise the system can be retrained without the checking data, if the training data captures sufficiently the features being represented. The training error plotted against epochs is shown in Figure 8.

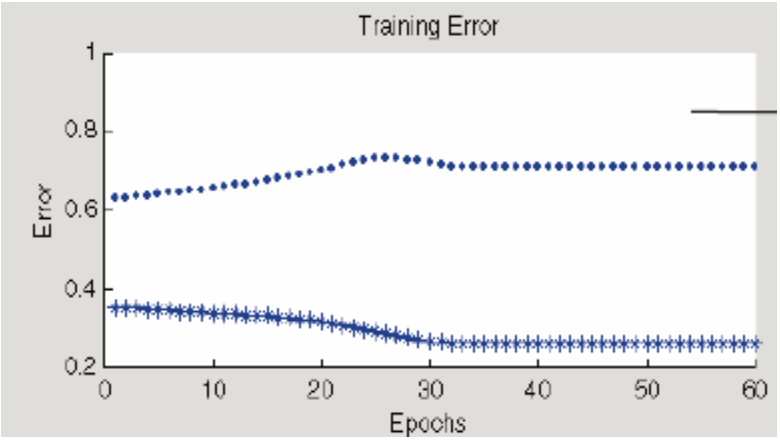

Figure 8: Training error against epochs

The result of approximating the data is shown in Figure 9.

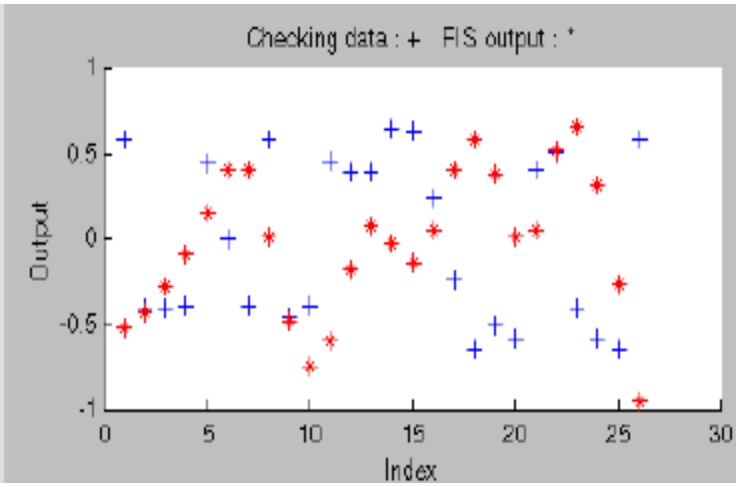

Figure 9: Plot against checking data

The number of input is 1, output is 1 and input membership functions are 4. The error tolerance is 0 and the epochs are 60. The fuzzy inference system is plotted against the checking data. The average testing error is 0.7

Conclusion

The non-linearity of fuzzy logic was solved through rules, membership functions, and the inference process, which resulted in improved performance, simpler implementation, and reduced design costs. This study was basically for municipal solid waste generation modeling using fuzzy logic, the design and the implementation of the developed model for accurate estimation of urban solid waste. The model was able to take into consideration the available data.

The system uses a fuzzy inference system that was able to encode the knowledge obtained and this was adapted by adjusting the knowledge base. Results obtained after analysis showed the efficiency and effectiveness of the system

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DESIGN AND CONSTRUCTION OF MANUALLY OPERATED BEARING EXTRACTOR, A CATALYST IN NIGERIA MANUFACTURING SECTORS

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Abstract
Coupled bearings get stiffened and stuck to the harboring shaft as a result of some irregularities in the assembly. A bearing extractor of 600N working load was therefore designed and constructed to safely separate the components at will without damage. The results of the design calculations were utilized at the construction stage, as a factor safety of 1.5 was adopted. The calculated efficiency of the machine was 44 % - a good value for a machine of that kind. (Hall, 1982). The breakthrough achieved in designing and construction of the bearing extractor is therefore a pointer to the inherent latent potentials in the citizens of the federation to achieve her developmental vision in technology through the popular local content initiative.

Keywords: *Homogeneous, isotropic, lead angle, working stress and effective force.*

Introduction

The developmental aspiration of Nigeria's economy largely depends on drastic improvement in the nation's manufacturing sector. Most workshop tools including bearing extractors used in Nigeria are imported in large quantity from other nations. This work represents an effort to gradually rid off the consuming attribute of the nation and replace it with producing attribute as far as manufacturing is concerned. Bearings and other circular components harbored round solid or hollow shafts could be gradually extracted (pulled out) using the constructed machine without causing damage to both the bearing and the shaft, contrary to the crude method of using hammer to forcefully drive out bearings. The puller's components include a power screw, a frame with nut, two arms (claws) and fasteners.

Stiffness between two components:

Interface stiffness between two components can occur as a result of

1. Poor lubrication or inappropriate lubricants,
2. Irregular lubrication
3. Corrosion and
4. Expansion.

These irregularities can be prevented by ensuring direct opposite of each of them.

Design Analysis

Euler's equation: Columns are conveniently designed for using Euler's equation.

Assumptions:

1. The shaft used is of uniform cross-section
2. The shaft material is homogeneous and isotropic.

The working stress σ_w is given as

$$\sigma_w = C^1\pi^2 E / (L/K)^2 \quad \text{..... 1}$$

Where C^1 is determined using end condition.

L= length of shaft

K= least radius of gyration

E= modulus of elasticity.(Hall, 1982)

The working stress $\sigma_w = U.T.S./F.S$ 2

Equating '1' and '2'

$$C^1\pi^2 E / (L/K)^2 = U.T.S./F.S$$

Where U.T.S is Ultimate Tensile Strength and F.S is factor of safety. (Jones, 1989)

Power screw

Screw thread is one of the basic and efficient ways of mechanically transmitting power. It also changes the rotary force to translational force. The diameter of a screw is taken as 'D' such that:

D=2r ('r' is radius)

For a thread of single start and continuous ridge, the tangent of the lead angle 'λ' is:

Tan λ =lead of thread/ circumference of the minor diameter.

(Minor diameter is the pitch diameter)

Figure 1 shows the power screw.

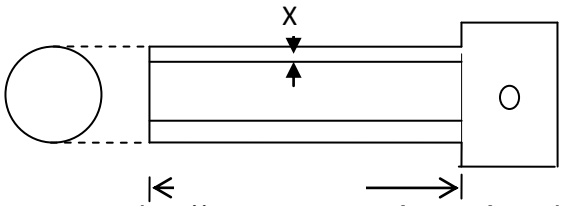


Figure 1:The X (in mm) pitch and 'y' length of travel.

Square thread

Square thread is most suitable for its strength.

Figure 2 shows the lead and lead angle relationship for square thread.

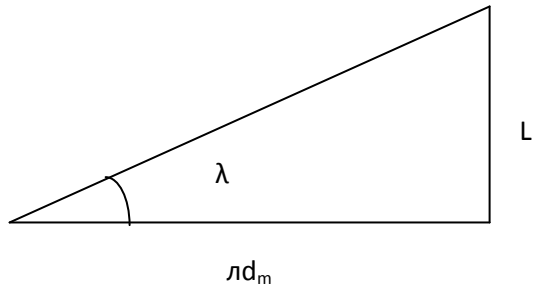


figure 2: Square thread lead and lead angle. Hall (1982) and Shigley et al (2006)

where λ=lead angle in degree, L=lead of the thread and d_m= mean thread diameter

From figure 2,

$$\text{Tan } \lambda = \frac{lead}{2\pi r_m} \quad \text{..... 3}$$

Where r_m is mean thread radius.

The force diagram of a square thread in engagement is as shown in figure 3.

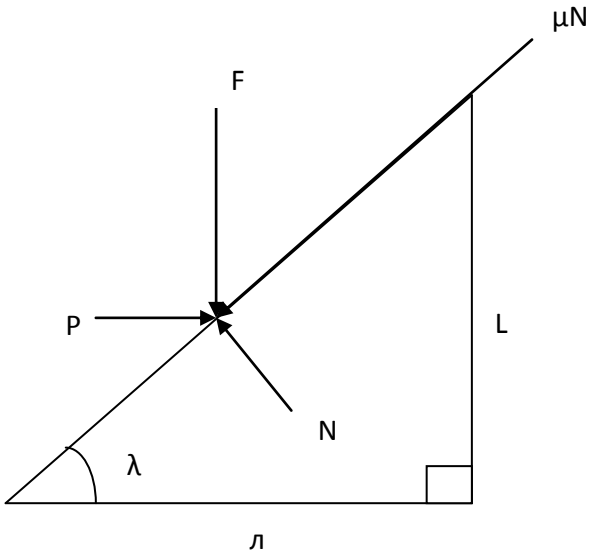


Figure 3:Force diagram of square thread in engagement. (Hall H.,1982) and Shigley et al (2006)

F = summation of all the unit axial forces acting upon the normal thread area

P = force acting to the right (to extract)

μN = the frictional force

N = normal force (reaction)

Лd_m = circumference of the thread

Λ = lead angle in degree.

For successful extraction, the whole system should be in equilibrium under the action of the above forces.

Therefore, let $\sum F_h$ be summation of horizontal forces and $\sum F_v$ be summation of vertical forces.

$\sum F_h = 0$ and $\sum F_v = 0$

so,

$P - N \sin\lambda - \mu N \cos\lambda = 0$ along the horizontal direction 5

$N \cos\lambda - F - \mu N \sin\lambda = 0$

$F + \mu N \sin\lambda - N \cos\lambda = 0$ along the vertical direction 6

From equation 5,

$P = N \sin\lambda + \mu N \cos\lambda$

$P = N (\sin\lambda - \mu \cos\lambda)$

$N = P / (\mu \cos\lambda + \sin\lambda)$ 7

Putting 7 into 6,

$$F + \frac{\mu P \sin\lambda}{\mu \cos\lambda + \sin\lambda} - \frac{P \cos\lambda}{\mu \cos\lambda + \sin\lambda} = 0$$

$$F - P \left(\frac{\cos\lambda}{\mu \cos\lambda + \sin\lambda} - \frac{\mu \sin\lambda}{\mu \cos\lambda + \sin\lambda} \right) = 0$$

$$F - p \left(\frac{\cos\lambda - \mu \sin\lambda}{\mu \cos\lambda + \sin\lambda} \right) = 0$$

$$F = P \left(\frac{\cos\lambda - \mu \sin\lambda}{\mu \cos\lambda + \sin\lambda} \right)$$

and

$$P = F \left(\frac{\sin\lambda - \mu \cos\lambda}{\cos\lambda - \mu \sin\lambda} \right)$$

Dividing through by cosλ,

$$P = F \left(\frac{\sin\lambda / \cos\lambda + \mu \cos\lambda / \cos\lambda}{\cos\lambda / \cos\lambda - \mu \sin\lambda / \cos\lambda} \right)$$

But $L / \pi d_m = \tan\lambda$

Therefore

$$P = F\left[\frac{(\frac{L}{\pi d_m} + \mu)}{(1 - (\frac{\mu L}{\pi d_m}))}\right] \quad \text{..... 8}$$

'P' is the effective force to effect the extraction.

Bending stress, shearing stress and bearing pressure

The three stresses are calculated, so that the highest among them is designed for, to avoid the possible danger of failure due to its effect.

Bending stress:

The working bending stress is $\sigma_w = Mc/I$ 9

Ferdinand and Russell (1992)

so, $Mc/I = \frac{(\frac{FL}{8})(\frac{d}{2})}{\frac{\pi d^4}{64}}$ 10

M=FL/8

C=d/2

And I=лd^4/64

Where 'M' = bending moment in Nm

'C' = maximum distance from the neutral axis and

'I' = moment of inertial in m^4

Shearing stress:

The shearing stress is

$$\sigma_s = F/A$$

Jones (1989)

where 'A' is 2(лd^2/4)

'F' is shearing force.

Bearing pressure:

The bearing pressure is

$\sigma_b = F/Ld$ 12

where F = bearing force

L =length of bearing and

d = diameter of bearing

Material selection

The selected material was mild steel with the following properties:

E=200 x 10^9 N/m^2

U.T.S = 517 x 10^6 N/m^2

DESIGN CALCULATIONS

Power screw rod

The maximum force expected to be applied to the extractor is 600N, owing to the fact that an average man's instant applied force is 580N and Factor of safety of 1.

At the cutting speed of 60rev/minute, square thread of 6mm pitch was cut on the rod with 279mm length of travel. The rod is desired to cover a maximum length of travel of the thread (28cm). so L= 30cm with 2cm clearance

End condition c^1 =0.25 (Fixed-free ends). (Hall, 1982)

The working stress

$\sigma_w = C^1\pi^2 E / (L/K)^2$

$\sigma_w = \frac{\frac{1}{4}(\pi^2)200x10^9}{(\frac{0.3}{k})^2}$

also

σ_w= UTS/ factor of safety 13

$= 517x10^9 / 1.5$

= 342.6667x10^6 N/m^2

Therefore 342.6667x10^6 = $\frac{\frac{1}{4}(\pi^2)200x10^9}{(\frac{0.3}{k})^2}$

K = 7.9mm

Where k is radius of gyration.

But $k=\left(I/A\right)^{\frac{1}{2}}$ 14

(Ferdinand and Russell ,1992)

$I=Ak^2$

$I=\pi d^4/64$

$A=\pi d^2/4$

Hence

$k=(\ (\pi d^4/64)/(\ \pi d^2/4\ ))^{0.5}$

$k^2=d^2/16$

$d^2=998.56$

$d=\sqrt{998.56}$

= 31.6mm ≈30mm.

Thread design

Table 1 gives the basic dimensions for square thread.

Table 1 :Basic dimensions for square thread

Normal series	Major Dia. Bolt	Nut	Pitch	H_2	h_1
24	24	24.5	5.0	2.0	2.5
30	30	30.5	7.0	2.5	3.0
40	40	40.5	6.0	3.0	3.5

P=pitch, a=clearance, h_1=thread depth, b=0.5 ,h_2=0.5p-b(all dimensions in mm)

h_1=thread depth. The lead angle is taken as 3.5°. (Lingaiah and Narayana ,1985)

From figure 1, Tan λ = $lead/2\pi r_m$

r_m = 15mm

tan3.5=lead/2лr_m

lead = tan 3.5 x 2лr_m

=0.06116 x 2 x 3.1416 x 15

=5.76

≈6mm

Therefore picth=6mm

h=0.5(picth)+ clearance(table 3.1)

h=(0.5 x 6) + 0.25

= 3.25mm

h≈3.3mm

major diameter $d_o = 2r_m + 0.5(\text{pitch})$

$= 30 + 0.5 \times 6$

$= 30 + 3$

$=33\text{mm}$

minor diameter $d_i = 2r_m - 0.5\ (\text{picth})$

$=30 - 0.5 \times 6$

$= 30\text{-}3$

$=27\text{mm}$

Effective force P from equation 8.

$$P = F\left[\frac{\left(\frac{L}{\pi d_m} + \mu\right)}{\left(1 - \left(\frac{\mu L}{\pi d_m}\right)\right)}\right]$$

F=600N , μ=0.08

$$P = 600\left[\frac{\left(\frac{6}{94.25} + 0.08\right)}{\left(1 - \left(\frac{0.08x6}{94.25}\right)\right)}\right]$$

=86.6N

Design of the frame

A rectangular cross-section rod was turned to get the frame. Internal rectangular thread was also cut to make the nut for the power screw, as shown in figure 4.

U.T.S = 517 x 10^6 N/m^2

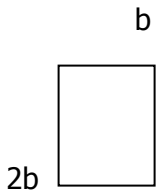
So, $U.T.S/1.5 = C^1\pi^2 E/(L/K)^2$

517 x 10^6/1.5 = $0.25\pi^2 200x10^9/(0.35/K)^2$

k=9.223m

from $k=\left(I/A\right)^{\frac{1}{2}}$,

I= $bh^3/12$ (for rectangular cross-section in 'b' units)



h=2b

$k=\sqrt{b(2b)^3}\Big/\frac{12}{2b^2}$

b=32mm

Figure 4 shows the frame.

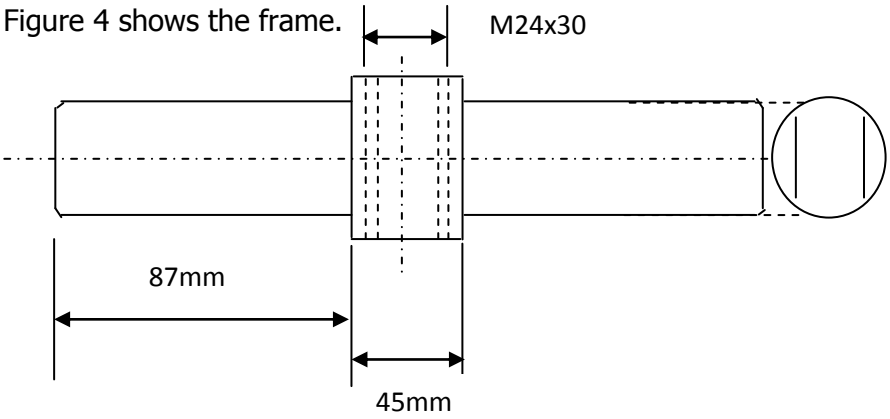


Figure 4: The extractor's frame and nut.

Design of the arms (claws): 'L' is the desired arm's length.

L=0.2m. σ_w=3.446 x 10^8

$$\sigma_w = \frac{\frac{1}{4}\pi^2 x200x10^9}{(\frac{0.2}{k})^2}$$

k=5.28mm

$k=\left(I/A\right)^{\frac{1}{2}}$,

k= $(\pi d^4/64)^{0.5}$ / $(\pi d^2/4)^{0.5}$

$d^2 = k^2$ x 16

d=21mm

A steel rod of 25mm diameter was turned to 21mm and 200mm length (Figure 5).

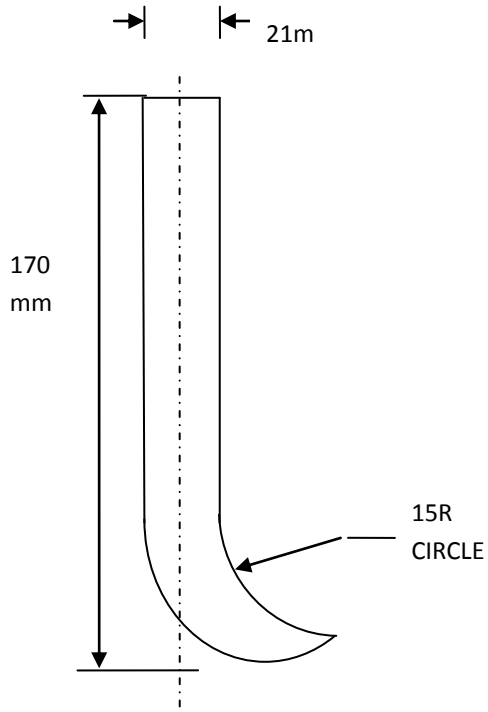


Figure 5: The extractor's arm [x2].

Design of the fasteners (bolt and nut)

The failures of the fasteners could be due to bending, shearing of bearing pressure

Failure due to bending gave the maximum diameter of bolt as:

$$\sigma_{wbolt} = \frac{(\frac{FL}{8})(\frac{d}{2})}{\frac{\pi d^4}{64}}$$

σ_{wbolt} = 171.3335 x 10^6 (3.446 x 10^8 / 2)

L=32mm (power screw diameter is 30mm) F=600N.

d=6.6mm

Device Operation

The two arms (claws) of the device grasp the raceway edge of the outer ring of the bearing to be extracted, while the tip of the power screw rest firmly on solid base of the harbor. Upon manually loading, the applied torque is transformed to an axial extraction force to pull out the bearing while the screw runs through the internal thread of the nut.

The photograph of the coupled constructed device is shown in plate 1.

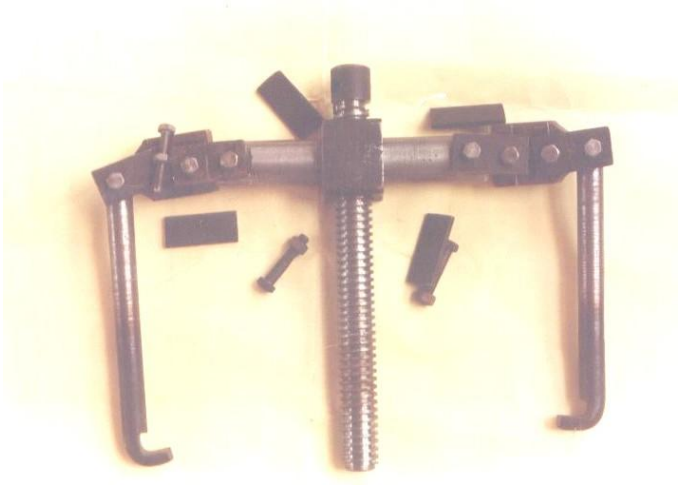


Plate 1; Photograph of the constructed Bearing Extractor.

