



**University of
Reading**

**WEST AFRICA BUILT
ENVIRONMENT RESEARCH
(WABER) WORKSHOP
2009
June 2-3**

British Council Accra, Ghana

Programme and Abstracts

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PROGRAMME

West Africa Built Environment Research (WABER) Workshop

2-3 June 2009

Main auditorium of British Council in Accra, Ghana

Tuesday 02/June/2009

Opening session

- 09:00-09:10 Welcome address by *Mr. Moses Anibaba* (Director of British Council in Ghana): *The role of the British Council in Africa*
- 09:10-09:20 Introductory remarks by *Professor Will Hughes* (Head of School of Construction Management and Engineering, University of Reading, UK)
- 09:20-09:30 Chairman's remarks by *Professor Kwasi Adarkwa* (Vice Chancellor of Kwame Nkrumah University of Science and Technology, Kumasi, Ghana)
- 09:30-09:35 Group photograph

Presentation sessions

Chairperson *Dr. Mrs. Bola Babalola* (Obafemi Awolowo University, Nigeria)

- 09:40-09:50 Neural network based predictive model for forecasting building works, *Amusan Lekan Muritala*, Covenant University, Nigeria
- 09:50-10:00 Development of an environmental cost-metric for assessment of construction work, *Afolabi Dania*, Ahmadu Bello University, Nigeria
- 10:00-10:20 Discussion
- 10:20-10:30 Investigating the economic feasibility of integrating energy efficient technology in buildings in Ghana, *Naa Adjeley Ashiboe-Mensah*, KNUST, Kumasi, Ghana
- 10:30-10:40 Integration of passive and low energy cooling techniques into buildings in Ghana, *Samuel Amos-Abanyie*, KNUST, Kumasi, Ghana
- 10:40-11:00 Discussion
- 11:00-11:20 Refreshments

Chairperson *Dr. Emmanuel Achuenu* (University of Jos, Nigeria)

- 11:20-11:30 An integrated approach for payment certification of construction works, *Peter Kuroshi*, Covenant University, Nigeria
- 11:30-11:40 Selecting nominated subcontractors for building construction projects in Nigeria, *Anita Dzikwi Adamu*, Federal University of Technology, Minna, Nigeria
- 11:40-12:00 Discussion
- 12:00-12:10 Construction sector and economic development in the ECOWAS: Validity of Bon curve, *Alabi Folasade*, University of Lagos, Nigeria
- 12:10-12:20 Branding the Nigerian construction industry for export, *Yusuf Mohammed Isa*, Federal University of Technology, Yola, Nigeria
- 12:20-12:40 Discussion
- 12:40-14:00 Lunch

Chairperson *Professor G.W.K. Instiful* (KNUST, Kumasi, Ghana)

- 14:00-14:10 Project appraisal to determine the benefit worth of a project at inception, during execution, and when put into use, *Audu Daka*, University of Jos, Nigeria
- 14:10-14:20 Development of design decision support model for optimizing whole life cost of building projects during early design stage, *Baba Adama Kolo*, Ahmadu Bello University, Nigeria
- 14:20-14:40 Discussion
- 14:40-14:50 Impact of ICT on the integration of construction procurement chains in Nigeria, *Adejimi Akinboade*, University of Lagos, Nigeria
- 14:50-15:00 Appraisal of Build-Operate-Transfer (BOT) procurement model in infrastructure development projects in Nigeria, *Alhassan Dahiru*, Ahmadu Bello University, Nigeria
- 15:00-15:20 Discussion
- 15:20-15:40 Refreshments

Chairperson *Dr. Kabir Bala* (Ahmadu Bello University, Nigeria)

- 15:40-15:50 Assessment of risk impact on building projects' performance in some cities in Nigeria: contractors' and consultants' perspectives, *Aliyu A. Soyngbe*, University of Lagos, Nigeria
- 15:50-16:00 Public health infrastructure projects in Ghana, the problem of non-completion, *Andrew Oppong-Danquah*, Ghana Health Service, Ghana
- 16:00-16:20 Discussion
- 16:20-16:30 Measurement of productivity of plumbers and electricians on Nigerian construction sites, *Fidelis O. Achi*, University of Lagos, Nigeria
- 16:30-16:40 Defining the parameters for good site concrete practice and management, *Anosike Nwabueze Michael*, Covenant University, Nigeria
- 16:40-17:00 Discussion

PROGRAMME
West Africa Built Environment Research (WABER) Workshop
2-3 June 2009
Main auditorium of British Council in Accra, Ghana
Wednesday 03/June/2009

09:00-10:00	Talk by Professor Will Hughes (Editor-in-chief of Construction Management and Economics journal): <i>Refereed Journal Papers: Practice and Process</i>
Chairperson	Professor Stella Zubairu (Federal University of Technology, Minna, Nigeria)
10:00-10:10	A study on the valuation of impact of landfills (dumpsites) on property values in Lagos state, <i>Ukabam Titilayo</i> , University of Lagos, Nigeria
10:10-10:20	A study into the relationship between procurement methods and the supply chain management of the construction industry, <i>Duga Ewuga</i> , Uni. of Jos, Nigeria
10:20-10:40	Discussion
10:40-10:50	A study on the use of benchmarking in facilities management in Nigeria, <i>Yewande Adewunmi</i> , University of Lagos, Nigeria
10:50-11:00	An investigation into female construction undergraduates' expectations towards practice, <i>Kulomri Jipato Adogbo</i> , Ahmadu Bello University, Nigeria
11:00-11:20	Discussion
11:20-11:40	Refreshments
Chairperson	Rev. Dr. Frank Fugar (KNUST, Kumasi, Ghana)
11:40-11:50	Evaluation of maintenance practices in prison institutions in South-west Nigeria, <i>Oluranti Farinloye</i> , University of Lagos, Nigeria
11:50-12:00	Health and safety conditions of building maintenance sites in Nigeria: the post occupancy contaminations of timber structures by microorganisms, <i>Isa H. Mshelgaru</i> , Ahmadu Bello University, Nigeria
12:00-12:20	Discussion
12:20-12:30	Bridging the equity gap in the evaluation of public housing environments in Lagos Nigeria, <i>Adetokunbo O. Illesanmi</i> , Covenant University, Nigeria
12:30-12:40	Post occupancy evaluation of Ogun State housing estates in Nigeria, <i>A. O. Ogunde</i> , Covenant University, Nigeria
12:40-13:00	Discussion
13:00-14:30	Lunch
Chairperson	Dr. Peter Kuroshi (Covenant University, Nigeria)
14:30-14:40	A comprehensive study of South-South places in Nigeria, <i>Harrison Elizabeth</i> , University of Lagos, Nigeria
14:40-14:50	Evaluation of the role of water-based facilities in tourism destinations in Lagos littoral aspects, <i>Nnezi Uduma-Olugu</i> , University of Lagos, Nigeria
14:50-15:10	Discussion
15:10-15:20	A performance evaluation of housing finance by the Federal mortgage bank of Nigeria (1992-2008), <i>Musa Nuhu Madawaki</i> , Ahmadu Bello University, Nigeria
15:20-15:30	Agricultural solid waste generation in Nigeria and their recycling potentials into building materials, <i>Usman Aliyu Jalam</i> , Abubakar Tafawa Balewa Uni., Nigeria
15:30-15:50	Discussion
15:50-16:10	Refreshments
Chairperson	Dr. Koleola T. Odunsami (University of Lagos, Nigeria)
16:10-16:20	Reducing construction costs by using mechanically activated pozzolanas as partial substitutes to ordinary portland cement, <i>James Sarfo-Ansah</i> , Building and Road Research Institute, Ghana
16:20-16:30	Selected mechanical properties of mortar for masonry incorporating artificial pozzolana, <i>Mark Bediako</i> , Building and Road Research Institute, Ghana
16:30-16:50	Discussion
16:50-17:00	Presentation of "CERTIFICATE OF PARTICIPATION"