Efficiency of the machine:

The efficiency is calculated as $\rho = \frac{work\,output}{work\,input} \times 100$

$$= \frac{FL}{2\pi T}$$

$$= \frac{600 \times 0.06}{2\pi \times 12.99}$$

$$= 44\%$$

Conclusion

The design and construction of the bearing extractor has been achieved. This potential can be tapped to further strengthen the nation's drive to achieving the vision 2020 aspiration. The machine can further be modified to operate electrically and number of claws increased for further improvement.

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SECURITY APPLICATION IN BLUETOOTH TECHNOLOGY

By

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Abstract
Before implementing some new technologies, a simulation program is usually designed to first demonstrate how the technology works. If it works perfectly, then the real implementation takes place, but if it fails, correction is made before the implementation. In this paper, we shall examine a program that demonstrates security application in Bluetooth technology. We shall also discuss how Bluetooth technology provides security measures at both the application layer and the data link layer. Finally we look at the two kinds of inherent features that make attacks more difficult.

Keyword: Bluetooth, Security, Network, Protocol, Application

Introduction

Over the years wireless technology has been promising a world without wires but look around, you will see lots of interconnecting wires. Look at your good old PC isn't it cluttered with wires? Wires connecting your PC to the printer, scanner, mouse, keyboard etc. It is a total mess. Some initial solutions using short range wireless connectivity with frequencies in the scientific, industrial and medical bands have resulted in some success in reducing this mess but there was very little scope for interoperability between devices due to their proprietary standards. A printer and a laptop could only be interconnected if they are bought from the same manufacturer. These and a host of other problems made these initiatives less feasible. But this is going to change for better. Bluetooth technology, originally developed by Ericsson but now controlled by the Bluetooth SIG (Special Interest Group), a consortium of 1000+ companies, offers the promise of a global standard for short-range wireless communication between an ever-increasing variety of devices and peripherals.

The fancy name for this short-range wireless connectivity protocol comes from the 10th century Viking king, Harald Bluetooth, who united Scandinavia after years of fighting and destructive competition. Today Bluetooth is following the same symbolic path to establish a common platform for communicating between disparate types of computing devices. Beyond the colorful origin of its name, Bluetooth is a compelling new radio technology that opens up a new world of opportunity for uniting and empowering mobile device users.

Bluetooth Specification in Brief

- Maximum data rate 750 kbps
- Master-Slave communication model.
- Operating Frequency is globally available 2.4-2.5 GHz free ISM band with spread spectrum technology
- Frequency hopping, full duplex signal at 1600 hops/sec.
- 79 frequencies with 1 MHz interval to provide noise immunity
- A device can be master of 7 slaves forming a network called piconet. Several piconets can interconnect to form a large network called scatternet.
- Royalty free standard

Bluetooth Protocol Overview

The Bluetooth protocol stack, can be divided into four layers according to their purpose, in the following ways:

1. Bluetooth Core Protocols, including Baseband, LMP, L2CAP, and SDP, comprise exclusively Bluetooth-specific protocols developed by the Bluetooth SIG that are required by most of the Bluetooth devices.
2. Cable Replacement Protocol, i.e. RFCOMM protocol, is based on the ETSI TS 07.10 that emulates serial line control and data signals over Bluetooth Baseband to provide transport capabilities for upper level services.
3. Telephony Control Protocols, including TCS Binary and AT-commands, are used to define the call control signaling, mobility management procedures, and multiple usage models for the Bluetooth devices to establish the speech and data calls and provide FAX and modem services.
4. Adopted Protocols, including PPP, UDP/TCP/IP, WAP, WAE, etc. Due to the open nature of the Bluetooth specification, additional protocols (e.g., HTTP, FTP, etc.) can be accommodated in an interoperable fashion.
5. Host Controller Interface (HCI), i.e. the boundary between hardware and software, provides a uniform command interface to access capabilities of hardware, e.g. Baseband controller, link manager, control and event registers.

Bluetooth Protocol Stack

The layers of Cable Replacement, Telephony Control, and Adopted Protocols form the application-oriented protocols that enable applications to run over the Bluetooth core protocols. Not all applications make use of all the protocols, applications run over one or more vertical slices of this protocol stack. In other words, applications may run over different protocol stacks (Bluetooth SIG, 2002). Nevertheless, each one of these different protocol stacks uses a common Bluetooth data link and physical layer, i.e. Bluetooth core protocols, including:

(i) Baseband. Based on the physical radio link, the Baseband can form the piconet between Bluetooth units and decide the roles of master and slave in the piconet. The Baseband provides physical links of both Synchronous Connection-Oriented (SCO) and Asynchronous Connectionless (ACL) to support the transmission of data and/or audio with corresponding packets (Java Community Process, 2001). Other functions include error correction, link management and control, audio transmission, etc.

(ii) Link Manager Protocol (LMP). The Bluetooth protocol LMP is responsible for link set-up between Bluetooth devices. This includes security aspects and the control and negotiation of Baseband packet sizes. Furthermore, it controls the power modes and duty cycles of the Bluetooth radio device, and the connection states of a Bluetooth unit in a piconet.

(iii) Logical Link Control and Adaptation Protocol (L2CAP). The protocol of L2CAP provides connection-oriented and connectionless data services to the upper layer protocols over the Baseband, with protocol multiplexing capability, segmentation and reassembly operation, and group abstractions, which permits higher level protocols and applications to transmit and receive L2CAP data packets. L2CAP is defined only for ACL links (Java Community Process, 2001).

(iv) Service Discovery Protocol (SDP). Using SDP to discover services is a crucial part of the Bluetooth framework and provides the basis for all the usage models. SDP query device information, services information, and the characteristics of the services, according to which a suitable connection between two or more Bluetooth devices can be established.

Security Framework

The Bluetooth technology provides security measures at both the application layer and the link layer. Besides there are two kinds of inherent features that make attacks more difficult. A hop selection mechanism of up to 1600 hops/sec is employed to avoid the interference from

external or other piconets. An automatic output power adaptation scheme is also included in the standard for the low power consumption of light-weight mobile devices, which can reduce the radio spread range for data transmission exactly according to requirements based on the detected intensity. A total of three different information security objectives are to be reached one or all. Confidentiality means that the data can only be used by authorized users and/or parties. Integrity means that the data cannot be modified during transfer and stored by adversaries. Availability means that the data is always available for authorized use (The Open Group, 1997). Typical attacks to a wireless network include DoS (Denial-of-Service), man-in the middle, spoofing, impersonating, session hijacking, eavesdropping, etc. Bluetooth launches three main techniques to achieve security features, including:

(i) Encryption: The process of transforming data into a form that it cannot be understood without a key. Both data and control information can be encrypted.

(ii) Authentication: The process of verifying 'who' is at the other end of the link. Authentication is performed for both devices and users.

(iii) Authorization: The process of deciding if a device is allowed to have access to a service. Authorization always includes authentication.

Security Modes

Each Bluetooth device can operate on one of the 3 security modes. First mode is a non secure mode in which a Bluetooth device shall never initiate any security procedure. Second mode is service-level enforced security where a device does not initiate security procedures before channel establishment at L2CAP level, and whether to initiate or not depends on the security requirements of the requested channel or service (Bluetooth SIG, 2003). Third mode is a link-level enforced security in which a Bluetooth device shall initiate security procedures before the link set-up at the LMP level is completed. Accordingly, two levels of Bluetooth security scheme can be identified as follows:

Link-level security corresponds to third mode. The Bluetooth device Initiates security procedure before the channel is established. This is the built-in security mechanism and it is not aware of service/application layer security. Second mode corresponds to service-level security. The Bluetooth device initiates security procedures after the channel is established, i.e. at the higher layers. This is a kind of add-in mechanism and is regarded as a practical issue.

Security Levels

Bluetooth allows different security levels to be defined for devices and services. Two security levels can be defined for a device. A trusted device has unrestricted access to all or some specific services. Basically this means that the device has been previously authenticated and marked as "trusted". An untrusted device has restricted access to services. Usually the device has been previously authenticated but has not been marked as "trusted". An unknown device is also an untrusted device. Three levels of service security are allowed to be defined so that the requirements for authorization, authentication, and encryption can be set independently, including services that require authorization and authentication, services that require authentication only, and services open to all devices. These three security levels can be described by using the following three attributes:

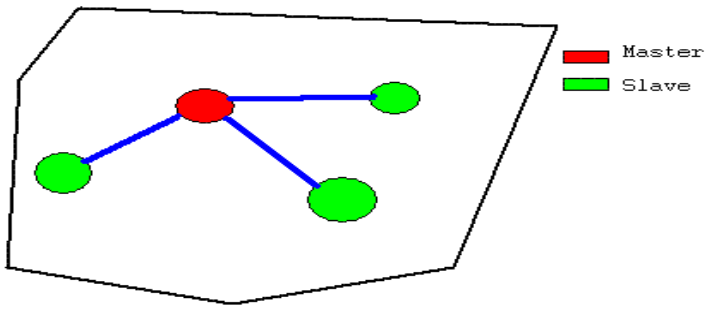
Authorization Required: Access is only granted after an authorization procedure. Only trusted devices would get automatic access.

Authentication Required: The remote device must be authenticated before being able to connect to the application.

Encryption Required: The link between the two devices must be encrypted before the application can be accessed.

How Bluetooth Works

Now a Bluetooth network actually consists of small subnets or piconets. A piconet consists of two or more connected nodes sharing the same channel. Every piconet have one master and up to 7 slaves. There is never a direct transmission between slaves. Rather all communications go through the master.



A Piconet

Two or more connected piconets form a scatternet. To connect piconets simply let them have a node in common. A node may be a slave in one piconet and a master in another. This is the basis for forming ad-hoc networks in Bluetooth.

The core Bluetooth protocol stack contains 5 layers. The radio and baseband layers describe the physical implementation of Bluetooth. It operates on the 2.4GHz frequency. There are 79 1MHz channels and upper and lower guard bands. The technology uses frequency hopping spread spectrum for information transmission with 1600 hops per second. Each channel is occupied for 0.625ms, called a slot and the slots are number sequentially. The master in the piconet determines the frequency hopping sequence and it is a function of the master's address

Conclusion

Conclusively, this paper explores security in Bluetooth technology and also layers in security implementation using Bluetooth technology. Security modes and also security level in Bluetooth technology is also examine.

Further research that will be recommended here is to design a complete simulation that can take care of all the security issues in a mobile ad hoc network including both misused and anomaly detection of intrusions. A real or physical implementation of the simulation on any JAVA enabled mobile phone is also recommended to see in real life how the security features will work physically.

Further research work can also be done to increase the radius covered by Bluetooth to discover devices and transfer data.

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A SURVEY OF E- EXAMS SYSTEM IN NIGERIAN UNIVERSITIES WITH EMPHASIS ON RESULT INTEGRITY

By

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Abstract
The recent employment and eventual widespread acceptance of electronic test in examining students and various classes in Nigeria has created a significant impact in the trends of educational history in the country. In this paper, we examined the impacts, associated challenges and security lapses of the existing electronic-examination system with the aim of ameliorating and developing a new acceptable e-Exam system that takes care of the existing system's challenges and security lapses. Six Universities that are already conducting e-Examination were selected across the country for this research work. Twenty (20) students that participated in the e-exams and five (5) members of staff were selected for interview and questionnaire. Based on the analysis of the interviews and study of the existing electronic examination system, some anomalies were discovered and recommendations were made in order to correct the anomalies.

Keywords: *Electronic Examination (e-exams), e-learning, Biometric Fingerprint, Cryptography, Result Integrity*

Introduction

Electronic examination has been highly interested and suitable in both educational and pedagogical aspects. Examination is one of the best methods of evaluating the knowledge and ability of an individual. To this end, various methods has been employed in examining the ability of an individual, starting from manual means of using paper and pencil to electronic, from oral to written, practical to theoretical and many others.

The present information technology means of examining students is the use of electronic systems in place of paper and pencil method which was characterized by massive examination leakages, impersonations, demand for gratification by teachers, bribe-taking by supervisors and invigilators of examinations.

The employers are conducting aptitude test for their job seekers through electronic means; the universities and other tertiary institutions are registering and conducting electronic examination for their students through the internet and other electronic and networking gadgets, various examination bodies in the country like the West Africa Examination Council

(WAEC), National Examination Council (NECO), National Board for Technical Education (NABTEB), National Teacher Institute (NTI) and so on. register their students through electronic means, recently electronic examination has been widely adopted by nearly all the Nigeria University for post Unified Tertiary and Matriculation Examination (Post-UTME) otherwise called pre-admission screening. With these aforementioned and many more educational bodies engaging in electronic examination and registration for testing the ability of their candidates, which determine the future o this country and her teeming youth, there is need for serious examination of the system which has great impacts on the populace.

Prospects

E-exams simply the process by which examinations are delivered, taken and scored electronically. It entails questions being deployed onto computer workstations (intranet and internet) and candidates answering the questions on to the computer. The process of writing exams is thus completely paperless. It is sometimes referred to as CBT (Computer-based testing) or CBA (Computer-Based Assessment). This testing method is now being extensively used in many parts of the world today. The use of e-exam simplifies the entire testing cycle, including generation, execution, evaluation, presentation and archiving. This simplification saves time and money while improving reliability. Advocates for the e-exams models argue that it not time-consuming but rather time saving, (McCormack and Jones 1998, Ryan et al 2000) and identify these advantages:

(i) Time saving; as assessments can be created using software tools and adapted and reused as needed. They can be distributed and collected using a web-based system which saves development and distribution time.

(ii) Reduces turnaround time; as the systems enables assessments to be corrected by computers. Reduces time further enables students to use the knowledge obtained from corrected assessments to address further assessments sooner.

(iii) Reduces resources needed by replacing human resources with computer resources.

(iv) Keeping records of results that can be stored centrally and assessed by interested parties, such as students and staff.

(v) A key element in computer-based testing is that fewer people are required to supervise each examination. This will result in considerable cost savings. While the thought of a computer-based assessment or electronic assessment may intimidate those who are unfamiliar with a computer, electronic tests require only minimal computer knowledge

and will offer a familiarity tutorial allowing the test-taker to get acquainted with how to move the mouse, answer questions and move through the test. With computer-based assessment comes the possibility of radically changing how assessments are implemented and improving the quality of the information they can yield.

(vi) Increasing ease with which data can be used as corrected assignments corrected and stored electronically can be analyzed easier and the data can be used in spreadsheets and other statistical packages.

(vii) Now-a- days institutes are organizing exams online. In this module a user can give online exam of a particular subject and get the results instantly through which the user can know his/her potential and how much more effort he/she needs to put in to get better marks. No time is spent on evaluation that means results are available instantly.

(viii) The best available physical and data security techniques to protect the integrity of our tests and to ensure that each candidate takes the exam in a controlled environment. We are proposing stringent security policies and procedures to protect the content of all examinations, ensure that candidate taking the test is the person he/she is supposed to be, ensure that the candidate takes the test unaided and maintain security of data concerning the candidate and the testing session.

Literature Review

There is a growing body of research focused on developing better ways to manage e-exams systems and e-learning systems. Some of these researches focused on various sections of the system and these include:

Schramm (2008) looked at an e-learning web based system that could simply offer and grade mathematical questions with infinite patience. Therefore it needs the capability for in and output of mathematical formulas, the dynamic generation of plots and the generation of random expressions and numbers. Al-Bayati and Hussein (2008) presents an applied Generic Software of multiple kinds of e-exam package; this package of e-exam is oriented to Hearing Impaired (HI) persons. Therefore the exam material of this package is translated into language of HI persons like sign language and finger spelling. The idea of the Generic software is to present an empty templates to the teacher who would like to develop his required e-exam for the needful topic (mathematics, language, science, etc) and desired set of exam kinds (multiple choices, matching between words, fill in blanks and many others).

Web-based Examination System is an effective solution for mass education evaluation (Zhenming et al, 2003). They developed a novel online examination system based on a Browser/Server framework which carries out the examination and auto-grading for objective questions and operating questions, such as programming, operating Microsoft Windows, editing Microsoft Word, Excel and PowerPoint and so on. It has been successfully applied to the distance evaluation of basic operating skills of computer science, such as the course of computer skills in Universities and the nationwide examination for the high school graduates in Zhejiang Province, China. Another paper (He, 2006) presents a web-based educational assessment system by applying Bloom's taxonomy to evaluate student learning outcomes and teacher instructional practices in real time. The system performance is rather encouraging with experimentation in science and mathematics courses of two local high schools.

Another paper proposed web based online examination system (Rashad et al, 2010). The system carried out the examination and auto-grading for students exams. The system facilitates conducting exams, collection of answers, auto marking the submissions and production of reports for the test. It supports many kinds of questions. It was used via Internet and is therefore suitable for both local and remote examination. The system could help lecturers, instructors, teachers and others who are willing to create new exams or edit existing ones as well as students participating in the exams. The system was built using. various open source technologies AJAX, PHP, HTML and MYSQL database are used in this system. An auto-grading module was generalized to enable different exam and question types. The system was tested in the Mansoura university quality assurance center. The test proved the validity of using this kind of web based systems for evaluates students in the institutions with high rate of students.

An online website for tutoring and e-examination of economic course aimed to present a novel software tool can be used for online examination and tutorial application of the syllabus of economic course (Emary & Sondos, 2006). Also, among the main interests of the paper is to produce a software through it we make sure that students have studied all the concepts of economics. So, the proposed software is structured from two major modules: The first one was an online website to review and make self-test for all the material of economic course. The second part is an online examination using a large database bank of questions through which level of students can be evaluated immediately and some statistical evaluations can be obtained. The developed software offers the following features: 1) Instructors could add any

further questions to maximize the size of the bank of questions. 2) Different examinations for each student with randomly selected questions from the bank of questions can be done. 3) Different reports for the instructors, students, classes and so on can be obtained. 4) Several students can take their exams simultaneously without any problem inside and outside their campus. The proposed software has been designed to work base on the client server architecture.

Electronic exam is a difficult part of e-learning security (Huszti and Petho, 2008). The paper describes a cryptographic scheme that possesses security requirements, such that authenticity, anonymity, secrecy, robustness, correctness without the existence of a Trusted Third Party. The proposed protocol also provides students a receipt, a proof of a successful submission, and it is based on existence of anonymous return channels. Another research work proposed a theoretical approach that incorporates available fingerprint biometrics authentication technologies in conjunction with e-learning environments to curb unethical conduct during e-learning exam taking (Levy and Ramim, 2007). The proposed approach suggests practical solution that can incorporate a random fingerprint biometrics user authentication during exam taking in e-learning courses. Doing so is hypothesized to curb exam cheating in e-learning environments.

Ayo, Akinyemi, Adebiyi, & Ekong (2007) proposed a model for e-Examination in Nigeria where all applicants are subjected to online entrance examination as a way of curbing the irregularities as proposed by the Joint Admissions Matriculation Board (JAMB), the body saddled with the responsibility of conducting entrance examinations into all the Nigerian universities. This model was designed and tested in Covenant University, one of the private universities in Nigeria. Their findings revealed that the system has the potentials to eliminate some of the problems that are associated with the traditional methods of examination such as impersonation and other forms of examination malpractices. Based on the development of e-learning in the only Open University in Nigeria (Ipaye, 2009) discusses the process of establishing e-learning environment. Another paper seeks to solve a part of that problem by designing and developing a web application where tests in multiple choice formats will be taken online and graded immediately (Akinsanmi, Agbaji, & Soroyewun, 2010). The web application relies solely on Microsoft developed technologies. It runs on the Microsoft.net framework, uses the ASP.NET web server, C# as the intermediate language, ADO.NET to interact with the relational database and Microsoft SQL server as the relational database.

Analysis of the Existing Systems Used In Nigeria

In Nigeria, very few Universities have started using the e-exams system for their test/exams and these includes Federal University of Technology Minna, University of Ilorin, Covenant University Ota, Nigerian Open University of Nigeria (NOUN), to mention but a few. In all the six Universities visited in the course of this research, they are all operating almost in the same way. Only NOUN uses internet for the e-exams, while others uses intranet setup within the University environments. The intranet was setup in e-exams centers containing 50 to 200 computer systems and a server. Another observation made was that most of these centers are being managed by private company (Electronic Test Company Limited) which is not so good for the integrity of the results.

Architecture of the Existing System

Ayo et al (2007) and Akinsanmi (2010) presented a 3-tier architecture comprising the presentation tier, the logic tier and the database tier. The presentation tier offers an interface to the user, the logic tier serves as the middleware that is responsible for processing the user's requests, while the database tier serves as the repository of a pool of thousands of questions. It also consists of other modules for authentication (using User name/Registration Number and Password) and computing results. This is the architecture used by all the e-exams centers visited within Nigeria and it is also the same architecture that was used even in other countries with just little modifications. This type of architecture did not give security issues too much attention and impersonation is very likely.