NEURAL NETWORK BASED PREDICTIVE COST MODEL FOR BUILDING WORKS

Amusan Lekan M.*

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A number of uncompleted and abandoned projects are attributable to overall bad projects management of which poor forecasting approach is a factor. Poor cost forecasting approach will lead to underestimating or overestimating and consequently abandonment. This research is geared towards developing a robust model through neural network that will enable accurate determination of acceptable building cost. This study entails using the strengths of neural network to develop a stable predictive cost models for building works using cost parameters. Data on cost parameters such as ground floor area, storey height and cost of substructure, upper floor, frame structure, staircase, roofing, wall, doors and windows, wall finishes, floor finishes including services would be obtained from questionnaire and bill of quantities of live building projects. The theoretical framework for this study is based on information obtained through review of past works, book of abstract and journals. Neural network was chosen as a tool in generating a predictive cost model for building works, based on certain advantages over other types of models, such as parametric, simulation, regression, and heuristics. These advantages include large input and output, data training and re-training, genetic algorithm, back-propagation effects, consistent output, less margin error, stable output and good processing speed. A predictive cost model will be generated based on the concept of neural network. This would be cross-validated with step-wise regression technique and re-sampling method would be applied to establish the model's degree of stability. It is hoped that a stable model will lead to a stable cost, firmly established to ensure adequate funding for project delivery.

Keywords: neural networks, prediction, cost model, building.

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DEVELOPMENT OF AN ENVIRONMENTAL COST-METRIC FOR ASSESSMENT OF CONSTRUCTION WORKS

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This paper is an interim report on an on-going PhD research work on developing other alternative Environmental Management tools. With increasing concerns for the effect of Man's activities (and specifically construction) on the environment, several management tools have been developed to assess the environmental performance of the Built Environment. However, some of these tools such as the voluntary Leadership in Energy and Environmental Design (LEED) Green Building Rating System in the United States and the United Kingdom's Building Research Environmental Assessment Method (BREAM) only assess the environmental performance of the Built environment against some pre-determined criteria. This research work is aimed at augmenting these efforts by developing on the other hand, an Environmental Cost Metric for denominating what the Environment loses for every item of work on construction projects and quantifying these costs in a 'currency' called the 'VIRON' (an acronym for Vital Improvement/Restoration Of Nature). This research work is being undertaken by firstly reviewing requirements for sustainable construction and existing environmental assessment procedures/tools, and then assessing various construction activities with particular reference to materials used and methods and determining the extent to which they affect the environment. A framework for determining what would constitute one unit of the VIRON would be determined based on the effects of the various construction activities. It is intended that by quantifying the impact of prospective construction activities on the environment, it would be easier to determine the environmental viability of these projects.

Keywords: environment, environmental assessment tools, environmental impact, metric, sustainable construction

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THE ECONOMIC FEASIBILITY OF ENERGY EFFICIENT BUILDING TECHNOLOGIES IN GHANA

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Accelerating the development and utilization of energy efficient technologies is one of the objectives defined by Ghana's current energy sector plan – Strategic national Energy Plan 2006-2020. Many studies have shown that the presence of energy efficiency building codes have immense effect on the adoption of energy efficiency measures in buildings. The absence of energy efficiency building codes in Ghana has resulted in the inability to take full advantage of the opportunity for energy savings that exists in the building stock. In the absence of these mandatory regulations however information on the economic viability of technical options is essential for the realization of the potential for energy efficiency. The aim of the research is to identify energy saving technologies that can be applied in a case of three buildings and evaluate the cost-effectiveness of adopting these measures. The study also assesses the effect that any changes in energy tariffs will have on the cost-effectiveness of the technologies. The economic assessments will be carried out using discounted cash flow methods since these methods are widely used as a quantitative basis for rational decision making by investors. Moreover discounted cash flow methods are ideal for determining the economics of differing processes, systems or materials and have been used in the investment analysis of various energy efficiency studies. It is expected that the study will identify various building energy efficient technologies and show the profitability of integrating them in the selected cases. The study will serve as a starting point for broader analysis that incorporates social and political criteria. It will also help understand economic problems associated with energy efficient technology integration in Ghanaian buildings and influence the way in which the problems are tackled.

Keywords: energy efficiency, economic assessment, buildings, Ghana.