Method of Preparing the Questions

The first step in preparing the e-examination questions is to ask the lecturer in-charge of the course to submit the questions to the administrator at the center via the faculty/school exams officer some days before the commencement of the actual exams. The second step is for the administrator (mostly private operator) to enter the pool of questions into the database. The last step is to set the timing for the exams. The implication here is that, when examination questions passes through so many hands it is likely that the questions may leak, especially when a private individual is involved.

The major aim of the research work is to determine the acceptability or otherwise of the existing electronic system of examining students in our tertiary institution and come out with a new design (Secured e-Examination) based on the deficiency of the existing system

E-Exams Result Presentation/Checking

In most of the centers visited in this research work, students don't get to see their results immediately after the exams. In some cases, the results may take weeks or even months before it is made available to the students. This violates one of the main essence of introducing e-exams (instant access to results). This may give room for alteration of students result. There is also no room for the users to see the correction of their tests if they so wish.

Methodology

Six Universities that have been engaging electronic examination were participated in this study across the country, where twenty (20) students (15 male, 5 female) were selected from each University for the interview and questionnaire purposes. Also five (5) Lecturers were selected from each University for the interview on the impacts of electronic examination on their students' performance. University of Ilorin, University of Lagos, University of Nigeria Nsuka, Covenant University Ota, Nigeria Open University of Nigeria and Federal University of Technology Minna.

Interviews and Questionnaire

The interview was conducted for the students that have undergone e-Examination for post-UTME and internal universities e-Examination. The questionnaires were also distributed to both students and staff members whose students had been evaluated using e-Examination. The questionnaire consisted of 4 essay questions and 20 scaled items concerning the examinees' acceptance of the Secured Electronic Examination (SEE), and its usability. A scale from 1 (total disagreement) to 5 (total agreement) was used.

The result of the interview was analyzed in the Table 1:

Table 1: Presentation of the Questionnaire

University	Students				Lecturers			
	Good/ Acceptance	Fair	Rejection	Indifference	Good/ Acceptance	Fair	Rejection	Indifference
University of Ilorin	5	15	5		2	3	2	
FUT Minna	10	10	4		2	2	1	1
Convenant, University Otta	5	15	3		1	4	3	
University of Nigeria Nnsuka	5	13	4	2	1	4	2	
NOUN	5	14	2	1	2	3	1	
University of Lagos	5	15	2		3	2	1	
Total	**40**	**77**	**20**	**3**	**11**	**18**	**10**	**1**

Data Analysis and Interpretation

From the table above, it was discovered that out of 140 students that were interviewed, 40 students accept that the present e-Examination is good enough, 77 students attest that the existing system is fair but need to be improved, 20 students reject the use of existing system while only 7 students were indifferent to the interview. Also, out of 40 lecturers across the Universities participated in the interview, 11 lecturer attested that existing e-Examination is good enough, 18 lecturers has one or more complains about the system but agreed that it is fair but need an improvement while 10 lecturers reject the system and only one lecturer did not respond to the questions.

The deduction from the table was that the majority of the students and staff prefer e-examination to manual methods of examining students but want improvement on the system

From the table above:

1. Good /Acceptance implies that the existing e-Exam is accepted
2. Fair implies that the existing e-Exam is partially accepted i.e require further improvement
3. Rejection implies non acceptance and requirement of total overhauling of the system
4. Indifference signifies non-responded to the questions

Recommendations

Based on the finding of the research, the following are highly recommended:

(i) The questions of the test should be sent online to the e-center and not through the human transmission.

(ii) That the questions should be encrypted and decrypted through the encryption algorithm in order to enhance the security of the question.

(iii) That the software of the question should be designed in such a way that the result should be release to the student immediately after the examination.

(iv) That there should data capture machine to monitor and reveal the activities of participant.

Conclusion

It was discovered during the survey that majority of students and staff in higher institution learning prefer e-exams to paper and pencil method of examination. It was also discovered that many stakeholder urge for an improvement in the present e-exams system in order to enhance security and integrity of the system and reduce the associated problems. These problems includes human interference, impersonation, bribe-taking by lecturers, invigilators and supervisors, too much paper work, examination leakages and also reduce the number of invigilators needed for invigilators. The security will be more effective through use of biometric fingerprint authentication, picture capture and data encryption and decryption.

Candidates screening should be online and real-time. The improved online system have the tendencies of increasing computer literacy, online learning and network security awareness. The result integrity could also be enhanced if the candidates have access to instant result checking. The new system should also allows the students to check the corrections at their own wish after the exams.

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HUMAN CAPACITY TRAINING FOR SECURITY OF LIFE, PROPERTY AND INVESTMENT: A CHALLENGE FOR ESTATE MANAGEMENT EDUCATION

By

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Abstract
Security of life, property and investment are essential requirements for the growth and development of any nation. This paper examines human capacity training for security of life, property and investment in the context of the present-day curriculum of Estate Management programme in tertiary institutions in Nigeria. The paper argues that areas of knowledge such as property insurance, computer-aided facilities management and property investment appraisal, which would enable real estate professionals play their roles effectively in the security of life, property and investment are still marginal within the Estate Management curriculum. The paper concludes that increased emphasis on these areas of knowledge by estate management educators is necessary if sustainable human capacity building for security of life, property and investment must be achieved.

Keywords: *Estate Management Curriculum, Human Training, Investment, Property, Skills*

Introduction

The right to life and right to acquire and own property are fundamental human rights in Nigeria. These rights are recognized by the 1999 Constitution of the Federal Republic of Nigeria. On the other hand, investment involves the commitment of a capital sum for benefits to be received in the future in the form of an income flow or capital gain or a combination of both (Hargitay and Yu, 1993). According to Gitman and Joehnk (1984), investment is a vehicle into which funds can be placed with the expectation that they will be preserved or increased in value and or generate positive returns. Baum and Crosby (1988) argue that an investment can generate positive returns in three ways. These are; by generating a flow of income; by generating a return of capital and by producing a psychic income. Millington (1982); Baum and Crosby (1988); Hargitay and Yu (1993); Richmond (1993) and Kalu (2001) have identified property as a type of investment. Property investment may be direct or indirect. Hargitay and Yu (1993) believe that direct property investment covers direct ownership of commercial, industrial, residential and agricultural property interest. Indirect property investment involves taking an indirect stake in property by acquiring the shares of property companies, property

bonds, real estate investment trusts among others. Thus, the right to acquire and own property is the right to investment. This right cannot exist except there is right to life. The security of these rights is essential for a dynamic economy. This paper is concerned with human capacity training for security of life, property and investment as a challenge for Estate Management Education in Nigeria.

In the present-day Estate Management curriculum, the development of requisite skills in security of life, property and investment is not given adequate attention. This has hindered the effectiveness of real estate professionals in this regard. Thus, what is responsible for the marginal nature of courses capable of developing these requisite skills in the Estate Management curriculum? What areas of knowledge can develop these skills and what is the strength of the Estate Management programme in imparting these areas of knowledge? This paper seeks to answer these questions as well as identify what should be done to impart areas of knowledge which skills are necessary for real estate professionals to play effective role in security of life, property and investment.

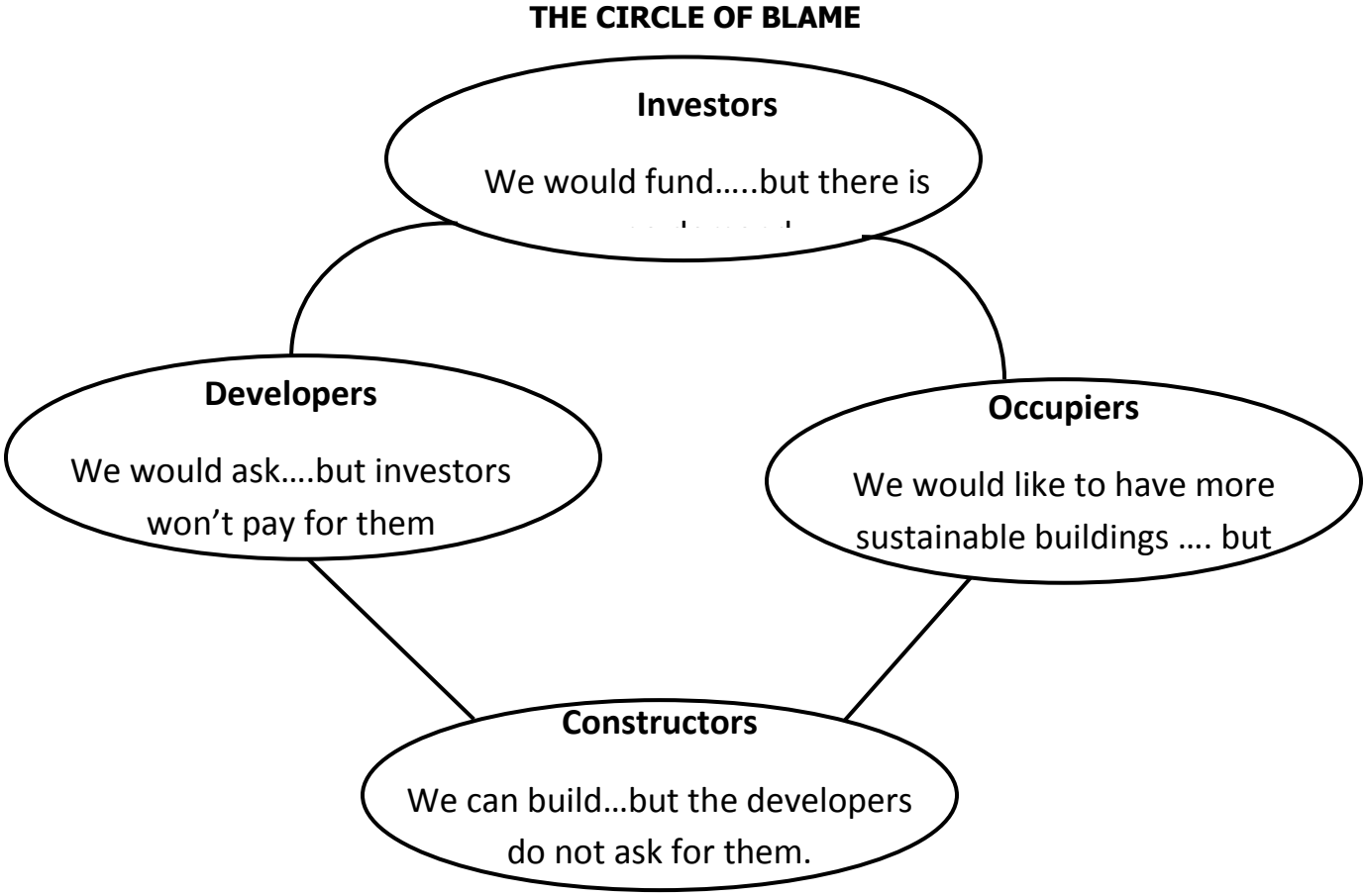
Effect of Insecurity on Life, Property and Investment

Insecurity denotes a state of lack of protection of human life, property and investment. As explained in the Global Environmental Change and Human Security Services Plan (GECHS, 1999), human security is achieved when and where individuals and communities have the options necessary to end, mitigate or adapt to threats to their human, environmental and social rights; have the capacity and freedom to exercise these options; and actively participate in pursuing these options. With emphasis on the situation in the Niger Delta region of Nigeria, Chikuezi (2006) argued that insecurity is a hindrance to sustainable development in Nigeria. Sustainable development is development that meets the needs of the present without compromising the ability of the future generation to meet their own needs (Brundtland, 1987). It also involves continuity of economic, social, institutional and environmental aspects of human society as well as non-human environment.

The Need for Security of Life, Property and Investment

For a nation to achieve sustainable economic growth and development there is need for security of life, property and investment of its citizens. However, absence of effective security of life, property and investment may result in lack of economic, social and environmental sustainability. Lack of sustainability in relation to real property assets may create conflict among investors, occupiers, constructors and developers of real property or what the sustainable

construction Task Group (2000) describes as Circle of Blame. This is illustrated in the figure below:



Source: Sustainable Construction Task Group (2000)

Lewis; Sayce and Ellison (2005) argue that under the Circle of Blame hypothesis, the lack of success in embedding sustainability within the built stock is caused, not by a lack of environmental knowledge, but by a market failure to respond. Hence, where there is lack of sustainability coupled with insecurity, investors may be willing to fund or invest in real property but there is no demand for such properties as occupiers are unwilling to pay for them. Also, developers are uninterested in developing real properties in areas where there is no environmental protection and sustainability. Thus, if the Circle of Blame could be broken and replaced by a virtuous circle in which sustainable buildings that support environmental and social objectives became those most in demand by occupiers and investors, and therefore the buildings of choice of developers, there would be real evidence of built environment's commitment to the drive for sustainability and the potential for significant change over time

(Lewis et al, 2005). This would involve paying greater attention to security issues in relation to real property and the investments there in.

Review of Estate Management Curriculum

Estate Management is concerned with the valuation, feasibility and viability appraisals, taxation, management, development and utilization of land and resources inclusive of estates and interests thereof, as strongly rooted in philosophical and socio-economic foundations of their relationship to man, society and the environment (University of Nigeria, n.d). The Estate Management programme in universities and polytechnics in Nigeria is designed to prepare graduates for professional practice in property valuation, property and facilities management, property development, land settlement, real estate taxation and rating valuation, feasibility and viability appraisals. Although the Estate Management curriculum in Nigeria has undergone changes over the years, the stress areas within the curriculum have remained unchanged. According to the Academic Brochure of the Department of Estate Management, University of Nigeria (n.d), these stress areas are as follows:-

1. Land Policies and Resources Development
2. Valuation
3. Feasibility and Viability Appraisal
4. Property Management
5. Rating and Other Forms of Land Taxation
6. Estate and Development Finance
7. Dissertation

However, emerging challenges in human resources development in the Nigerian real estate industry such as human capacity training for security of life, property and investment; globalization and information technology adaptation to real estate practice have necessitated the need for the expansion of these stress areas. This is due to the inadequacy of these stress areas in training real estate professionals to face these emerging challenges. No meaningful investment can be made without security of life and property. Security of property involves management of the risks associated with real property. These risks could be avoided (risk avoidance), retained (risk retention), controlled (risk control) or transferred (risk transfer). In performing these tasks, the real estate professional must have adequate knowledge of property insurance (Scarett, 1983). Property insurance is still a marginal concern within the curriculum of

Estate Management programme in universities and polytechnics in Nigeria and is not listed among the stress areas.

Estate Management Education and the Challenge of Human Training for Security of Life, Property and Investment

Education is the total process of human learning by which knowledge is imparted, faculties trained and skills developed (Farrant, 1980). As a subset of vocational education, estate management education involves the training of persons to develop some fundamental skills necessary for them to function as estate surveyors and valuers. Estate Management education in Nigeria began in 1957 at the Enugu branch of the then Nigerian College of Arts, Science and Technology, now University of Nigeria, Enugu Campus (Ifediora, 1993). Based on the data collected from the Joint Admissions and Matriculation Board (JAMB, 2010a, 2010b), the number of universities and polytechnics offering courses in Estate Management in Nigeria as at 2010/2011 academic session are presented in Table 1 as follows:-

Table 1: Undergraduate Programmes in Estate Management in Tertiary Institutions in Nigeria as at 2010/2011 Academic Session.

Type of Institution	No. of Institutions and Programmes Offered				
	OND	HND	B.Sc	B.Tech	% of Total
Conventional Universities	-	-	9	-	19.6
Universities of Technology	-	-	-	5	10.9
Polytechnics	25	17	-	-	54.3
Colleges of Technology	2	2	-	-	4.3
Private Polytechnics	1	-	-	-	2.2
Private Universities	-	-	4	-	8.7
Total	28	19	13	5	100

Source: *Joint Admissions and Matriculation Board (2010a, 2010b).*

In Nigeria, the education and training of estate surveyors have remained unchanged even after the advent of information technology and other emerging challenges. Areas of knowledge required by real estate professionals to enable them play their roles effectively in the

security of life, property and investment are still marginal concerns within the present-day curriculum of Estate Management programme in universities and polytechnics in Nigeria. These areas of knowledge include:-

(a) Property Insurance

(b) Facilities Management

(c) Property Investment Appraisal

Property Insurance

Property insurance entails the management of risks associated with real property (Scarett, 1983). If not avoided, controlled, retained or transferred, these risks could result in serious losses, including loss of life. As property professionals, estate managers require sound knowledge of property insurance to be able to handle risks affecting real properties under their management.

Facilities Management

Facilities management is the total management of all services that support the core business of an organization (Northumbria University, n.d). It focuses on the interaction between the core business, the support functions and the facilities throughout all sectors of industry, commerce and services. Facilities management course is very relevant if real estate professionals must play effective role in security of life, property and investment. It should form a core area of their training. What is offered presently in the curriculum is workspace and property management. In order to meet the challenges posed by security of property and investment, much emphasis should be placed on strategic facilities management and computer -aided facilities management.

Property Investment Appraisal

According to Baum and Crosby (1988), property investments cannot be appraised in isolation. It must at some stage be appraised in comparison with alternative investment vehicles. Estate Management curriculum in universities and polytechnics in Nigeria appraises property investments in isolation from alternative investments in the investment market. These alternative investments as mentioned earlier include bank deposits, fixed interest securities, index-linked gilts and equities or ordinary shares. This scenario does not enhance the development of skills in comparative investment appraisal and as such hinders the training of estate surveyors as investment specialists. However, current global trend is that property investment is treated as part of the wider investment community, not in isolation (Baum and

Crosby, 1988; Udo, 1993; Gane, 1995; Ajayi, 1998, Wyatt, 2007; Ogunba and Ojo, 2007 and Udoekanem, 2009). Knowledge of comparative investment appraisal would enable an estate surveyor to advise a property investor on portfolio diversification, where a property investment within a portfolio is relatively insecure.

For the purpose of this study, the marginal nature of these areas of knowledge was explored by comparative analysis of the course requirements of undergraduate Estate Management programmes in two universities in Nigeria. These universities are the University of Nigeria, Nsukka (UNN) and the Federal University of Technology, Minna (FUTM). This analysis is limited to these institutions due to the paucity of information on the course requirements of other tertiary institutions offering Estate Management Programmes in Nigeria. The course requirements of Estate Management undergraduate programmes in the selected institutions are as follows:-

Table 2: Course Requirements of Estate Management Undergraduate Programmes in Selected Universities in Nigeria as at 2008/2009 Session

Nature of Course	**Institutions and No. of Courses Offered**		
	UNN		**FUTM**
Major courses	29 (36.25%)		
Required courses	35 (43.75%)	Core Courses	88(88%)
Elective courses	16 (20%)		12(12%)
Total	80 (100%)		100 (100%)

Source: *Students Information Handbooks of the Departments of Estate Management, UNN (n.d) and FUTM (2009)*

However, the contents of these courses were examined to identify courses capable of developing skills in property insurance, facilities management and property investment appraisal. This is presented in Table 3 as follows:-

Table 3: Distribution of Courses capable of developing skills in property insurance, facilities management and property investment appraisal in the institutions under study

Institution	UNN	FUTM
Total No. of courses offered for the undergraduate Estate Management programme.	80	100
No. of courses capable of developing property insurance skills.	3	2
No. of courses capable of developing facilities management skills.	1	1
No. of courses capable of developing property investment appraisal skills.	6	1

Source: *Students Information Handbooks of the Departments of Estate Management, UNN (n.d) and FUTM (2009)*

The proportion of courses capable of developing requisite skills in property insurance, facilities management and property investment appraisal as compared to the total courses offered for the programmes are summarised in Table 4 as follows:-

Table 4: Courses capable of developing skills in property insurance, facilities management and property investment appraisal as percentage of total courses offered

Skills Required	UNN		FUTM	
	No. of Courses	% of total courses offered	No. of courses	% of total courses offered
Property Insurance	3	3.75%	2	2.00%
Facilities Management	1	1.25%	1	1.00%
Property Investment Appraisal	6	7.5%	1	1.00%
Total	10	12.5%	4	4.00%

Source: *Computed from Data in Table 3.*

Of these three areas of knowledge, facilities management appears to be the most marginal in courses offered for Degree programmes in Estate Management in the two institutions under study as it constitutes less than 2% of the total courses offered for the programmes (Table 4). This is due to its complexity and high level of technical competence required for its impartation. Because these areas of knowledge are real estate-based, Estate Management programme can enhance the development of skills in these areas if its curriculum is reviewed and more courses relevant to these areas introduced to replace irrelevant elective courses currently being offered.

Conclusion

Estate management education in Nigeria is encumbered by some challenges. One of such challenges is human capacity training for security of life, property and investment. In order to overcome this challenge, the stress areas within the Estate Management curriculum in universities and polytechnics in the country should be expanded to include relevant areas of knowledge that would make Estate management graduates more responsive to security issues concerning life, property and investment. These areas of knowledge are property insurance, computer-aided facilities management and property investment appraisal. Increased emphasis on these areas by estate management educators would enhance the development of skills required by real estate professionals to play effective role in the security of life, property and investment.

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ARTICLES AND RESEARCH REPORTS ON MATHEMATICS

LINEAR PROGRAMMING APPROACH TO MARKOV DECISION MODEL FOR HUMAN HEALTH

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Abstract
A linear programming method and the application to a Markov decision model of human health conditions are discussed in this paper. This approach involves the use of simplex method to solve a linear program model formulated with discrete time Markov decision processes in contrast to the policy- iteration algorithm. The model was initially formulated and solved with policy iteration method and now verified on identical data using linear programming. The result obtained is in agreement with the policy- iteration method. However, the linear programming method has the advantage of wide spread and simple computer software that can easily be used, unlike the policy- iteration algorithm that may demand writing its own computer codes by the individual. It is important to observe that the two methods are very efficient to determine the long-run fraction of time that a man is in a poor condition of health.

Keywords: Linear programming, Policy- iteration, Markov, Decision, Model, Health, Condition

Introduction

Linear programming is an optimization technique. It receives so much attention in recent years due to the availability of the methods of solution to the general linear programming problems involving large variables Diego and German (2006) and Abubakar(2005). Linear programming formulation of Markov Decision processes has been reported also in Diego and German (2006) and Tijm(1988). The application of Markov decision model to study human health conditions is discussed in Abubakar(2011). In that work, policy- iteration was used and found to be very involving and cumbersome, it is therefore necessary to seek for alternative method and that is the issue addressed in this paper; the linear programming approach.

Markov Decision Processes and Linear Programming.

According to Kurkani (1999), Puterman (1994), Goto et al (2004) and Hillier and Lieberman(1980); we consider a Discrete Time Markov Chain (DTMC) $\{X_n, n = 0, 1,...\}$, whose transition probability matrix depends on the action taken A_n. Additionally, the system incurs a cost $c(i, a)$ when an action a is chosen at some state i. Then the joint process $\{(X_n, A_n), n=0, 1,...\}$, is a Discrete Time Markov Decision Process (DTMDP).

The policy-iteration algorithm solves the following average cost optimality equation in a finite number of steps by generating a sequence of improving policies.

It was observed in Abubakar(2011) that the finite convergence of the policy-iteration algorithm implies that numbers g^* and v_i^*, $i \in I$, exist which satisfy the average cost optimality equation

$v_i^* = \min_{a \in A(i)} \{c_i(a) - g^* + \sum_{j \in I} p_{ij}(a) v_j^*\}, i \in I$ ..... (1)

I is the set of states. The constant g^* is uniquely determined as the minimum average cost per unit time, that is

$$g^* = \min_R g(R)$$

Moreover, each stationary policy R^* such that the action R_i^* minimizes the right side of (1) for all $i \in I$ is average cost optimal Tijm (1988).

Another convenient way of solving the optimality equation is the application of a linear programming formulation for the average cost case.

According to Diego and German (2006), the next model specifies how to obtain an optimal average cost using linear programming tools.

Min $\sum_{i \varepsilon S} \pi_i \sum_{a \varepsilon A(i)} f(i,a) c(i,a)$

subject to

$\pi_j = \sum_{a \varepsilon A(i)} \pi_i p_{ij}(a) \quad j \in S$ Balance equation

$\sum_{a \varepsilon A(i)} f(i,a) = 1$ Normalization equation, S is the set of all allowable states.

This model is not linear. But if we define new decision variable $x_{ia} = \pi_i f(i,a), i \in S, a \in A(i)$, then we can build an equivalent linear model. The meaning of x_{ia} is the long run fraction of the time that the system is in state i and action a is chosen.

Min $\sum_{i \varepsilon S} \sum_{a \varepsilon A(i)} c(i,a) x_{ia}$

subject to

$\sum_{a \varepsilon A(i)} x_{ja} - \sum_{i \in S^-(j)} \sum_{a \varepsilon A(i)} p_{ij}(a) x_{ia} = 0 \quad j \in S$

$\sum_{i \varepsilon S} \sum_{a \varepsilon A(i)} x_{ia} = 1$

$x_{ia} \geq 0, \qquad i \in S, a \in A(i)$

Where $S^{-}(j)$ is the set of possible predecessors of state j.

i.e. $S^{-}(j) = \{i: j \in S(i,a)\ for\ some\ a \in A\}$. Once the model is solved, to recover the quantities of interest you must follow the following steps:

- Stationary Distribution

  $\pi_i = \sum_{a \varepsilon A(i)} x_{ia}, \quad i \in S$

- Value Function: This is the optimal objective value obtained by linear programming, note that the same value function applies for each state, due to be solved for the average problem.
- Decision Rule: It can be shown that there exists a deterministic decision rule, instead of a randomized one. If the transition probability matrix of every stationary policy is irreducible, the next statement shows how to get in general way.

  $$f(i,a) = \frac{x_{ia}}{\pi_i}$$

  However, if there is no knowledge about how is the performance of the discrete time Markov decision process (DTMDP), the next statement could be used, due to a DTMDP always obtain a deterministic decision rule.

  $$d^*(i) = \begin{cases} a & if\ x_{ia} > 0, i \in S^* \\ arbitrary & if\ i \in S - S^* \end{cases}$$

Where,

$$S^* = \{s \in S: x^*(i,a) > o\ for\ some\ a \in A(i)\}$$

Denardo and Fox(1968) gives the following linear programming algorithm which was used in this work

Linear programming algorithm

Step 1: Apply the simplex method to compute an optimal basic solution (x_{ia}^*) to the linear program

Minimize $\sum_{i \varepsilon S} \sum_{a \varepsilon A(i)} c(a) x_{ia}$ ..... (2)

subject to

$$\sum_{a \varepsilon A(j)} x_{ja} - \sum_{i \varepsilon S} \sum_{a \varepsilon A(i)} p_{ij}(a) x_{ia} = 0, \quad j \in I$$

$$\sum_{i \varepsilon S} \sum_{a \varepsilon A(i)} x_{ia} = 1,\ x_{ia} \geq 0, \quad i \in I \text{ and } a \varepsilon A(i)$$

Step 2: Start with the non-empty set

$$S: = \left\{ i / \sum_{a \varepsilon A(i)} x_{ia}^{*} > 0 \right\}$$

and, for any state $i \in S$, set the decision

$$R_i^{*}: = a \; for \; some \; a \; such \; that \; x_{ia}^{*} > 0$$

Step 3: If S = I, then the algorithm is stopped with the average cost optimal R*. Otherwise, determine some state $i \in S$ and action $a \varepsilon A(i)$ such that $p_{ij}(a) > 0$ for some j ∈ S , set R_i^{*}: = a and $S: = S \cup \{i\}$, and repeat *step 3*.

The object of the linear program is the minimization of the long-run average cost per unit time, while the first set of constraints represent the balance equations requiring that for any state $j \in I$ the long-run average number of transitions from state j per unit time must be equal to the long-run average number of transitions into state j per unit time. The last constraint obviously requires that the sum of the fraction x_{ia} must be equal to 1.

Next we sketch a proof that the above linear programming algorithm leads to an average cost optimal policy . Following Tjims(1988), the starting point is the average cost optimality equation (1)

Since this equation is solvable then the linear inequalities

$$g + v_i - \sum_{j \in I} p_{ij}(a) v_j \leq c_i(a) \qquad i \in I \text{ and } a \varepsilon A(i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

must have a solution. Next it readily verified that any solution $\{g, v_i\}$ to this inequalities satisfies $g \leq g_i(R)$ for any $i \in I$ and any policy R, where $g_i(R)$ denotes the long-run average cost per unit time under policy R when the initial state is i. The inequalities $g \leq g_i(R)$ follow by a repeated application of the inequalities $g + v_i - \sum_{j \in I} p_{ij}(R_i) v_j \leq c_i(R_i), i \in I$; Hence we can conclude that for any solution $\{g, v_i\}$ to the linear inequalities (3) holds that $g \leq g^{*}$ with g^{*} being the minimal average cost per unit time. Hence, using the fact that relative values v_i^{*} exist such that $\{g^{*}, v_i^{*}\}$ constitutes a solution to (3), linear program.

Maximize g ……. (4)

subject to

$$g + v_i - \sum_{j \in I} p_{ij}(a) v_j \leq c_i(a) \qquad i \in I \quad \text{and} \quad a \varepsilon A(i), g, v_i \quad \text{unrestricted}$$

has the minimal average cost g^{*} as the optimal objective-function value. Next observe that the linear program (2) is the dual of the primal linear program (4) by the dual theorem of linear

programming, the primal and the dual linear program have the same optimal objective function value. Hence the minimal objective function value of the linear program (2) yields the minimal average cost g^*. To show that an optimal basic solution (x_{ia}^*) to the linear program induces an average cost optimal policy, we first prove that the non empty set

$$S_0 = \left\{ i / \sum_{a \varepsilon A(i)} x_{ia}^* > 0 \right\}$$

is closed under any stationary policy. The proof proceeds by contradiction. Suppose that $p_{ij}(a) > 0$ for some $i \in S_0$ and $j \notin S_0$ then it follows from the constraint of the linear program (3) that $\sum_{a \varepsilon A(i)} x_{ja}^* > 0$, contradicting $j \notin S_0$. By the closeness of the set S_0 under any policy and the assumption that every average cost optimal policy has no two disjoint closed sets. The states $i \notin S_0$ are transient under every average cost optimal policy. This result guarantees that the completion of policy R^* in steps 3 of the linear programming algorithm is feasible. It remains to prove that the constructed policy R^* is average cost optimal. To do so, let $\{g^*, v_i^*\}$ be the particular optimal basic solution to the primal linear program (4) such that this basic solution is complementary to the optimal basic solution (x_{ia}^*) of the dual linear program (2) then, by the complementary slackness property of linear programming

$$g^* + v_i^* - \sum_{j \in I} p_{ij}(R_i^*) v_j^* = c_i(R_i^*) \quad \text{for} \quad i \in S_0$$

By the construction of policy R^* and the fact that the set S_0 is closed under any policy, we have that the set I(R^*) of recurrent state of policy R^* is contained in the set S_0. Thus, noting that no transition is possible from a recurrent state to a transient state.

$$g^* + v_i^* - \sum_{j \in I(R^*)} p_{ij}(R_i^*) v_i^* = c_i(R_i^*) \quad \text{for} \quad i \in I(R^*)$$

By iterating these equalities, we find that under policy $R^*$the average cost per unit times equals g^* for each recurrent initial state. Hence, since for any transient initial state the close set of recurrent states will be reached after finitely many transitions, the average cost per unit time under policy R^* is equal to g^* for each initial state, and so policy R^* is average cost optimal.

The Model

According to Abubakar(2011), suppose that at the beginning of each day the health condition of a man is observed and classified as good health or poor health. If he is found to have poor health, he is given either a first aid/preventive treatment or curative treatment so that the health condition could change to good health and could attend to his usual activities .

Suppose also that he could be found in good health conditions i = 1,2,… N. The good health condition i is better than i+1. That is, the health condition deteriorates in time. If the present condition is i and does not fall ill, then at the beginning of the next day then he has good health conditions j with probability p_{ij}. It is assumed that his body cannot improve on its own. That is $p_{ij} = 0$ for j<i so that $\sum p_{ij} = 1$ for j>i. Let the health condition i = N represents a poor condition that requires treatment taking two days. For the intermediate states i with 1<i<N there is a choice for him to preventively take treatment so that he could remain in good health condition for the present day. Let a first aid/preventive treatment takes only one day at most and a change from poor health to a good health (after treatment) has a good health condition i=1. We wish to determine a rule which minimizes the long-term fraction of time the man is taking treatment.

Let us put the problem in the frame work of a discrete-time Markov decision model. We assume a cost of one for each day he takes treatment, the long-term average cost per day represent the long-term fraction of days that he takes treatment. Also, since a treatment for poor health condition N takes two days and in the discrete Markov decision model the state of the system has to be defined at the beginning of each day. We need auxiliary state for the situation in which a treatment is in progress. Thus the set of possible states of his health condition is chosen as

I = {1, 2, … N, N+1}. Here the state i with $1 \leq i \leq N$ corresponds to the situation in which an observation reveals good health condition i, while state N+1 corresponds to the situation in which treatment is in progress already for one day. Denoting the two possible actions by

$$a = \begin{cases} 1 & if\ the\ condition\ is\ good\ health. \\ 0 & otherwise \end{cases}$$

The set of possible actions in state i is chosen as

A (1) = {0}, A(i) ={0,1} for 1<i<N, A(N) = A(N+1) = {1}

We find that the one step transition probabilities $P_{ij}(a)$ are given by

$P_{ij}(1) = 1$ for 1<i<N

$P_{N, N+1}(1) = 1 = P_{N+1, 1}(1)$

$P_{ij}(0) = P_{ij}$ for $1 \leq i \leq N$ and $j \geq i$

$P_{ij}(a) = 0$ otherwise

Further, the one step costs $C_i(a)$ are given by

$C_i(1) = 1$ and $C_i(0) = 0$.

A rule or policy for controlling the health condition is a prescription for taking actions at each decision epoch.

In view of Markov assumption, and the fact that the planning horizon is infinitely long, we shall therefore consider stationary policies. A stationary policy R is a rule that always prescribes a single action R_i whenever the system is found in state i at a decision epoch.

The rule prescribing a treatment or poor health condition only when he has a good health condition for at least 5 working days is given by $R_i = 0$ for $1 \leq i < 5$ and $R_i = 1$ for $5 \leq i \leq N+1$.

Illustration

The average cost optimal when the number of possible working conditions equals N = 5 and the deterioration probabilities of the health conditions of staff in a company is given below

$$P = \begin{pmatrix} 0.80 & 0.15 & 0.05 & 0 & 0 \\ 0 & 0.60 & 0.20 & 0.10 & 0.10 \\ 0 & 0 & 0.40 & 0.35 & 0.25 \\ 0 & 0 & 0 & 0.50 & 0.50 \end{pmatrix}$$

The policy – iteration algorithm is initialized with the policy which prescribes treatment, be it a first aid or curative action a=1 in each state except state 1

The linear programming problem is

Minimize $\sum_{i=2}^{N+1} x_{i1}$

subject to

$$x_{10} = \left(p_{11}x_{10} + \sum_{i=2}^{N-1} x_{i1} + x_{N+1.1} \right) = 0$$

$$x_{j0} + x_{j1} \sum_{i=1}^{j} p_{ij}x_{i0} = 0 \qquad 2 \leq j \leq N-1,$$

$$x_{N1} - \sum_{i=1}^{N-1} p_{iN}x_{i0} = 0,$$

$$x_{N+1.1} - x_{N1} = 0,$$

$$x_{10} + \sum_{i=2}^{N-1} (x_{i0} + x_{i1}) + x_{N1} + x_{N+1.1} = 1,$$

$$x_{10}, x_{i0}, x_{i1}, x_{N1}, x_{N+1.1} \geq 0.$$

The linear program has the optimal basic solution

$x_{10}^* = 0.6021, \quad x_{20}^* = 0.1753, \quad x_{31}^* = 0.0847, \quad x_{41}^* = 0.0392, \quad x_{51}^* = x_{61}^* = 0.0318.$

This yields an average cost optimal policy R* = (0, 0, 1, 1, 1, 1) with the minimal average cost $\sum_{i=2}^{N+1} x_{i1}^{*}$ = 0.206, in agreement with the results obtained by the policy-iteration algorithm.

Conclusion

The objective of the linear program is the minimization of the long-run average cost of treatment per unit time and the fraction of time in the long-run that a member staff could be in a poor condition of health and perhaps stays away from work.

This could be determined for each staff, so that for the staff whose value is a large contrast to that of the staff of the company could be considered as being in poor health condition quite often and therefore unproductive and may be retired. The cost obtained is not very realistic; it could be determined by other methods. The linear programming formulation has the advantage that sophisticated linear programming codes with the additional option of sensitivity analysis are widely available. The policy-iteration formulation usually involves the writing of its own code. However, the two methods are very efficient.

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ARTICLES AND RESEARCH REPORTS ON EDUCATION

THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING OF PHONICS IN CHILDHOOD EDUCATION

By

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Abstract
The invaluable contribution of ICT to knowledge acquisition is being exploited by both teachers and learners in diverse fields of education disciplines. This study has investigated the role of ICT in the teaching and learning of phonics in childhood education. The area of the study was Awka Urban. The design of the study was survey. Two research questions guided the study. All the primary school teachers in the area of study constituted the study while 420 were randomly selected as the sample. A 20 item instrument structured on four point rating scale was used for data collection. Mean scores were used to analyse the research questions. Findings revealed that ICT has many roles to play in the teaching and learning of phonics ranging from providing both the teacher and the learner many materials and strategies for drills to providing immediate feedback. Based on the findings, the researchers recommended that government should equip schools with computers and organize workshops and seminars to train teachers on the use of computer for optimal benefit by learners. Parents should also have their children trained to use computer.

Introduction

Reading is a complicated process; it requires competence in several sets of skills including the ability to identify and recognize words; and their sound systems by which we communicate with one another which leads to developing independence in reading (Fox and Hull, 2008). The study of sound systems; the relationships of the letters and their combinations in print to the sounds they represent is called phonics. Phonics and its use in reading and spelling is one set of word attack skills. Venezky (1999) describes the English language as a fundamentally alphabetic writing system. It is not surprising then that researchers: Carr and Posner (1995); Adams (1990) conclude that reading achievement is higher when instructional programs include phonics. Research evidence has shown that phonics when taught systematically, significantly improves the reading ability of children (Baumann, Hoffman, Moon and Duffy-Hester, 1998; Snow, Burns and Griffin, 1998).

Introduction of ICT in teaching and learning has tremendously enhanced the quality of knowledge and skills acquired by learners (Snow, Burns and Griffin, 1998). Several studies have

shown positive results of ICT to support phonics instruction with children. Reitsma (1988) reports improved rate and accuracy of word identification by beginning readers after working with software that offered digitized pronunciation of words. Barker and Torgesen (1995) report a study of first graders who used a software application with speech capabilities. Children in the experimental group out performed their peers in both phonemic awareness and in their consequent ability to identify and read words. When appropriately designed and used, software can have substantial impact on teaching and learning (Grabe and Grabe, 1996). Computer software are programmed with rich drills that if used appropriately can supplement teaching very effectively and may, in fact be convenient tools in helping children achieve proficiency in phonics. Burns, Roe and Ross (1996) corroborate this in their finding which shows that phonics software's not only help children develop fluency and accuracy in word identification but also enable them develop their understanding of word play (combination and segmentation) into recognizable components visually or audibly. Software with visual highlighting and synthesized speech improve children abilities to blend words after learning them segmented at the onset-rime (ie. first sound rest of word) level. This software also enhances whole words and syllable recognition among children. Children with reading difficulties may also have much to gain from software designed to drill phonics (Olson, Wise, Ring and Johnson; 1997). Drill phonics software also helps children to learn words that are unfamiliar to them (Roth and Beck, 1987). Computer also trains children to sit still, paying attention to their learning. Use of ICT in teaching and learning of phonics avails diverse materials/strategies for the teacher and the child. ICT innovation is part of the quest to enhance teaching and learning for better learning out-comes in a globalized word such as ours. The effectiveness of teaching and learning of the child in a contemporary world therefore, depends to a large extent on the use of ICT (UNESCO, 2002). The role ICT plays in childhood education is critical to equipping the child strongly to face the challenges of future learning tasks in their complexities. The ICT role is of special need in the teaching and learning of phonics because without solid foundation in phonics; reading and spelling difficulties might emerge and adversely affect the child's education career. The purpose of this study therefore is to find out the role ICT plays in the teaching and learning of phonics in childhood education.

Research questions

The following research questions guided the study

(i) What are the roles of ICT in teaching phonics in childhood education?

(ii) How can ICT facilitate learning of phonics for children?

Methods

The design of this study was survey. The area of the study was Awka Urban. All the primary school teachers constituted the population. A sample of 420 teachers was randomly selected. Two research questions guided the study. A 20 item researchers- developed instruments, which were duly validated and reliably tested which yielded 0.79 and 0.88 coefficient values were used for data collection. The instruments were structured on four point rating scale of Strongly Agree (SA, 4 points), Agree (A, 3 points), Disagree (D, 2 points) and strongly Disagree (SD, 1point). Part A sought demographic data, part B sought role of ICT in teaching phonics while part C sought the role of ICT in learning phonics. The instrument is titled the Role of ICT in Teaching and Learning of Phonics (RICTTLP). Mean scores were used to answer the research questions. Mean 2.50 and above were accepted while below 2.50 were rejected.

Results

The results were presented in the order of research questions.

Research question one

Table 1: Teachers' mean responses on the role of ICT in teaching phonics.