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INTEGRATION OF PASSIVE AND LOW ENERGY COOLING TECHNIQUES INTO BUILDINGS IN GHANA

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The gradual increase in the use of information technology in Ghana, employing personal computers and associated electrical gadgets, and the need for high illumination levels, liberates heat into buildings. Many buildings are erected with non-climatically responsive architectural approach that leads to high penetration of solar radiation. Choice of building materials has often been based on affordability, aesthetics, durability and some cases availability, other than functional, thermal performance. A straight forward response to excess heat in buildings in Ghana has been the adoption of an air conditioner, which leads to high peak electricity demand. The research intends to assess the potential of passive and low energy techniques to improve thermal comfort and reduce electricity demand for cooling in air conditioned public office buildings in Ghana. An experimental research method will be employed. The potential use of passive and low energy cooling techniques will be determined with the Building Bioclimatic Chart on the standard psychometric chart. A computer based dynamic numerical modelling and simulation tool will be used to undertake a parametric analysis to predict the energy use based on the reaction of input variables on a system structure. The significance of the research is to encourage innovative and individual design solutions amongst building design professionals. The reduction of the peak cooling-energy demand would be of interest to power generating industries and building investors, as it will imply a possible reduction in the required installed plant capacity. It will also be an essential element in Ghana's Climate Change Mitigation Programme.

Keywords: passive cooling techniques, public office buildings, Ghana, building bioclimatic chart.

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AN INTEGRATED APPROACH FOR PAYMENT CERTIFICATION OF CONSTRUCTION WORKS

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The multiplicity of transactions during project execution makes financial probity in the Nigerian construction industry a daunting objective. In order to have common bases for monitoring and controlling project expenditures by client, financiers, chain suppliers, and contractors - who invariably are stakeholders for any given project, this research is focusing on developing an e-network that will become the backbone of measures for curbing financial mismanagement during project execution. This takes cognizance of the basic rights, responsibilities and relationships of the parties involved in a construction project. Thus, a fully developed network intends to consist of mathematical/logical system entities and processes typifying all possible financial transactions for a project, as carried out by the project's stakeholders i.e. Client, promoters (e.g. banks), and all other economic units providing both tangible and intangible construction resources. Payment certifications that are premised on well-defined methods statement and contents of a project's bill of quantities BOQ) are to be facilitated based on approvals through a system of relevant software(s), smartcards, network of computers (i.e. intranet, extranet, and internet based) and peripheral configurations. Thus, the design of prototype software(s)/smartcards will be based on typical construction costs data (e.g. unit cost as obtainable in BOQs, materials, labour rates), information from designers specifications, and work procedure obtainable from a precedence network programme.

Key words: e-network, financial probity, payment certification.

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CONSTRUCTION SECTOR AND ECONOMIC DEVELOPMENT IN THE ECOWAS: VALIDITY OF THE BON CURVE

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The underdevelopment status of ECOWAS countries when compared with developed economies has been a concern requiring policy intervention with the intent of boosting the economic development of the sub-region. A notable aspect of the economy where such policy is imperative is the construction sector, which according to past studies has been adjudged to have a link with economic growth and development. The study aims to validate or otherwise Ranko Bon proposition (Bon curve) which describes the pattern of movement of construction sector with the economic development of any country. The study intends to follow the methods and structure of the previous studies in order to achieve consistency for the purpose of comparison. The study will make use of analytical tools such as Leontief's (1936) input-output analysis and econometric methodology developed by Engle and Granger. In addition, unit root test will be used in conjunction with co integration test. The study will use time series annual data (1980 -2006) to demonstrate the causal relationship between construction sector and GDP in ECOWAS. It is expected that the result of study will show some resemblance to those of developing countries, especially the result for sub-Saharan Africa where a relative decrease in construction volume correspond to a decreasing growth in GDP per capital, while the converse does not appear to be true also. Thus the study findings may be significant for policy makers (Local, National and Regional) and also provide future direction for research in the ECOWAS sub region.

Key words: Bon curve, economic development, ECOWAS.