S/N	Item	$\overline{X}$	Decision
1.	ICT provides tasks that involve matching sounds and letters	2.60	Accepted
2.	It provides tasks that involve matching spoken and written words	2.58	Accepted
3.	It provides tasks that involve combining letters to form words	2.55	Accepted
4.	It provides individual problem pairs of words to be arranged	2.63	Accepted
5.	It presents stories to focus on the letter sound correspondences	2.70	Accepted
6.	It provides words that the child has not mastered	2.50	Accepted
7.	It helps teacher meet the individual needs of children	2.54	Accepted
8.	It provides as many repetitions of task as possible	2.58	Accepted
9.	It provides reports for teachers	2.52	Accepted
10.	It provides immediate feedback	2.61	Accepted

Table 1 above shows that teachers accepted all the 10 items as the role of ICT in teaching phonics. They all scored 2.50 and above.

Research question two

Table 2: Teachers' mean responses on the role of ICT in learning phonics

S/n	Item	$\overline{X}$	Decision
1.	ICT provides game contexts	2.76	Accepted
2.	It provides attractive visual presentations	2.81	Accepted
3.	Provides texts for children to read with scaffolds to support phonic skills	2.69	Accepted
4.	Engages children in self-directed work on phonics	2.56	Accepted
5.	Provides reports on children's progress and areas in which individual children need additional work	2.88	Accepted
6.	It holds children's interest	2.89	Accepted
7.	It provides feedback	2.61	Accepted
8.	It gives hints or cue on how to carry out task	2.58	Accepted
9.	It provides motivating speech	2.53	Accepted
10.	It alters the speed of speech to meet individual needs	2.64	Accepted

Table 2 above shows that teachers accepted all the items as the role of ICT in learning phonics. They all scored 2.50 and above.

Discussion

The result of research question one shows that teachers accepted that ICT has roles to play in the teaching and learning of phonics. This finding corroborates the findings of Reitsma (1988) and Barker and Torgesen (1995) which showed positive results of ICT to support phonics instruction with children. It is interesting that teachers are aware of the role of ICT in teaching phonics to children. ICT has many benefits to offer in teaching phonics in childhood education ranging from providing tasks that involve matching sounds and letters, matching spoken and written words, combining letters to form words, providing individual problem pairs of words to be arranged, presenting stories to focus on the letter sound correspondences, providing words that the child has not mastered, helping the teacher to meet the individual needs of children, providing as many repetitions of task as possible, providing reports for teachers to providing immediate feedback. ICT software facilitate teaching as well as learning. It enriches teaching, shifting it away from the traditional/conventional classroom practices to

methods that make learning experiential, assist children discover learning, offer gaming simulation and personalize remediation of some difficulties in learning.

The result of research question two shows that teachers accepted that ICT has roles it plays in learning phonics. This finding corroborates the report of Olson, Wise, Ring and Johnson (1997) which shows that ICT software facilitate learning of phonics through drills even with children experiencing reading difficulties. Roth and Beck (1987) report that ICT software aid children to learn even unfamiliar words. The ICT software designed to assist children in phonics offer many opportunities that diversify learning for the child; making it very interesting and qualitative. The child as a result is enabled to meet and solve multiple learning tasks that aid consolidation of knowledge which comprises decoding of individual letter sound, letter identification, combining letters to form words and ability to read effectively. Since solid foundation in phonics is critical to literacy development of the child, it becomes very necessary that all available ICT software in phonics be employed. It would not only facilitate teaching and learning of phonics; but also, provide opportunities for the child to interact with many learning activities which would consolidate reading and spelling skills for the child.

Conclusion

In this age of information explosion availed by the introduction of technology in teaching and learning, it is very pertinent that ICT experience bears on our educational system. The benefits of using ICT in teaching and learning of phonics cannot be over emphasized. It is therefore necessary to expose children to benefit maximally from innovation such as information and communication technology.

Recommendations

(i) The government should integrate ICT in the education system of childhood education i.e. primary school curriculum.

(ii) Teachers and learners who are not computer literate should be encouraged to become computer literate. This could be done by organizing workshops and seminars where teachers could be trained.

(iii) Parents should arrange and have their children trained in the use of computer because possession of rich fundamental knowledge would boost children's education career.

(iv) Schools should be equipped with computers by the government. Software programmes with rich phonic drills on consonants and vowel sounds, visual highlighting, synthesized speech and word segmentation should be installed in these computers. Installation of

these software in the computers would meaningfully engage both teachers and children in the learning process for better outcome. This would help teachers and children have unlimited access to use of computers.

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EFFECTS OF GUIDED INQUIRY INSTRUCTIONAL STRATEGY IN COOPERATIVE AND INDIVIDUALIZED LEARNING SETTING ON SECONDARY SCHOOL STUDENTS ACHIEVEMENT IN BIOLOGY IN ABUJA MUNICIPAL AREA COUNCIL

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Abstract
This study investigated the effects of guided inquiry instructional strategy in cooperative and individualized learning setting on secondary school students' achievement in biology. Also, examined was the influence of gender on the performance of students expose to guided inquiry instructional strategy in cooperative setting. The research was a pretest posttest control group design. The sample for the study comprises 40 senior secondary school students (SSSII) randomly drawn from two private secondary schools in Abuja Municipal Area Council (AMAC), Abuja, Federal Capital Territory (FCT) Nigeria, the schools serve as experimental and control group respectively The experimental group was taught using Guided inquiry instructional strategy in a cooperative setting while the control group was taught guided inquiry in an individualized setting. The instrument "Genetics Achievement Test (GAT)" which was validated and its reliability coefficient found as 0.80 was administered to the experimental and control group as pretest and posttest, the scores were subjected to t-test analysis. The findings of the study showed that the experimental group performs better than their counterpart in the control group. However, no significant difference existed in the performance of male and female students' exposed to Guided inquiry instructional strategy in a cooperative setting. Based on the findings it was recommendations that there is need to encourage cooperative learning environment in science classes.

Keywords: Guided inquiry, Cooperative setting, Individualized setting and Achievement.

Introduction

Science, technology and mathematics (STM) occupy a central position in the evolution of modern world in the 21st century. They have transformed every aspect of human endeavor; Agriculture, Business, Education, Health, among others. Hence, nations of the world continue to strive to ensure a steady improvement in their science curriculum in the classroom. Biology as a subject occupies central position in many science courses such as medicine, pharmacy, agriculture, nursing, just to mention a few. In spite of the importance and popularity of science Biology indeed science to mankind, the performance of students at senior secondary school level has continued to be poor (Ahmed 2008) in Yusuf and Afolabi (2010). As a result of poor performance in science, the attentions of researchers have been focused on the causes of the poor performance. The factors responsible for poor performance in science have been identified

to include lack of instructional materials and science equipment (Shaliu 2004; Yusuf, 2004), and poor use of traditional method of teaching (Biodun 2004; Bajah 2010 & Okebukola, 1999). Yusuf (2010) observed that students perform poorly in biology because the biology classes are usually too large and heterogeneous in terms of ability level, just to mention a few.

Using traditional teaching method in teaching science allowed students to assimilate instructional content at knowledge level of the cognitive domain only and they usually memorize what they learnt without understanding of what is taught. Thus, this tends to affect students academic achievement and attitude towards science. The search for effective instructional strategies and the need to try some students-centred method of teaching have been the theme in different science fora nationally and internationally. Methods that promote active learning or learning by doing. Since science is inquiry (Ramalingam, 2001) then, for one to understand and learn science, there is the need to approach it by the inquiry method. Teaching science using inquiry method involves teaching students to solve problems using science process skills in a logical and systematic way. Polman, (1998); Timothy and Awodi (1997) and Obeka (2010) observed that inquiry based learning is gaining increasing support in science education, with a growing number of educators becoming interested in teaching inquiry strategy. The most important feature of this method is that it enables learners to be researchers and problem solvers. Furthermore it makes students active and improve their research skills (Metz, 2004; Wallace et al, 2004) in Bilgin, (2009).

Research evidence on guided inquiry by Agboghoroma (2005) & Obeka, (2010) among others concluded that the use of guided inquiry instructional strategy results in higher achievement than the use of conventional method. For instance, Timothy and Awodi (1997) investigated the relative effects of inquiry and lecture methods on the performance of high and low achievers in senior secondary school biology. Their findings showed that inquiry method improved the performance of low achievers students in biology and female students performed better than their male counterparts. Hence, this study seeks to investigate the effect of guided inquiry instruction in individualized and cooperative setting.

Learning setting in either cooperative or individualized may be a significant factor in students' performance in science. Cooperative learning is an instructional method in which students are required to work together on a learning task (Harasim 1997) in Gambari, (2010). In cooperative learning, members share skills, knowledge, experiences and materials with one another which lead to achievements of set objectives. Cooperative learning has been widely

researched and findings have shown that cooperative learning produced positive effects on students' achievement (Yusuf 2004; Adeyemi, 2008 & James, 2008). Students engage in cooperative learning, work together to achieve group goals leading to positive interpersonal relationship that cannot be achieved in individual or competitive setting. (Bailey, 2008; Eskilsson, 2008 & Bilgin, 2006) in Ibrahim, (2009) found that when teaching materials are used in cooperative learning environment, students' performance better in science concepts.

Aluko, (2010), investigated the effects of cooperative and individualistic instructional strategies on students` problem solving abilities in secondary school chemistry in Nigeria and found that the cooperative group performed better than individualistic instructional strategy. However significant difference was found on the performance of male and female students exposed to both cooperative and individualistic instructional strategy. In individualized Instructional setting, the computer will present instructions interactively with one student only. Students enter an individualized process and proceed at their own pace. Question will be given to each student after each sequence of instruction and individual members of the class will be expected to provide answers to the questions without any interaction. The teacher's role is to monitor the activities of the students so as to ensure strict compliance with instructions.

The under achievement of students in biology at senior secondary school certificate examination is a source of concern to all stake holders in the Nigeria education system. The poor performance has been attributed to poor teaching methods (Mathew, 2002; Olorukoba, 2007), abstract nature of science concepts (Biology inclusive) (Nsofor, 2006 & Shehu, 2006). Findings on the influence of gender on the performance of students in science have been inconclusive. Ifamuyiwa (2004) and Iwendi (2009) reported that male students performed better than their female counterpart in science and mathematics concepts while some researchers found that female students perform better than their male counterpart (Olson, 2002 & Anagbogu & Ezeliora 2007). Research reports from Adeyemi (2008), lfamuyiwa and Akinsola (2008), revealed that there is no significant difference in the performance of male and female students.

Genetics concepts in biology are among the difficult concepts as perceived by students (Katto 2004).

Table 1: Genetics Concepts Perceived as Difficult by Students

S/N	Items/concepts	Correct conceptions number and (%)		Misconceptions number and (%)	
1.	MUTATION	25	(20.8%)	80	(66.7%)
2.	PHENOTYPE	30	(25.0%)	78	(65.0%)
3.	GENOTYPE	30	(25.0%)	80	(66.7%)
4.	GENES	40	(33.3%)	71	(59.2%)
5.	CHROMOSOMES	33	(21.5%)	70	(58.3%)
6.	RECESSIVE CHARACTER	31	(25.8%)	66	(55.0%)
7.	DOMINANT CHARACTER	40	(33.3%)	67	(55.8%)
8.	HEREDITY	50	(41.7%)	58	(48.3%)
9.	FILIAL GENERATION	20	(16.7%)	52	(43.3%)
10.	ZYGOTE	40	(33.3%)	51	(42.5%)
Mean ($\bar{x}$)		28.2%		56.1%	

Source: Katto, (2004).

From table 1 above, the average percentage misconceptions (56.1%) were higher than the percentage of correct conception (28.2%). Also the difficult concepts as reported by WAEC Chief Examiners report (2002 & 2005) included genetics. Hence the need for the search for alternative instructional strategy that will improve students conception and performance in genetics.

Research Questions

1. Are there differences in the performance of students taught genetics with guide inquiry?
2. Is there any difference between the mean performance of male and female students taught genetics with guided inquiry instructional strategy in a cooperative learning setting
3. Is there any difference between the mean performance of male and female students taught genetics with guided inquiry instructional strategy in an individualized learning setting

Research Hypotheses

HO_1: There is no significant difference in the mean performance scores of student taught

biology with guided inquiry in individualized setting and those taught in cooperative setting

HO_2: There is no significant difference in the mean performance scores of male and female students taught biology with guided inquiry in cooperative setting.

HO_3: There is no significant difference in the mean performance scores of male and female students taught biology with guided inquiry in individualized setting.

Methodology

The research design was a pretest posttest control group design. The population was all the twenty one senior secondary schools in Abuja Municipal area council (AMAC). The sample for this study was randomly drawn from two comparable co-educational secondary schools in Abuja Municipal Area Council in the Federal Capital Territory (FCT), Abuja. Preliminary investigations showed that the two schools were comparable in terms of academic standard, method of students' admission, recruitment of teachers, physical facilities and science laboratory equipment and materials. The subjects of this study 40 senior secondary school II students (SSS2) were randomly assigned into experimental group (n=20) and control group (n = 20). Students in the experimental group were instructed with Guided Inquiry in a cooperative learning setting, while students in control group received Guided Inquiry in an individualized setting. The main differences between the two instructional approaches are that students in the experimental group discussed all models, critical questions, exercises and problems cooperatively in small groups, while students in the control group, read and did all questions, exercises and problems individually in class.

The instrument for this study was Genetics Achievement Test (GAT). The (GAT) is composed of 25 item multiple choice question which covered the following topics: Heredity, genes, chromosomes, cross breeding, recessive and dominant characters. The objective questions were validated by two science education lecturers and one senior Biology teacher. The reliability of the instrument was found to be 0.80.

Research Procedure

The study lasted for 6 weeks, the experimental and control groups were given GAT as pretests at the beginning of the study. Both groups gained experience with guided inquiry instruction in Genetics concepts. In the control group, students studied teaching materials in class individually thereafter the teacher randomly called student to share their findings with the class. In the experimental group, the students were assigned to four member-learning teams in

a small group-learning environment. The experimental group was trained about cooperative learning approach and a detailed description of the cooperative learning approach was distributed to all of the students before the treatment. Students in experimental group studied all of the teaching materials in class cooperatively. When groups completed their work for each question and reached a consensus, the teacher asked some members of the group to explain their answers during evaluation of the lesson. At the end of the treatment, both the experimental and the control groups were administered GAT as post-tests.

The data collected from pre and posttest were analyzed with mean, standard deviation and t-test using the Statistical Package for Social Science packages (SPSS) 17.0

Results

The analyses and interpretation of results are presented in table 1, 2, 3 and 4.

Table I: **t-test Result of Pretest Scores**

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
Experimental	20		20.85	2.76		
		38			0.28^{ns}	0.78
Control	20		21.10	2.86		

ns: not significant at 0.05 level

t-test analysis of students' pretest scores of the experimental and control groups revealed that there is no significant difference t= 0.28; p > 0.05 This indicates that the initial mean score of the two groups were equivalent and that the subjects of this study were comparable.

Hypothesis one (Ho_1): There is no significant difference in the mean performance scores of student taught biology with guided inquiry in individualized setting and those taught in cooperative setting

Table 2: **t-test results of the posttest scores of Experimental and Control Groups**

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
Experimental	20		69.00	5.76		
		38			4.21^{*}	0.01
Control	20		62.00	4.70		

*Significant at 0.05 level

The result of the analysis in table 2 shows the posttest achievement scores of experimental and control group. The posttest mean score are 69.00 for the experimental group

and 62.00 for the control group. The experimental group score differ significantly from the control group scores. The experimental group has higher mean score than the control group ($t = 4.21$; $p < 0.05$) hence, the null hypothesis is rejected indicating that there is a significant difference between the achievement of the experimental and control groups.

Hypothesis one (Ho_2): There is no significant difference in the mean performance scores of male and female students taught biology with guided inquiry in cooperative setting.

Table 3: t-test comparison of the posttest mean score of male and female students in experimental group

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
Male	10		68.00	4.83		
		18			0.20^{ns}	0.84
Female	10		68.50	6.26		

Ns: not significant at 0.05 level

Table 3 indicates the posttest mean score of male and female students in the experimental group. The posttest means score are 68.00 for the male students and 68.50 for the female group. The male scores did not differ significantly from female scores when both were taught genetics using guided inquiry in a cooperative setting, ($t = 0.20$; $p > 0.05$) This shows that there is no significant difference between the posttest mean score of male and female students. Therefore, the null hypothesis is accepted.

Hypothesis one (Ho_3): There is no significant difference in the mean performance scores of male and female student taught biology with guided inquiry in individualized setting.

Table 4: t-test comparison of the posttest mean score of male and female students in the control group

Group	N	df	Mean	SD	t-cal	Sig. (2-tailed)
Male	10		57.00	5.87		
		18			1.21^{ns}	0.24
Female	10		54.00	5.16		

ns: not significant at the 0.05 level

Table 4: shows the posttest mean score of male and female students in control group. The posttests mean score is 57.00 for the male students and 54.00 for the female group. The mean male score did not differ significantly from the mean female scores when both were taught genetics using guided inquiry in a cooperative setting, ($t = 0.21$; $p=0.24$; $p > 0.05$). This

shows that there is no significant differences between the posttest mean score of male and female students, taught genetics using guided inquiry in a cooperative setting. On this basis the null hypothesis is accepted.

Discussion

The study sought the effects of guided inquiry instructional strategy in cooperative and individualized learning setting on secondary school students' achievement in biology. Data collected were analyzed using t-test statistics.

The results of the t-test analysis on the performance of student taught genetics using Guided Inquiry in co-operative and individualized learning setting revealed that there was significant differences in the post mean score of the experimental and control group in their academic achievement in genetics. As a result, the null hypothesis which states that there is no significant difference in the mean performance of student taught guided inquiry in cooperative setting and those taught individualized setting was rejected. In other words, those taught genetics using guided inquiry in a cooperative setting performed better (X= 69.00) than those taught genetics in an individualized setting (X= 62.00).

This result is in line with the findings of (Bailey, 2008; Eskilsson, 2008 and Bilgin, 2006), who found that when the teaching materials are used with cooperative learning environment, students' perform better in science concepts. These findings also agrees with the earlier findings of Yusuf (2004), Adeyemi (2008) and James (2008) among others, that co-operative learning produce positive effects on students achievement. This implies that activities used in cooperative learning helped students to interact with the learning materials, share ideas and thereby enhanced.

Hypothesis Two was retained, signifying that there was no difference between the performance of the males and females of the experimental group taught genetics using guided inquiry in a cooperative setting. This finding agree with that of Adeyemi (2008), lfamuyiwa and Akinsola (2008), which revealed that there is no significant difference in the performance of male and female students in science and mathematics concepts. This result disagree with the findings of Ifamuyiwa (2004) and Iwendi (2009) who reported that male students performed better than their female counterpart in science and mathematics concepts. The non significant gender related difference in performance could be attributed to the fact that both participated actively in the learning process thus helped them to acquire meaningful learning

Hypothesis Three was retained signifying that there was no difference between the performance of the males and females of the control group taught genetics using guided inquiry in an individualized setting. This finding agrees with the findings of Umar (2011), who reported that there is no significant difference in the performance of male and female students in biology. This also agree with the findings of Adeyemi (2008), lfamuyiwa and Akinsola (2008) which revealed that there is no significant difference in the performance of male and female students in science. Hence individualized instruction seems to gender friendly.

Conclusion

The guided inquiry instructional strategy used in a cooperative setting is facilitative and proactive in promoting the acquisition of science skills and competences; it made the lesson activity based and enabled individual learners to interact among themselves. Hence, learning tasks requiring social interactions seem to stimulate learning. Guided inquiry in cooperative setting and individualized setting is not gender biased. The non significant gender related difference in performance could be attributed to the fact that fact that guided inquiry is a learner centered instructional strategy and it encouraged active learning rather than passive learning.

Recommendations

Based on the findings of this study, the following recommendations are made:

(i) Necessary attention should be accorded active learning such as Guided inquiry in a cooperative setting in secondary schools and relevant cooperative learning strategies should be encourage especially among biology teachers.

(ii) Students should be encouraged to develop social interaction among them in the classroom through cooperative learning.

(iii) Stakeholders should regularly organize workshops and seminars for science teachers on how to organize and facilitate cooperative learning

(iv) Since guided inquiry in cooperative and individualized setting is gender friendly, teachers should be encourage to use it in teaching in order to bridge the gender gap between male and females.

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IMPACT OF ICTS ON MANAGEMENT OF UNIVERSITY EDUCATION IN SOUTH WESTERN NIGERIA

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Abstract
This paper examined the impact of ICT on the management of University Education in South West Nigeria. It adopted descriptive survey type. The population for the study consisted of 350 academic staff holding administrative positions in the 10 public University existing in Southwest Nigeria out of which 210 samples was drawn through purposive, proportional and simple random sampling techniques. The instrument used was questionnaire tagged: ICT and management of University Education Questionnaire (ICTMUEQ). Three general questions were raised and analyzed descriptively. Two hypotheses were formulated and tested using Pearson product correlation co – efficient. The finding revealed that ICTS were used in the management of problems confronting University Education through the use of ICTS and there was significant difference in the utilization of ICTS between the federal and state Universities. It was therefore recommended that ICTS facilities should be provided and used in Universities.

Key Notes: Information, Communication. Management, Utilization, Universities

Introduction

The need to identify what it entails in improving the University education is a must. This is as a result of the rate of which the educational system all over the world is becoming an exceedingly complex enterprise. University is regarded as the most viable fountain of knowledge where people strive to increase the bounds of research, dissemination of knowledge and the pursuit of service to the country (FGN, 1981, Akpota, 1999). University is a place where knowledge is generated, transmitted and applied in solving society socio – economic, cultural and geo – political problems. The management quality of any educational institution, university in particular is observed to determine the quality of outputs.

It is of no doubt that there is an increasing demand on modern educational institutions for good results in terms of the functionality of the type of education being given. Based on this, there is need for improving on management of university education. Okunrotifia (1982) argued that the state of negligence has generated crisis, threatening the very foundation of the university system. Akpota (1999) also opined that the Nigerian university system has been in a high state of anxiety and frequent crisis of different types and intensity. There are crisis of

internal government and control crisis of condition of service and industrial, unrest crisis of brain drain and staff turnover (Omirin 2007).

It is observed that above problems exist as a result of poor management of most of our universities. This affects the quality (though increasing in quantity) of the school system to the point of affecting the outputs. Many seem to share common concerns and challenges imposed by uncertainly information chaos (Faloye and Oparah, 2007).

Lawsent and Vincent–Loncrin (1995) supported by Foray (2004) that knowledge, innovation and information and communication technologies (ICTS) have had strong effect on educational sectors. This serves as signal to us that education should not be left out rather it should be employed in the management of this apex of citadel of learning. This is because education is a prerequisite to the knowledge based economy which requires more lifelong educated population and workforce.

Omirin (2007) argued that the need for an effective ICTs management would develop education in the university system now and in the future. This is so because the university system does not operate in a vacuum. It must plan and decide on its operations in relation to both the internal and external environments towards goal attainment. Due to the multi – divisional goals of the Nigerian universities Abe and Adu (2007) agreed that the organizational structural requirement and information requirement are inextricably linked which characterized by the capacity for processing information. To many designers of ICT, school managers do not have relevant information at their disposal. At variance to this, Adedapo (2007) argued that school mangers need more because of the roles to be played by a computerized MIS in solving school problems.

Adedapo (2007) revealed that administration in Nigeria (university in particular) in bedeviled with series of problems among which are management that leaves much to be desired deficiencies in educational monitoring and evaluation procedure and inadequate access at all levels. It is therefore observed that using ICTs will promote issues on students' affairs administration like designing admission forms, which are properly labeled and numbered for accountability purpose. In addition, examination questions are prepared on the computers password and printed by the administrator himself which will prevent leakage. Registrations are done on the offices at the same time reduce stress. It is also observed that monitoring and evaluation of staff, physical plant planning curriculum development, finical management and information dissemination will increase the efficiency of the universities if ICTs are adequately

and properly used. This is expected to go a long way to avoid misinterpretation and ignorance on the part of the stakeholders.

In most countries (Nigeria inclusive) the question is no longer whether or not tertiary education institutions should invest on ICT (Simkins, 1981). The competition between institutions and student demand for easy access to courseware material and flexible learning environments, most tertiary education institutions willing to deliver quality teaching are bound to invest in e – learning. As we have seen, the large majority of institutions are now embracing e – learning adoption cycles one and two, which are basically about providing the students with better access to learning and course material and facilitating the electronic communication between students and teachers. Again, only very few institutions and faculties are however systematically exploring and producing re – usable learning material and objects (third cycle) or have taken full advantage of new ICTs with focus on active learning that combines face – to – face, virtual, synchronous, and asynchronous interaction and learning in novel ways (fourth cycle). The latter approach would require faculty and students to adopt new roles with each other and with the technology and support staff.

While ICTs offer powerful new instruments for innovation, universities are generally decentralized where individual faculty often has the sole responsibility for teaching courses and delivering course materials. Adoption of the third and especially the fourth e-learning cycle would imply changing to more collaborative ways of organizing and producing teaching material. Faculty members would in many cases have to collaborate with a whole range of new staff as e.g, course managers, web designers, instructional / pedagogical designers, and cognitive scientist etc. to produce course materials. This could lead to resistance from "traditional" faculty arguing that current teaching practices have proved its value for centuries and there is no need to change them to new pedagogical and teaching methods, which have hardly proven their efficiency yet. Moreover, promotion of faculty and funding allocations in universities are often linked to research activities rather than teaching activities, often seen as less prestigious. Faculty members have therefore often relatively few incentives to invest their time in ICT activities. On the note, this paper is prepared to focus on the impact of ICT on management of universities in south West Nigeria.

Statement of the Problem

It is observed that educational sector is characterized with slow progress in terms of innovation development which affects the management of university education in Nigeria. Some

universities only have interest in the use of ICT because it increases their Internally Generated Revenue (IGR) service, some fail as a result of inability to manage facilities. In view of the above, the following questions will be answered in this study.

i. To what extent are ICT used in the management of universities in the Southwest Nigeria?
ii. What are the problems faced by the universities when using ICT?
iii. To what extent are ICT available in universities in Southwest Nigeria?
iv. Is there any significant relationship between the availability and utilization of ICT in universities in Southwest Nigeria?
v. Is there any significant difference between the utilization of ICT in federal and state universities in South West Nigeria?

Research hypotheses

To guide this study, the following hypotheses were formulated.

Ho_1: There is no significant relationship between the availability and utilization of ICT in universities in South West Nigeria.

Ho_2; There is no significant difference between the utilization of ICT in the management of federal and state universities in Southwest Nigeria.

Methodology

The design of this study is a descriptive survey research. Openheim (1966) defines a survey as a form of planned collections of data for the purpose of analyzing the relationship between variables. To him, a survey attempts to answer such questions as what variables should be measured and what kind of sample will be drawn? As a descriptive survey, the researcher is concerned with describing existing phenomena in order to highlight their relevance to given situations.

The population of this study consisted of 350 academic staff holding administrative positions and the 260 senior administrative officers in the 10 public universities existing in the Southwest Nigeria out of which 210 were drawn from 6 universities (3 state universities and 3 federal universities) in the Southwest Nigeria.

The instrument was the questionnaire tagged ICT and Management of University Education Questionnaire (ICTMUEQ) was used to collect data from the subjects.

Five research questions were raised and analyzed with percentages while the two hypotheses were generated and analyzed using Pearson Product Moment Correlation co-efficient are tested at 0.05 level of significant.

Descriptive Analysis

Research Question 1: To what extent are the ICTs used by the universities in the Southwest Nigeria?

In answering this question, the data were collected from the respondents and analyzed with percentages as indicated in table 1.

Table 1: The use of ICTs by the Universities in Southwest Nigeria

S/N	**Items**	**Always**		**Occasional**		**Not Used**	
		No	%	No	%	**No**	**%**
1	Admission of Students	342	76.00	108	24.00	0	0
2	Registration of Students	310	69.00	92	20.44	48	10.66
3	Staff Recruitment	284	63.11	84	18.67	82	18.22
4	Dissemination of Information	290	64.44	107	13.77	53	11.78
5	Used for Seminal Presentation	244	54.22	127	27.11	84	18.07
6	Overhead Projector for teaching	31	6.89	177	17.11	342	76.00
7	For internet services	87	19.33	271	58.00	101	22.67
8	Used for Security Purpose	79	17.56	89	7.7	282	62.67
9	Compilation of Results	412	91.16	31	6.89	07	1.56
10	Used for power point	48	10.67	57	12.67	345	76.67
	Mean score	**213**	**47.33**	**103**	**22.89**	**134**	**29.83**

In table 1, it shows that 91.16 $^{0}/_{0}$ attracted highest responses that ICT was used for computation of result, also admission and registration of students, staff recruitment attracted above $60^{0}/_{0}$ responses that ICT were used always. But there was low responses for the use of over head project for teaching, the use of power point. However ICT were used by the universities in southwest Nigeria.

Research Question 2: What are the problems facing the universities when using ICTs?

In answering this, percentages were used to calculate the data as indicated by the respondents thus.

$$\frac{\text{Number of respondents}}{\text{total number}} \times 100$$

This is indicated in the table 2 below

Table 2: ICT Problems in the Universities

S/N	Items	Always		Occasional			
		No	%	No	%	No	%
1	Poor power supply	336	74.67	83	33.11	31	6.89
2	Poor support by government	146	84.66	139	30.09	65	14.44
3	Inadequate funding of the ICT	396	85.78	47	10.44	17	3.78
4	Lack of interest by the student	215	47.78	142	31.56	93	20.68
5	Poor Communication network	232	51.56	136	30.22	82	18.22
6	Lack of security for the facilities	193	42.89	186	41.33	71	15.78
7	Inadequate personnel for ICT	316	70.22	73	16.22	61	13.56
8	Inadequate soft ware	93	20.67	241	58.56	116	25.78
9	Virus problem	308	68.44	68	15.11	74	16.44
10	Problems in correcting errors	318	70.67	78	17.33	54	12.00
	Mean	**264**	**58.69**	**119**	**29.44**	**67**	**14.89**

As indicated in the table 2 above, 336 (74.67%) responded that there was always poor power supply, poor support from the government attracted 246 ($54.66^0/_0$) inadequate funding of ICT took 396 (85.78%). It shows that universities in southern Nigeria are facing ICT problems when using ICTs.

Research Question 3: Are the required ICT facilities available in the universities?

In analyzing this general question, numbers of available ICT facilities were used. The frequency count and percentages were used to analyses the responds. The results are shown in table 3.

Table 3: Availability of ICT Facilities in the Southwest Nigeria

S/N	Items	Available		Not Available	
		No	%	No	%
1	Internets	437	97.11	13	2.89
2	Computer	337	84	72	16
3	Overhead projector	74	15.44	376	83.56
4	Fax	38	8.44	412	91.56
5	Telegram	428	95.11	22	4.89
6	Intercom	410	91.11	40	8.89
	Average	**294.17**	**65.37**	**155.83**	**34.63**

As indicted in table 3 above, most of the ICTs facilities were available always. Those available are: computer set, internet, telegram and intercom while overhead projector and fax were said not to be available.

Testing of Hypotheses

Hypothesis 1: There is no significant relationship between the availability and utilization of ICT in Universities in Southwest Nigeria.

In testing this hypothesis, the responses to the item 1 – 8 on availability of ICT are correlated with items 9 to 15 on the utilization of ICT in management of universities in Southwest, Nigeria. The results were showed in table 4.

Table 4: Correlation Coefficient of Availability and Utilization of ICT in the Management

Universities	N	df	r – cal	r – tab	Result
Availabilities of ICTs	450				
		898	0.263	0.195	Significant
Utilization of ICT	450				

Table 4: above shows that the r – calculated value is 0.263 while the r – table value is 0.195. The calculated value is greater than the table value at 0.05 level of significance. Hence the hypothesis is rejected. Therefore, there was a significant relationship between availability of ICTs and utilization of ICTs in the Southwest Nigeria.

Hypothesis 2: There is no significant difference between the utilization of ICTs in the management of federal and state Universities in Southwest Nigeria.

The hypothesis was tested using the responses in the items 9 – 15 of the instrument for federal and state universities on utilization of ICT as indicated in table 5 below.

Table 5: t-test Analysis in Between the Utilization of ICTs in the Management of Federal and State Universities in Southern Nigeria

Group	N	X	SD	df	t–cal	t–tab
Federal universities	168	2.81	2.18	448	3.45	1.96
State Universities	282	3.04	2.75			

As revealed in table 5, the differences in the utilization of ICT in the Federal and State Universities. The t – cal of 3.45 was found to be greater than the t – table value of 1.96 at 0.05 level of significant. This shows that the hypothesis that there was no significant difference between the utilization of ICT in the Federal and State Universities is rejected. Therefore, there was significant difference between the utilization of ICTs in the management of Federal and State Universities.

Discussion

The result of the descriptive analysis revealed that ICTs are used in the management of the universities. This might be as a result of its relevance in the school system as agreed by Sambo (1992) and Omirin (2006) that relevant information is that which increases knowledge, reduces uncertainty and is used for the intended purpose. Abe and Adu (2007) also summarized the characteristics of good information as relevant for its purpose, sufficiently accurate for its purpose and completely enough for the problem.

Also revealed was that the universities always faced lot of problems when using ICTs. This is in line with the view of Kolade, Ojo and Omodara (2007) that there was no clear direction on teacher training on ICTs in the National Policy on Information Technology (NPIT). Lack of competency by the lecturers and administrative staff in utilizing the ICT facilities, high price of the ICT items and epileptic supply of electricity in Nigeria.

On the availability of ICT facilities, it was indicated that ICT facilities were available in most of the Universities. This disagreed with report of Adigun (2007), Alabi (1997), Ogiebaren

and Iyanu (2005) that ICT related facilities were not available in most of the education institutions in Nigeria.

As shown in result of the hypothesis that there was significant relationship between the availability of ICT and their utilization in the universities. This might be as a result of the needs in the society. Most of the universities would go along with the advancements in technology as supported by Aribamikan (2007) that the solid achievements many industrialized nations have been attributed to technology and most of the developing country (including Nigeria) can not do away with the use of Information and Communication Technology (ICT).

The result also shows that there was significant difference in the utilization of ICTs between the Federal and the State Universities. Contrary to Omirin (2007) that state universities have the higher means than the federal universitie indicated that state universities use more of ICTs related facilities in the management of its institutions. Observation also shows that most of the state universities engage in ICTs services to increase their Internally Generated Revenue (IGR).

Conclusion

From the findings, it is concluded that;

i. Information Communication and Technology is used in the management of Universities in South West Nigeria.
ii. There are lots of problems confronting the universities through the use of ICTs, ranging from poor power supply to lack of competence by the academic and non-academic staff of the universities.
iii. The ICT facilities are available in the universities.
iv. There was significant relationship between the availability of ICT and utilization of ICT in Universities in Southwest Nigeria.
v. There was significant difference in the utilization of ICT between federal and state universities.

Recommendations

Based on the findings and conclusions of this study, the following recommendations were made:

i. There should be improvement on the power supply so that ICT can be used at appropriate time.

ii. Competent and experienced ICT personnel should be employed in the universities for effective management of the institutions.

iii. Since there was significant relationship between availability and utilization of ICT in the management of universities, provision should be made for the availability of ICT.

iv. Adequate security should be made available for the ICT facilities.

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DERIVATION OF SOME QUALITY CONTROL MEASURES FOR ACHIEVING STANDARD IN BUILDING CONSTRUCTION INDUSTRY IN MINNA METROPOLIS

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Abstract

The purpose of this study is to investigate the factors required for quality control measures in order to achieve standard in building construction industry. Two research questions and hypothesis guided the study. The study made use of survey research design. It was carried out in Niger State, Minna metropolis. The population of the study was 57 made up of 25 building site engineers and 32 contractors in 32 building construction firms in Minna metropolis. There was no sampling due to relatively small size of the population. The instrument used for data collection was a 25-item structured questionnaire which was validated by three experts. Cronbatch alpha reliability method was adopted to determine the internal consistency of the questionnaire items and a coefficient of 0.83 was obtained. Fifty seven copies of the instrument were administered; all were successfully retrieved and analyzed using weighted mean and standard deviation. The hypotheses were tested using t-test statistic. It was found out that all the 25 questionnaire items identified as factors for quality control measures for achieving standard in building construction firms were required. It was also discovered from the test of hypotheses that there is no significant difference in the mean rating of building site engineers and contractors in the 25 questionnaire items. The study therefore recommended that building the construction industry should embrace adequate planning right from the design of a structure to execution level in order to achieve required quality standard of work in building construction project.

Introduction

Defects and failure in any construction infrastructures can be as a result of poor quality control during the entire construction process. Quality has been defined by Mcnulty (1992) as an "aesthetic sense of harmony" or the definition can be limited to "an absence of malfunction and failure". The letter definition is the minimum accepted in any type of work and is tempered by the consideration of the risk of malfunction and the time expected before such a malfunction will become apparent to the degree that needs correction. While quality control in construction facilities according to satter (2007) are critically important to a successful construction of project and should be adhered throughout the project from the conception and design to construction and installation. Quality control means making sure things are done according to plans, specifications and permit requirement.

Quality control and safety are increasingly important factors for almost all construction managers in the building industry. Quality Control according to Addison (2002) in building

industry typically involves insuring compliance with minimum standards of material and workmanship in order to ensure the performance of the facilities according to the design. These minimum standards are contained in the specifications of the project. For the purpose of insuring compliance, random sampling and statistical methods are commonly used as the basis for accepting or rejecting work completed and batches of material. Awarim (1998) stressed that total quality control in building construction is a commitment to quality expressed in all parts of an organization and typically involves many elements. Design review to insure safe and effective construction procedures is a major element, while other elements include extensive training of personnel, shifting the responsibility for detecting defects from quality control inspectors to workers and continually maintaining equipments.

Similarly, Fademiro (1996) describe quality control as a fitness purpose, i.e. providing a product (building) which provides an appropriate quality for the purpose for which it is intended. The price to be paid for the building is a reflection of the expectation of quality. A cheaper building probably used inferior materials and is likely to be less attractive and less durable and by implication can be risky and the quality is also related to the timing of when it is delivered.

Statement of the Problem

Building collapse during and after construction which subject the construction participants and users of the facilities to series of risks such as death, injuries, fatalities, large cost of reconstruction, etc. These are all as a result of failure to achieve the required quality and operational requirements.

Similarly, defect and operational requirements can result in legal embarrassment. Even with minor defect reconstruction may be required and facility operation impaired. Increased costs and delay for the completion of the project may also result. As with the cost control, the most important decisions regarding the quality of a completed facility are made during the design and planning stages rather than during construction. Quality control during construction consists largely of insuring conformance to its original design and planning decisions.

Lanfor and Tunker (1987) found several problems from planning in construction project, first, the motivation for planning come from outside sources, legal consideration and owners' requirement. Consequently today, most construction managers pay no attention to the adequate planning of construction projects. They also seem not to adequately assign superintendents to supervise work thereby allowing defects and risks to ruin the project.

Levit and samelson (1999) observed that most accidents and collapse of buildings in the developed and developing countries are as a result of poor planning and inadequate supervision of the building project. He added that most project superintendents' compromise standard, and consequently resulting to casualties. It is however believed that when effective planning and supervision of building projects are encouraged, it will ensure standard in the entire building construction process. Based on the above assertion, the researchers feel that there is need to carryout this study in order to improve the quality control measures in the building construction industry in Minna metropolis.

Methodology

Two research questions were developed to guide the study, while two hypotheses were formulated and tested at $P < 0.05$ level of significance. The study adopted survey research design. Survey research design in the opinion of Olaitan and Nwoke (1999) is that in which the same information is gathered from an unbiased representative group of interest. It is a very valuable tool for assessing opinions and trends from representatives group of population being investigated. The study was carried out in Niger State; specifically in Minna metropolis. The population for the study is 57 made up of 25 site engineers and 32 contractors in 32 building construction industries in Minna metropolis while some of the building construction industries have no site engineers. The instrument used for data collection was a 25-item structured questionnaire. The structured questionnaire has 4 point response scale of highly required, slightly required, averagely required and not required with a corresponding value of 4, 3, 2, and 1. The instrument was face validated by three experts, one from the Department of Industrial and Technology Education, and two from Building Technology Department all in Federal University of Technology. Their suggestions were used to improve the final copies of the questionnaire. Cronbach alpha reliability method was adopted to determine the internal consistency of the questionnaire items; a Cronbach coefficient of 0.83 was obtained. Fifty-seven copies of the instrument were administered on the respondents. The entire 57 copies administered were retrieved and analysed. Mean and standard deviation were used to answer the research questions while t-test statistics was used to test the hypotheses at $P < 0.05$ level of significance and at 55 degree of freedom. The values attached to the response option of the questionnaire were

Highly Required (HR) = 4

Averagely Required (AR)= 3

Slightly Required (SR)= 2

Not Required (NR) = 1

The arithmetic mean for the values was computed as 4 + 3 + 2 + 1 = 10/4 = 2.50. therefore, any item with weighted mean of 2.50 was regarded as required and any item with weighted mean less than 2.50 was regarded as not required. For testing the hypotheses, 2.00 was critical value of 55 degree of freedom; any item that has its t-cal equal to or less than t-critical was considered accepted and any item that its t-cal value is above the t-critical was considered rejected.

Research Question I

What are the organizational roles required as quality control measures for achieving standard in building construction industry?

Hypothesis 1

There is no significant difference in the mean ratings of the responses of the building site enquirers and contractors on organizational roles as quality control measures for achieving standard in the building construction industry in Minna metropolis.

The data for answering research question 1 and for testing hypothesis 1 are presented in table 1.