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BRANDING THE NIGERIAN CONSTRUCTION INDUSTRY FOR EXPORT

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The construction industry in Nigeria is organized in terms of economic units providing consultancy services and producing built spaces; these manifest in form of residential buildings, building structures that support services for national development and building objects which are parts of technical infrastructure. The increasing demand for the industry outputs resulted in growth of construction firms along different fields of specialization. In view of development in the industry and the enhanced financial support capacity of the banking industry, Nigeria apparently occupies a lead position in the African continent. This research work is a comparative study of the mode of operation of multinational and large indigenous construction firms in Nigeria. The aim is to identify the problems and possibilities of proposing the creation of Nigerian brand of construction products and services for export in line with international best practices. This is in view of the prospects of being a big player in building markets within Africa. The study entails evaluating resource requirement in terms of personnel, finance, machinery and materials for an export model brand. Information on best practices would be obtained through literature review for validation / confirmation by administration for questionnaires and oral interviews. Additional relevant data would be sourced from records of multi-national firms. The outcome of this research is intended to advance the building profession across boundaries in Africa, in view of the multi-dimensional possibilities of construction management profession.

Keywords: branding, re-capitalized banks, indigenous firms, resources, products and services

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PROJECT APPRAISAL TO DETERMINE THE BENEFIT WORTH OF A PROJECT AT INCEPTION, DURING EXECUTION AND WHEN PUT INTO USE

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Projects generate employment, cause migration and social activities, before, during and after completion. Have they changed the life of their host communities? What benefits have they brought to their host communities? These and other questions are to be answered in this research. Project evaluation is an integral part of any development programme, to evaluate the rate of return on a project; social profitability, side effects on the growth rate of population, employment, and rate of reinvestment. It also helps to assess the impact of the new project on the people of the area especially social and economic conditions. It involves, review of the situation before the project is started; appraising during operation in order to find what has been accomplished and what remains to be accomplished; suggesting ways and means to improve its operation further and to plug loopholes; and evaluating the ends achieved by the project when it is completed and is in full operation. The aim of the research is to study project evaluation techniques applicable to construction development projects with a view to developing mathematical model for predicting the benefits of construction development projects at inception. The research would cover public projects like road construction; dam; and housing. The data would be the final cost of the project, maintenance costs of the project after completion up to the time of evaluation, and benefits. The result expected is the model that would be developed to help in the evaluation of proposed projects at inception, for selection from alternatives.

Keywords: project, cost, worth, evaluation, and development.

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DEVELOPMENT OF DESIGN DECISION SUPPORT MODEL FOR OPTIMIZING WHOLE LIFE COST OF BUILDING PROJECTS AT EARLY DESIGN STAGE

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Information upon which design decisions are made has been found to significantly add to the problems associated with building costs. The nature of projects – having temporary organizational structures, contributes to the incongruent nature of information management amongst design team members, which has culminated into design decision resulting as ‘off-the-shelf’ (i.e. revolutionarily) rather than ‘in-house’ (i.e. evolutionarily). The reason for this may not be unconnected to the little or no form of commonality (formulating, nurturing, resolving and harvesting design information) amongst members of the design team towards arriving at the design solution(s) for same projects. This presentation highlights on a PhD Proposal which seeks to develop design decision support model (DDSM) that collaboratively capture design data and generate design information that optimizes whole life cost (WLC) at early stages of building projects. This presentation briefly outlines the need for DDSM at early design stages, a conceptual framework for developing the DDSM and contextualizes the adoption of genetic algorithm as the optimization tool for the DDSM. The study adopts a two-sided research approach viz data mining and model development. The former entails desk survey, questionnaire survey and project data extraction, for data sourcing while statistical and factor analyses shall be performed on the data collected. For model development, this will involve data warehousing and the use of genetic algorithm to optimize WLC. The model is expected to provide design information towards achieving design solutions which optimizes WLC at early design stages based on project specific data and factors.

Keywords: information, design decisions, genetic algorithm, decision support model.