Table 1: Mean rating and t – test analysis of the responses of the building site engineers and contractors on organisational role required as quality control measure for achieving standard in the building construction industry

S/No	ITEM STATEMENT	X	SD	t – Cal.	t – tab.	REMARKS RQ	H_o
1	Making programme of work available in building site.	3.75	0.062	0.430	2.00	Rqrd	NS
2	Providing required information both safety and operational to enable workers discharge their duties deligently.	3.83	0.194	-1.923	2.00	"	"
3	Forming work group to ease supervision of work for quality assurance.	3.83	0.194	-1.923	2.00	"	"
4	Provide avenue for effective coordination of work of various unit for job continuity and quality.	3.33	0.090	0.469	2.00	"	"
5	Provide first aid room and boxes in the construction site	3.91	0.123	-1.200	2.00	"	"

6	Requirement of qualified workers for quality and safety	3.85	0.078	0.684	2.00	"	"
7	Effective material and equipment storage system on the site.	3.94	0.078	0.593	2.00	"	"
8	Provision of adequate platform working such as scaffold, ladder e.t.c	3.89	0.136	-1.523	2.00	"	"
9	Effective site supervision to ensure quality control and safety on the site.	3.87	0.096	0.682	2.00	"	"
10	Provision of adequate tools/apparatus for material testing to ensure quality control.	3.88	0.096	-1.458	2.00	"	"
11	Sequencial and interrelated activities are always properly considered	3.88	0.063	0.901	2.00	"	"
12	Timely organisational orientation on operational activites and safety is always observed	3.53	0.087	-0.503	2.00	"	"

Note: X = Mean H_0 = Null Hypothesis SD = Standard Deviation Rqrd = Required
RQ = Research Question NS = Not Significant

Data in table 1 above revealed that the 12 organisational role items had their means ranged from 3.53 to 3.94. This indicated that their mean were all above the cut – off point of 2.50. These mean values indicated that all the twelve items were required as organisational roles for quality control measure for achieving standard in the building industries. The hypothesis tested in table 1 revealed further that the 12 organisational roles items had their calculated t – values ranged from 1.923 to 1.166 which were less than t – table value of 2.00 at 0.05 level of significance and 55 degree of freedom. This indicated that there is no significant difference in the mean ratings of the responses of the two groups of respondents on the 12 organisational roles items required by building construction industry in Minna metropolis. With this result, the null hypothesis of no significant difference was upheld for the twelve organizational role items.

Research Question 2

What are the planning roles required as quality control measures for achieving standard in building construction industry?

Hypothesis 2

There is no significant difference in the mean rating of the responses of the building site engineers and contractors on the role of planning as quality control measures for achieving standard in building construction industry in Minna metropolis.

The data for answering research question 2 and for testing hypothesis 2 are presented in table 2

Table 2: **Mean rating and t – test analysis of the responses of the building site engineers and contractors on planning role required as quality control measure for achieving standard in the building construction industry.**

S/No.	ITEM STATEMENT	X	SD	t – Cal.	T – tab.	REMARKS RQ	H_o
1	Good work and material specification is in planning	3.79	0.106	0.850	2.00	Rqrd	NS
2	Provision of safety education to construction personnel in the building site.	3.77	0.085	1.325	2.00	"	"
3	Allow architech to do his function of design work within allowable time as stipulated in building regulation	3.89	0.501	0.373	2.00	"	"
4	Production building were quality is related to the price	3.81	0.124	1.307	2.00	"	"
5	Faults and defects can be minimized to reduce construction cost through planning	3.88	0.102	0.426	2.00	"	"
6	Planning avoid delays in project completion and improve quality	3.01	0.209	0.426	2.00	"	"
7	Planning enhance adequate supervision of site work and material for quality control	3.69	0.122	0.785	2.00	"	"
8	Reduction of the reoccurrence of accident and risk is ensured through effective planning	3.75	0.173	-0.223	2.00	"	"
9	Planning ensure good material usage, handling and storage	3.76	1.042	0.171	2.00	"	"
10	Determination of project						

	cost estimate and reduction of wastage is ensure through effective planning	3.83	0.096	0.502	2.00	"	"
11	Labour requirement schedule is ascertain through planning	3.93	0.084	-0.311	2.00	"	"
12	Contractor, architect and site engineer were involved in site planning	3.90	0.230	0.169	2.00	"	"
13	Building design are carefully studied by all construction team before the commencement of the project	3.59	0.132	0.192	2.00	"	"

Note: X = Mean H_0 = Null Hypothesis SD = Standard Deviation Rqrd = Required RQ = Research Question NS = Not Significance

Data in table 2 showed that the 13 items had their means ranged from 3.59 to 3.93. This indicated that their means were all above the cut – off point of 2.50. These mean values indicated that all the thirteen items were planning roles required in achieving standard in the building construction industry. The data presented on hypothesis testing in table 2 also revealed that the 13 planning roles required had their calculated t – values ranged from -0.311 to 1.325 which were less than t – table value of 2.00 at 0.05 level of significance and 55 degree of freedom. This indicated that there is no significant difference in the mean ratings of the responses of the two groups of respondents on the 13 role of planning required by building construction industries in Minna metropolis. With this result, the null hypothesis of no significant difference was upheld for the thirteen planning roles items.

Discussion of Result

The results of this study revealed that the building site engineers and contractors agreed that all the twenty five (25) items on quality control measure for achieving standard are required by the building construction industry. The result is in conformity with Fadamiro and Ogunsemi (1996) that pointed out the importance of site organization in building construction industry. They describe site organization as the process where human and material resources are properly positioned for their effective usage. Site organization promotes optimal utilization of resources (material and human) reduces time wastage as result of movement, reduce double handling, minimizes risk of theft, encourages fast delivering of material, encourages record keeping (inventory) of material brought in and the one that has been used, creates relationship

between workers and promotes safety and quality in the industry. Also Hinze and Figone (1998) state that the time and effort, the construction managers and contractors devote in organizing through proper co-ordination of workers to ensure that they do a safe and qualitative job during their time on site will pay off dramatically in safety, quality and productivity both for the sub-contractors and for the project as a whole. Organizing activities in building construction industry have a significant role to play in ensuring quality control and achieving standard construction, risk-free and effective productivity. When construction resources are properly organized, right person for a right job would be achieved and the question of what workers should do could easily be achieved. Meanwhile, where right people are employed in the construction site quality work can easily be achieved with high efficiency. The result of the study agreed with the submission of Hinze, Jimmee, and Lassau (1999) affirmed that construction planning is a fundamental and challenging activity in building construction industry for effective execution of project. They pointed out that for construction to achieve its objectives effective planning must be considered; it involves the choice of technology, the definition of work tasks, the estimation of the require resources, duration for individual tasks and the identification of any interaction among the different work task. Planning has also been seen as a tool for quality control in building construction industry. Hinze also asserted that the essential aspect of quality planning includes; generation of required construction activities, analysis of the implication of these activities, choice among the various alternatives, means of performing the activities, formulating supporting plans in conformance with specification.

The findings of the study from the test of hypotheses further indicated that there was no significant differences in the mean responses of building site engineers and contractors on organizational and planning roles required for quality control measure for achieving standard in building construction industry in Minna metropolis. The implication of this is that it helps to validate the questions raised and answered by this study. It also revealed that the work experience of two groups of respondents did not significantly influence their perceptions on the factors identified in the study.

Conclusion

From the findings of the study, the following conclusions were drawn; that there are factors that are associated with planning and organization of construction activities as quality control measures for achieving standard in the building construction industry. These factors include proper planning to enhance good constructional work, material specification and also

there is a strong need for proper organization to control quality of work and ensure standard in the building construction industry.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Building construction firms should always have good planning right from the design of the structure to execution level to achieve quality of work
2. There should be adequate planning and organization to enhance effective labour and coordination of work at various units for continuity, safety and standard at all the term.
3. There should be a long term planning to eliminate faults and defects to minimize construction cost that may pose construction delay, minimize structural failure and improve the standard.
4. Construction firms should have plans for material and equipment storage system on the site for their effective usage and achieving standard in the entire construction procedure throughout the project period.
5. Construction firms should periodically organise orientation for their workers while on the construction site in an attempt to maintain and achieve quality standard.

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AVAILABILITY OF INSTRUCTIONAL MATERIALS IN THE TEACHING OF PRIMARY MATHEMATICS IN BASIC SCHOOLS

By

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Abstract
This study investigated the availability of instructional materials of mathematics in primary schools. Ten schools comprising four private and six public primary schools were randomly selected in Oyo west local government area of Oyo state. In all, 300 pupils participated in the research (i.e. 30 pupils from each school). Two hypotheses guided the study and Wilcox on matched pairs [WMP] signed-ranked text was used to analyze the data. Findings showed that, there were significant differences in the performance of pupils taught with instructional materials, and those that are not in the primary schools and that the use of instructional materials make pupils have positive attitude towards mathematics. Recommendations were made on the need for using instructional material for teaching mathematics in Primary school.

Introduction

The effective teaching of mathematics for technological development is very crucial for nation-building. Since the children of today are expected to be involved in the development of the nation tomorrow, there is need to monitor them in the way they learn mathematics. There is no gainsaying the fact that the quality of mathematics education of a country determines the technological potential, for without mathematics, technological culture cannot really be imbibed by the citizens (Okunowo, 2001).

One of the problems of mathematics teaching and learning is lack of sustainable interest in the subject among pupils. Ivowi (1996) observed that the bias of girls and boys against mathematics need to be recognized. There is the need to 'catch them young', right from primary schools. Interest in mathematics and technology is best developed through the psychomotor and effective domains than the cognitive domains. Therefore, the use of instructional materials, either real objects or improvisation to develop pupils interest in mathematics for nation building should be from primary schools. Akinbote (1995) observed that instructional materials increase learning effectiveness. The developed countries are able to 'raise their heads' because their citizens are able to fabricate equipment through either local materials or imported materials.

The Concept of Instructional Materials

By definition, instructional materials have been seen as channels, through which instructional information passes out, in order to achieve specific instructional objectives (Akanbi, 1998). Many authors, variously classified instructional materials into; audio, visual and audio-visual (Nwosu 1991); printed and non-printed media (Agun, 1998); hypermedia, discursive, adaptive, interactive and reflective types. The choice and use of instructional materials depend on such factors as instructional objectives, the characteristics of the learners, the size and composition of the class, cost of the materials, availability of the materials, technical quality of the materials and others (Akanmu, 2004). The same author observed that teachers use instructional material anyhow, regardless of the above factors and hence the difference in the procedure for selecting and utilizing instructional materials in primary schools. In the primary school curriculum, the materials are already written beside each topic along with the activities to be carried out by the teachers.

Most of these instructional materials needed are not available in schools. Pupils do not understand the rudiments of mathematics at this level before going to secondary schools, while some of them would have developed their attitude towards mathematics even at this level because of many other factors which may include lack of quality teachers, lack of positive attitude towards improvisation (Egbegbedia, 1997), lack of material for teaching (Olagunju, 2000) and alternative teaching strategies with improvisation (Akinrotohin, 2000). Primary education is the foundation of the whole system of education and some of the goals of primary education, according to the National Policy on Education (NPE, 2008), section 3 (16), is to lay a sound basis for scientific and reflective thinking and to develop the manipulative skills that will enable pupils to function effectively in the society within the limits of his capacity. Ajayi (1999) observed that mathematics has been presented to the pupils and the community at large as an activity which is different from what is happening in the society. Some teachers even teach without instructional materials at the primary school level. All these invariably affect the attitude of the pupils towards mathematics negatively.

Nobody is born with attitude; it is developed through learning and social interaction. Some attitudes affect human perception. A boring and dull lesson can negatively affect the perception of students about the subjects and subsequently affect their performance on the subject. Aikem (2007) observed that, there is a significant correlation between performance and measure of attitude.

Statement of the Problem

This study investigates the availability of instructional materials necessary for teaching mathematics in primary schools. It further investigates the subjects' attitude to mathematics with, or without instructional materials.

Purpose of the study

When interest in mathematics is developed in the child, then a foundation for technology is laid. The use of toys, improvisation and other concrete instructional materials for teaching is to arouse the curiosity of pupils and to sustain the interest of pupils in going further to study mathematics at the secondary school level and technologically based courses at tertiary institutions. This is to make teachers become aware of the need for the use of instructional materials while teaching.

Research hypotheses

(i) There is no significant difference between the performance of pupils where instructional materials are used and where they are not used in the primary schools.

(ii) There is no significant difference in the attitude of pupils taught mathematics with instructional material, and those who are not.

Research Design

The design of the study is descriptive in nature, in the sense that, it is concerned with the practices that prevail and are conducted under conditions that do not permit manipulations of variables.

Sample and Sampling

The sample of the study comprises of 10 primary schools situated within Oyo west local Government. They were randomly selected among the public (six) and private (four) primary schools. Thirty pupils were randomly selected in each primary five classes in private schools, and primary six in public schools, making a total of 300 pupils.

Instrument

The instrument used for the study is a questionnaire divided into three sections. Section 'A' seeks the information on name, school, sex and age of the pupils, while section 'B' contains statements seeking the opinion of the pupils on the usefulness of instructional materials and about their attitude towards mathematics. Section 'C' is a checklist of instructional materials needed to teach mathematics. In the existing National Education Commission Primary Schools

Curriculum modules, the needed teaching materials were written besides the contents, hence teachers know what to use. About 60 items were identified from the syllabus in section C.

Procedure

The administration of the questionnaire was done personally by the researcher. Sections A and B of the questionnaire were given to 30 pupils in each of the ten (10) schools selected to fill and were later collected back. Section C of the questionnaire was personally filled by the researcher. The researcher observed the availability of instructional materials in each school and ticked. This was done to prevent schools covering up their inadequacies.

Result

Hypothesis 1: There is no significant difference in the availability and non-availability of instructional materials in primary schools.

For Hypothesis 1, Wilcoxon matched-pairs (WMP) signed-rank test was used for data analysis.

Table 1: Availability of Instructional Materials in Primary School

S/N	AV	NAV	Diff(AV-NAV)	Rank of diff	Rank of Smallest Sum
1.	32	28	4	1	
2.	20	40	-20	-(5)	-(5)
3.	43	17	26	8	
4.	25	35	-10	-(2)	-(2)
5.	22	38	-16	-(3)	-(3)
6.	16	44	-28	-(9)	-(9)
7.	18	42	-24	-(7)	-(7)
8.	21	39	-18	-(4)	-(4)
9.	19	41	-22	-(6)	-(6)
10.	15	45	-30	-(10)	-(10)
				+9	-46

N = 10 T = -46
+9

If the null hypothesis was correct and acceptable, we would expect the sum of the positive (+9) and that of the negative (-46) ranks to be more or less balanced. This value indicated a rejection in the null hypothesis. A sum of available materials in the ten (10) schools showed an average of 23.1 in each school while a sum of non-available materials in the ten

(10) schools showed and average of 36.9 per School. This means that about 30% of the instructional materials were available in each school. Only two private schools have 50% of the materials.

Hypothesis 2: There is no significant difference in the attitude of pupils taught mathematics with instructional material, and those who are not.

Table 2: Attitude of Pupils Taught with and without Instructional Materials

S/N	Y	N	D	Rank of diff	Rank of smallest sum
1.	132	168	-(36)	-(1)	-(1)
2.	264	36	228	9	
3.	241	59	182	8	
4.	265	35	230	10	
5.	203	97	106	3	
6.	235	65	170	5	
7.	221	79	142	4	
8.	113	187	-(74)	-(2)	-2
9.	237	63	174	7	
10.	236	64	172	6	
				52	-3

N = 10 T = -3
52

If the null hypothesis was correct and acceptable, we would expect the sum of the positive (+52) and that of the negative (-3) ranks to be more or less balanced. This value indicated a rejection in the null hypothesis. Therefore it can be concluded that students' attitude towards mathematics is dependent on instructional materials.

Discussion

The year of establishment of schools used, ranges from 1950 to 2001. One school was established in 1950, two schools established in 1940s, three schools in 1980s, one in 1994, while the remaining three were in the 1990s. There is no school that is less than eight years old. Some are above 40 years and so one expects that since they have been teaching mathematics for years, they are supposed to have at least 70% of the instructional materials on ground.

This shows that most of the mathematics contents have been taught to pupils without instructional materials. One can then see the reason why the pupils have negative attitude towards the learning of mathematics. The study shows that, the schools and the teachers care less about the importance of using instructional materials.

The responses of the pupils to the statements raised under section B of the questionnaire showed that the pupils like mathematics as a subject but do not see it as a science; this may be due to the inability of teachers to teach with instructional materials. It is also observed in many primary schools under study most of the instructional materials are not available both in private and public schools. Many teachers seem not to appreciate the importance of using instructional materials to teach.

Conclusion and Recommendation

The findings of this study confirm that most of the primary schools teachers do not use instructional materials to teach mathematics in their classes. There is need for each school to have a resource centre where materials are kept, for the use of teachers. The center should have shelves and tables where materials are displayed for the manipulative skills of the pupils.

Use of charts, printed materials, audio and visual aids in teaching/learning in primary schools should be emphasized for effective teaching and arousing pupils' interest in learning mathematics. Instructional materials help in awaking the memory of pupils, therefore teachers should intensify more effort in the use of these materials in mathematics lessons. The Federal and states' Ministries of education should make appropriate plans to provide, train and expose primary school teachers to the use of instructional materials. Also, seminal should be organized on school bases to train teachers about the improvisation of instructional materials.

This study could still be carried out in more local government areas in Oyo state for wider coverage and possible corroboration.

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THE ROLE OF IMPROVISATION IN THE EFFECTIVE TEACHING AND LEARNING OF MOTOR VEHICLE MECHANICS WORK AT TECHNICAL COLLEGE LEVEL

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Abstract
Teaching and learning are two activities that are both geared towards the attainment of educational objectives. The attainment of these objectives has been ineffective, simply because of lack of necessary instructional materials, tools and equipment in our technical colleges. This paper therefore focuses attention on the role of improvisation in teaching and learning of motor vehicle mechanics works at technical college level. The paper examined the concept of improvisation, teaching and learning, the need for improvisation in motor vehicle mechanics work, improvisational skills required by the technical teachers as well as selection and use of improvised materials. It was recommend that technical teachers should be encouraged to design and construct prototypes of improvised equipment; States Science and Technical Schools Boards should organize workshop and conferences at least once in a year for technical teachers on improvisation of instructional materials and equipment; and improvisation should be teachers, students and parents concerned so as to reduce the financial burden on government.

Introduction

Motor Vehicle Mechanic Work is one of the vocational technical education programmes which involve the acquisition of scientific knowledge in design, selection of materials, construction, operation and maintenance of motor vehicles. According to Doyin (2004) Motor vehicle mechanics is a vocational programme, and a vocational programme is all about preparing one for a specific occupation. Vocational programmes are generally designed to prepare individuals for a gainful employment as semi-skilled or skilled worker or technicians or sub-professional in recognized occupation and in new and emerging occupations or to prepare individual for enrolment in advanced technical education programme (Ugwaja,2010). Motor vehicle mechanics work at technical college level consists of three components/subjects grouping as follows: Service station mechanics work, Engine maintenance and refurbishing, and Auto electricity.

The programme of motor vehicle work in Nigeria technical colleges is designed to produce competent motor vehicle craftsmen for Nigeria technical and industrial development (Aruku, 2007).The objective of motor vehicle mechanics work is to enable graduates to test,

diagnose, service and repair any fault relating to conventional motor vehicle assembly main units and system to the manufacturers specification (NBTE,2001). MAET (2005) stressed that motor vehicle mechanic students need the following skills and abilities:
an interest in mechanical/electronic system in motor vehicle, good problem solving ability, good vision, hearing and sense of smell, manual dexterity and mechanical aptitude, ability to communicate well in English, physical fitness and strength, ability to drive a range of vehicles, ability to read technical diagrams and illustration, have concern for safety and responsible work attitude; and interest in keeping up to date with technology.

From the above it can be seen that motor vehicle mechanics work should equip technical students with necessary theoretical knowledge and practical skills that will enable them secure paid employment, be able to set up their workshops and be self-employed and even employ others. Teaching and learning through which these objectives ought to be achieved have witnessed a lot of criticisms because students are not learning enough. Their performances in school examinations have continued to decline. Similarly their performances in industries where they are employed have also been poor. Several factors have been identified for these poor performances. Some of these factors according to Ngember (1996) include the inability of technical teachers to improvise and to embrace the use of improvised materials for teaching and learning of technical courses. Zambraxu (2006) lamented that the use of improvisational material has not been institutionalized in some of our technical colleges. The teaming population of students in our schools and the scarcity of real instructional materials such as tools, models and equipment, according to Igweh (1999) called for improvisation of instructional materials. Technical teachers who are charged with the responsibility of improvising these instructional materials to meet the need and interest of the students are found wanting, simply because they have not been motivated by the concerned authorities to do so (Wingoddy, 2003).

Technical subjects which motor vehicle mechanics work is an integral part of cannot be understood without practical demonstration with real practical equipment and so on. In most technical colleges there is poor funding, those models, tools equipment and materials are lacking (Garmneri, 1998). Furthermore, motor vehicle industries worldwide has witnessed a lot of changes, these changes are as a results of rapid advancement in technology. Motor vehicle teachers therefore need to improvise various parts of motor vehicles such as engine components so as to be able to cope with these changes. But, evidences from literature

revealed that technical teachers rely heavily on the use of chalks, chalkboards and outdated text books for the entire teaching.

There is need for a diversified instructional material such as models, equipment by motor vehicle mechanics teachers. Teachers need to revisit their attitudes with a view to imbibing the improvisational models and equipment that will aim at improving teaching and learning of motor vehicle mechanics work and consequently lead to the good performance of students in the area of skill acquisition and school examinations. In other words, teachers needs to shown the tradition of chalks, chalk boards, and outdated text books and improvised, embraced and incorporate the improvisational materials in teaching and learning of motor vehicle mechanics work at technical college level.

Concept of Improvisation

Improvisation is the making of substitutes from local materials found at home or school premises when the real or original material/equipment is not available. Ashilokun(2004) defined improvisation as the act of using alternative teaching materials and resources whenever there is lack or shortage of actual teaching process. Aleburu (1999) in Igweh (2009) saw improvisation as the choice of the best instructional materials which enable teachers to achieve some carefully specified educational objectives. In the words of Eniayeju(1983) improvisation in teacher education is the act of using alternative materials and resources to instruction whatever there is lack or shortage of first hand instructional aides. Accordingly, Ordor and Azeke (1986) cited in Igweh (2009) identified three kinds of improvisation to include: as mere substitute, as a creation of substitute and as an original creation.

Bomide(1986) however opined that improvisation as a role substitute and as a role simulation. He further explained that it serves as substitute when the original material is slightly modified in order to perform novel function in an experimental set up like glass cup substituting a beaker or a building model substituting a normal building. Furthermore, Maduabum(1990) asserted that improvisation is an equipment and material which the teacher uses to help the achievement of lesson objectives. From the foregoing analysis it can be seen that improvised materials/equipment should be able to convey special messages just like the original material.

Teaching and Learning

Teaching is a conscious or deliberate effort on the part of a more experienced person to impact practical skills into a less experienced person. In the words of Santrock (2004) teaching is an attempt to help someone acquire, or change some skills, knowledge, ideas or

appreciation. He further explained that one of the cardinal objectives of teaching is to assist the learners develop physically, intellectually, emotionally, morally and socially in a manner that he/she will be able to exploit his/her potentials maximally. Thus teaching can influence the acquisition of desirable changes in the behaviour of learners.

Akinote (2005) explained that teaching as the interaction between a teacher and student under the teacher's responsibility in order to bring out the expected change in the learner's behaviour. The process of teaching includes schooling, teaching, training, instructing, indoctrinating, adapting and initiating ideas (Rais, 2004).

From the above analysis it can be seen that teaching is a human undertaking the of which aim is to help learners to learn. It is an interaction between a teacher and a student under the teacher's guide and for teaching to be effective the teacher needs to know how the students grow, learn, think, feel and respond to outside influences in their development (Wraser, 2003).

Learning on the other hand, is a change in behaviour due to experience. It is the process by which behaviour is initiated modified or changed. It is a process by which we acquire and retain attitudes, knowledge, understanding, skills and capabilities that cannot be attributed to inherited behaviour patterns or physical growth. All these reveal that learning is a process that is used to accomplish set goals by the learner (Oguntonade, 1998). Hakah (2005) explained that learning is the acquiring of habits, knowledge and attitudes involving new ways of acquiring practical skills. He further stressed that it is a changing of individual's ways of responding which comes from his thinking, perceiving emotional reaction or other psychological activity, and that skill learning is facilitated when there is explanation, demonstration and meaningful practices.

From the foregoing analysis, it can be seen that teaching and learning activities that goes on in the workshop revolve around the teacher and learner. and that the type of relationship that exists between the teacher and learner to a large extent determines whether or not learning will take place. According to Wayridge (2001) a good relationship with the learner is the most significant single element in satisfactory teaching. Apart from the personal rapport with individual learner, the general way by which the teacher interacts with the students in the workshop is another crucial factor in teaching learning process. All together, teaching is a process that facilitates learning. The teacher is the facilitator and act as a catalyst by stimulating and encouraging students to learn. And that teaching/learning process that

places the learner at the centre of all activities in the workshop is known as child-centred education. The learner should be an active participant in the process, as this is the only way by which learner can be free, happy, creative and well developed individuals.

There are two sides to any effective teaching-learning situation. There is usual theoretical side which has to do with the teaching of facts and knowledge. The second side has to do with the teaching of practical skills and attitudes. This according to Adedokun (2007) involves muscular dexterity, and coordination of mind and muscles. He further stressed that this essentially the practical side of teaching-learning situation. For any effective teaching and learning teacher must ensure that his/her teaching skills, attitudes and assessment of students knowledge is applied in the right mix for optimum effect of any particular objective. In other words, teacher must put in place every necessary tools, materials and equipment that could enhance learning; and this can simply be attain though improvisation.

The Need for Improvisation in Motor Vehicle Mechanics Work

Ashilokun (2004) lamented that no effective technical teaching can take place without equipment and current students' population in our technical colleges in the face of dwindling economy justifies the need for improvising technical equipment and materials. Limited original equipment and materials provided by the authorities concerned can no longer meet students' demand. This situation therefore underscores the need for improvisation to supplement imported equipment and materials. Improvisation helps to take care of population explosion which is phenomenal in schools by providing more materials and equipment which would have been very expensive to procure (Igweh, 2009). Alonge (1983) expressed the need for improvisation as follow:

(i) To bridge the gap between abstraction and reality. Instead of teaching in abstraction a similar item is presented for learner to see and it becomes real.

(ii) To make teaching/learning of instruction very easy. The learner understands better when he/she sees something that is being talked about in its real form.

(iii) To save cost, because it will be cheaper to improvise than to buy the actual materials.

(iv) To encourage creativity in teaching and learning situation.

Furthermore, Gwangwam(1998) outlined the role of improvisation in teaching and learning to include:

(i) it presents next to real situations to students in the absence of real thing.

(ii) it fills the vacuum that otherwise have existed in the teaching and learning process.

(iii) it provides a frame of reference on which students can focus their attention during workshop activities.

(iv) it makes students participate in creative and physical thinking when they are involved in making or sourcing those needed materials.

(v) being actively involved in improvisation process, the students acquire problem solving skills, manipulative skills, scientific attitude and knowledge needed in solving everyday problems.

(vi) improvisation helps in focusing teaching and learning process easier.

From the foregoing, it is clear that teacher can adopt improvisational materials/equipment to improve teaching and learning of motor vehicle mechanics work at technical college level. It can further be inferred that there is need to improvise equipment and materials that are needed for effective teaching. However, certain skills that are needed by the teachers so as to be able to easily improvise according to National Teacher Institute (2008) includes: creativity, practical skills, design skills, resourcefulness, research skills, initiative, positive work habits and proficiency in technical illustration. In the words of Iwuozor (2000) any teacher in science and technology who intends to achieve maximum result from the use of improvised materials should be guided by the following on the selection and use of such materials:

(i) Comprehensive knowledge of subject matter to be taught.

(ii) Thorough understanding of learning process generally.

(iii) Knowledge of available improvised materials.

(iv) Material selected be valid and authentic to knowledge or skill to be taught.

(v) Cover topic/subject matter intensively and extensively; and

(vi) Reflect awareness of individual differences.

Conclusion

From the discussion so far, it is clear that lack of necessary instructional materials and equipment are the major constraints on teaching and learning of motor vehicle mechanics work in our technical colleges. It was also evident that improvised materials have great roles to play in teaching and learning of motor vehicle mechanics. The only way out to supplement the very scarce equipment and material is to urgently encourage technical teachers to achieve some carefully specified educational objectives.

Recommendations

The inadequacy of instructional materials that will improve teaching and learning of motor vehicle mechanics work has made improvisation imperative. To make individuals most especially motor vehicle mechanics teachers to be aware of the role of improvisation in teaching and learning, the following recommendations should be are made:

(1) Technical teachers should be encouraged to design and construct a prototype of improvised equipment. Such equipment could mass be reproduced so as to be distributed to other technical colleges where they are needed.

(2) Government should be charged with the responsibility of funds to assist technical teachers from not spending their meagre salary.

(3) Science and Technical School's Boards should organize workshop and conferences at least once in a year for technical teachers on the improvisation of instructional materials and equipment.

(4) Improvisation should be teachers, students and parents concern so as to reduce financial burdens on the government.

(5) Government at all levels should encourage improvisation of technical instructional materials and equipment.

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EFFECTS OF COMPUTER ASSISTED INSTRUCTIONAL PACKAGE ON THE PERFORMANCE OF SENIOR SECONDARY SCHOOL STUDENTS IN HISTORY

By

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Abstract
This study investigated the Effects of a Computer Assisted Instructional (CAI) package on the performance of Secondary School Students in History. The design adopted for the study was the pretest-posttest experimental control group design. 120 students from senior secondary class one (SSI) were randomly selected from six secondary schools in Niger State. The instrument for data collection was the History Achievement Test (HAT). The data were analysed using the t-test statistics. Two hypotheses were formulated and tested at 0.05 level of significance. From the analysis the following findings were reached; (i) the use of CAI package significantly improved students' performance in history, as the mean scores of the experimental group on posttest was more than that of pretest scores (t=13.83, df= 118, p<0.05). (ii) There was no gender difference in the performance of students that were exposed to the CAI package (t=0.34, df=58, p<0.05). Based on these findings, it was recommended that, the use of computers for teaching history at Senior Secondary Schools should be encouraged.

Introduction

History is a discipline that studies the chronological record of events as it affects a nation or people based on a critical examination of source materials and usually presenting an explanation of their causes. Encyclopedia Britannica (2010). History is a subject that develops peoples interest in the past by allowing students to appreciate human achievements and aspirations. It is also a subject that teaches students about the major issues and events in the history of their own country as well as the world at large (Osokoya 2007). Also, it teaches us how these events have influenced each other. Therefore for any nation to develop a sound basis of solving its present societal problems and issues, the study of history is necessary because it provides information on how similar issues and problems had been resolved in the past. History also establishes how issues and problems of the past have been different from the present ones. As a discipline, history contributes immensely to personal and social education of the people. It develops in the students attitudes and values necessary for tolerating a wide range of opinions needed in unifying a nation with diverse socio-cultural, political and religious differences such as Nigeria (Okai, 2010 & Osokoya 2006).

Richard (2010) stated that the major aim of teaching history is to promote understanding of the concepts which foster peace, patriotism and stability in the country. By its nature, history tells us more than just about the past, as it argues for an ideology or a world view, which involves explanation and the study of the interconnections between events. The study and writing of history involve evidences from available data which can be gathered orally, written or through archeological excavation (Okai 2010). History as a subject remains very important in the educational system of any country, and Nigeria in particular. The National Policy on Education (2004) has placed history in group A among the core subjects to be offered at Senior Secondary School. This is with a view to achieving the goals of fostering National Unity with emphasis on the common ties that unite Nigerians in their diversity. And also to raise a general of people who can think for themselves, respect the views and feelings of others, respect the dignity of labour and live as good citizens. It was stated by Richard and Ugbe (2010) that lack of the knowledge of history would generate a feeling of chaos and insecurity, a development which would create a dilemma and crisis in the life of any society.

Gender has been identified as one of the factors influencing students academic achievement, yet no consistent result has emerged. Some researchers (Ash, 2005; Basturk, 2005; & Gambari, 2010) reported that gender has no significant influence on achievement.

Contrarily, Fagbemi (2004), and Osokoya (2007), reported otherwise. The non-conclusive researches on the influence of gender on students' performance sustains the curiousity of the researcher and make it necessary to understand how achievement may be influenced by gender and Computer Instructional Packages.

Statement of the Problem

Richard (2010) maintained that, despite the relevance of history to man, society and national development, the teaching and learning of history has become increasingly deplorable in Nigeria. Osokoya (2007), asserted that the subject has been replaced by social studies in Junior Secondary School, and at the Senior Secondary School level (SSI – SSIII) where it is taught, statistics have consistently shown low enrolment of students in history. Also the few students that enrolled in the subject over the years have demonstrated poor performance in the West African Examinations Council (WAEC) and National Examinations Council (NECO), Senior Secondary School Examinations, (Osokoya 2007, Richard and Ugbe 2010 and Richard 2010).

Table I gives the statistics of students enrolment and performance in history at the West African School Certificate Examination between 2004 – 2009.

TABLE I: Students Enrolment and Performance in WAEC/SSCE Examinations in Niger State from 2004 - 2009

S/No	Year	Total Enrolment WAEC	History Total Enrolment	History Percentage	Credit A1– C6	Credit A1 - C6 Percent	Fail No. Percent (F9)
1	2004	61273	53615	87.50%	22363	41.71%	19347 36.08%
2	2005	64465	57335	88.94%	17188	29.98%	24680 43.05%
3	2006	63276	55718	88.05%	17445	31.30%	22980 41.24%
4	2007	65077	57543	88.42%	9055	15.73%	23044 40.04%
5	2008	11772	7052	59.90%	1075	15.24%	2447 34.70%
6	2009	63433	55127	86.91%	7390	13.41%	25594 46.43%

Source: ***WACE Office, Niger State 2011***

From the above table it is clear that between 2004 – 2009, the percentage of candidates with Credit level (A1 – C6) in History is below 50%. While in 2004 only 41.71% obtained a Credit, in 2005 29.98%, in 2007 15.73%, in 2008 15.24% and in 2009 only 13.41% scored a Credit Pass.

Many reasons have been advanced for poor performance and low enrolment of students in history (Evuti, 2005; Nakaka, 2006; Osokoya, 2007; & Richard and Ugbe, 2010). It was observed by Richard (2010) that the low enrolment and deterioration in students' achievement in history must have been caused by the poor method of teaching the subject in Schools. Also many history teachers in Nigeria depend mostly on lecture method which makes learning boring and uninteresting (Osokoya, 2007). Adeyinka (2002) laments that the frequent use of lecture method for History teaching in Nigeria does not provide for effective teaching/learning experiences.

The aforementioned situation necessitated the need to explore other teaching and learning approaches that would enhance the learning of history, facilitate understanding of

concepts and possibly encourage higher enrolment of students. Educational Technologist are of the view that Computer Assisted Instructional Strategy (CAI) can be used to improve students performance, arouse their interest and motivate them to learn (Gambari 2010). Computer Assisted Instruction is an instructional technique by which a computer is used to present an instructional programme to the learner through an interactive process on the computer (Bakac, Tasoglu & Akbay, 2011). This functions on interactions, promotes instruction, help students to learn at their own pace, saves time, gives feedback, favours all categories of learners, enhances motivation and is highly learned centred. This study therefore investigated the effects of Computer Assisted Instructional package on the performance of Senior Secondary School students in history.

Research Questions

The study answered the following research questions:

(i) Is there any difference in the performance of secondary school students taught history using computer assisted instructional package?

(ii) Is there any difference in the performance of male and female students taught history using computer assisted instructional package?

Research Hypotheses

The following null hypotheses were formulated:

HO_I: There is no significant difference between the mean achievement scores of students taught history with Computer Assisted Instruction and those taught with conventional/traditional method.

HO_2: There is no significant difference between the mean achievement scores of male and female students taught history with Computer Assisted Instructional package.

Sample and Sampling Techniques

The target population for this study was all the Senior Secondary Class One (SSI) students in History in Niger State. The sample for the research study was made up of 120 students (60 males and 60 females) from six secondary schools randomly selected across the three educational zones of the State by means of stratified random sampling technique.

Research Instrument

The research instrument used in the study was the History Achievement Test (HAT), designed by the researcher and employed as a pretest and posttest in the study. The instrument is a 20-item multiple-choice objective question. The instrument was validated by

Senior Lecturers in History Department in Niger State College of Education, Minna and Chief Examiner of History in National Examination Council, Headquarters, Minna.

Results

Two Research questions were raised in this study and two null hypotheses were formulated and tested to provide answers to the research questions. Analyses of the pretest and posttest data collected by means of the History Achievement Test (HAT) were used to answer the research questions using the two null hypotheses as guide. Means, standard deviations and the t-test were employed in analysing the pretest and posttest data.

A pretest was administered to both the experimental and control groups. The test was given to determine the academic equivalence of the experimental and control groups. The mean scores of students in the experimental and control groups on the pretest were calculated and the t-test computed for the two means. Table 1 shows the means, standard deviations and the result of the t-test analysis.

Table 1: t - test Comparison of the Mean Scores of Experimental and Control Groups on the Pretest

Variable	N	df	$\bar{X}$	SD	t- value Cal	P	Remark
Experimental Group	60		4.13	1.42			
		118			0.26ns	0.73	Not significant
Control Group	60		4.07	1.34			

ns - Not significant at p> 0.05

The result of the t-test analysis in Table I shows that there was no significant difference in the pre-test means scores of Experimental ($\bar{x}$= 4.13) and Control ($\bar{x}$= 4.07) groups. The t-value of 0.26 not significant at 0.05 alpha level. This mean that students in the experimental and control groups were at the same entry level with regard to academic ability before the topics in History were presented to them. Their mean scores was not significant.

Hypothesis 1

There is no significant difference between the mean achievement scores of students taught history with Computer-Assisted Instructional (CAI) package and those taught without it.

To test this hypothesis the posttest means scores of the experimental and control groups were computed and compared using the t-test statistic. The result is shown in Table 2.

Table 2: t-test Comparison of the Posttest Mean Scores of the Experimental and Control Groups

Variable	N	df	X	SD	t- value Cal	P	Remark
Experimental Group	60		12.62	2.26			
		118			13.83*	0.01	Significant
Control Group	60		7.72	1.56			

* - *Significant at p< 0.05*

The result of the t-test analysis in Table 2 shows that there was no significant difference in post-test means scores of students exposed to Computer Assisted Instructional Package ($\bar{x}$ = 12.62) and those exposed to conventional teaching method ($\bar{x}$ = 7.72). The result favoured Experimental group exposed to Computer Assisted Instructional Package. The t-value of 13.83 was significant at the 0.05 alpha value. Therefore, the hypothesis which states that there is no significant different between the mean achievement scores of Experimental and Control groups taught History with Computer Assisted Instructional Package was rejected.

Hypothesis 2

There is no significant difference between the mean achievement scores of male and female History students taught history with the Computer-Assisted Instructional package.

To test this hypothesis, the posttest mean scores of male and female students in the experimental group were computed. The analysis was carried out using the t-test statistic and the result shown in Table 3.

Table 3: t-test Comparison of the Posttest Mean Scores of Male and Female History Students in the Experimental Group

Variable	N	df	X	SD	t- value Cal	P	Remark
Males	30		12.73	2.43			Not
Females	30	58	12.53	2.13	0.34ns	0.38	significant

ns - *Not Significant at p> 0.05*

From the result in Table 3, it can be seen that there was no significant difference between the posttest mean scores of male (x = 12.73) and female (x = 12.53) History students in the experimental group at 0.05 level of significance. The t-test analysis shows no significant difference (t_{cal} = 0.34; df = 58; p > 0.05). Null hypothesis 2 was therefore not rejected.

Discussion of Results

The result from the study is in agreement with earlier findings of Ash (2005), Basturk (2005) and Gambari (2010) who found that students taught with computer performed significantly better than those taught without computer. Computer can, therefore, be seen as a tool for effective teaching and leaIl1ing of all school subjects (Ezeliora, 2003). CAI is an effective and efficient developmental tool of individual cognitive structure, psychomotor, and affective abilities.

The result is contrary to the findings of Fagbemi (2004) who concluded that the role and performance of girls in electronic media and the computer is not encouraging. Also, Nakaka (2006) observed that, male students found computer to be more interesting than females. However, Gambari, (2010) concluded that female students performed better in integrative processes than their male counterparts. The result also agrees with the findings of Ash (2005) and Basturk (2005) who found that gender did not influence students' performance in Computer/sciences generally.

Conclusions

The result of the study revealed that students taught with the CAI package scored significantly higher in the History Achievement Test (HAT) than those taught without it. The package had the same effects on both male and female students. The study had also shown that, CAI package provided an effective teaching strategy that leads to understanding, meaningful learning, and improved performance.

Recommendations

From the findings of the study, it is therefore recommended that;

(i) The use of computers for teaching and learning in our schools should be encouraged. In addition, computer education should be made compulsory for teachers and students in all levels of education. To achieve this, curriculum designers should include the use of computers for teaching and learning into school curricula, especially the use of CAI Packages, computer modelling, CAI simulation and so on.

(ii) Computer laboratories/centres with adequate computers and internet facilities should be established in our primary, secondary and tertiary institutions. This would make information technology an integral part of teaching and learning activities as well as arouse students' interest which in turn enhances motivation to learn.

(iii) Educational authorities should provide enabling environment, materials and manpower required for the teaching and learning of all subjects using computer technology. To achieve this, government should provide adequate funds and seek for aids (where necessary) from bodies like United Nations Educational, Scientific and Cultural Organisation (UNESCO), United Nations. Children Education Fund (UNICEF), United States Agency for International Development (USAID) and so on, to assist in funding computer technology in our schools.

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