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IMPACT OF ICT ON THE INTEGRATION OF CONSTRUCTION PROCUREMENT CHAINS IN NIGERIA

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Various researchers have claimed that the construction industry is lagging far behind others in employing modern technology as major catalyst for improving productivity. While momentum for reversing this trend is being gathered in advanced countries through Computer Integrated Construction and researches into ICT penetration, the developing world battles with traditional, discrete and disintegrated construction procurement chains. As a result, there is scanty information on the trend and penetration of ICT in these countries. This study aims at finding out the depth of penetration and why if otherwise of ICT in the Nigerian construction industry with a bias to identify such effect on the integration of the country's construction procurement chains. The study will adopt IT Barometer survey to evaluate e-construction capacity in terms of the levels of skill, training, access, experience and the depth/type of usage of e-construction facilities. The IT Barometer survey will be modified to suit local situations. The questionnaires will have a five-point Likert-type scale to measure a range of opinions from "Very weak" to "Very strong". The significant agreement or otherwise with the notion being tested will be determined by adopting the mid-point value of the index as the hypothesized mean (Coakes and Steed, 2001). The data will be analysed using percentile method, mean score ranking, correlation analysis and the importance index. The study will assist in giving direction to ICT capacity development in terms of training, retraining, usage, software and hardware acquisition and development in the country's construction industry in line with vision 2020.

Key words: process-integration, e-construction, procurement-chains, virtual reality, ICT.

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APPRAISAL OF BUILD-OPERATE-TRANSFER (BOT) PROCUREMENT MODEL IN INFRASTRUCTURE DEVELOPMENT PROJECTS IN NIGERIA

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The study focuses on the appraisal of the Build-Operate-Transfer (BOT) procurement model in the context of Public-Private-Partnerships (PPPs) in the development and management of public infrastructure projects in Nigeria. A survey of eighteen BOT projects planned to be completed from 2003-2010 was conducted across the six geopolitical zones of the federation including Federal Capital Territory (FCT) Abuja. The projects were selected from each geopolitical zone based on their significance to the national development. Questionnaires were designed and administered on four categories of respondents namely: the clients, consultants, developers and investors across the six geopolitical zones of the country including FCT Abuja. Results obtained from the analyses revealed that significant correlations exist between the application of BOT concept and improper legal framework, political risk and financial risk. Thus the absence of legal framework to specifically support the application of the BOT concept coupled with high political and financial risks are the factors constraining the application of BOT concept in Nigeria. The study also discovered that lack of government support, poor tendering process and award mechanism, high level of bureaucracy, improper packaging of BOT projects, inadequate law enforcement, and lack of public awareness are responsible for the low level of success of BOT projects in Nigeria. A framework aimed at determining successful application of the BOT procurement model in Nigeria was developed. The model utilizes scientific approach to achieve good governance in the application of the BOT concept in public infrastructure development in the country.

Keywords: build-operate transfer (BOT), infrastructure, Nigeria

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APPRAISING THE PARAMETERS FOR GOOD SITE MANAGEMENT

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Introducing check and balances to avert building failure resulting from inefficient site concrete practice and management is what this study is set to accomplish. Concrete is a major component of most buildings and infrastructural facilities because of its versatility in use. Failure of most buildings and the infrastructures can be attributed to failure of this important element, although, there are existing established structural design as well as concrete production practices. Guideline for design load estimation and practical allowances are easily checked. However, concrete production practices e.g. purity of concrete materials, batching, workability, curing remains, to a large extent, difficult to control on sites. Therefore failure to achieve or establish control may render design factors ineffective. To be sure we are not overlooking the essential parameters for structural stability of our buildings and infrastructures made of concrete, there is a need to introduce check and balances to avoid defects and subsequent collapse as has been the case in recent times. Data for defining parameters for efficient concrete practice and management will be derived from quality of materials, batching, mixing, curing and other production practices, reviewed selected codes of practice -ISO, BS, Nigeria National Building Code, sampled concrete produced at 'on-site' substructure and superstructure stages and laboratory experimentations. The parameters for good practice identified from 'on-site' and 'laboratory' will be tested for level of significance using one-way 'ANOVA' and statistical 'Quality Control Charts' tools. Thereafter, the study proposes a model for sustainable quality site concrete practice that will avert building failures.

Keywords: defining, parameters, concrete, establishing, practice.

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A STUDY ON THE VALUATION OF IMPACT OF LANDFILLS (DUMPSITES) ON PROPERTY VALUES IN LAGOS STATE, NIGERIA

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Economic valuation of externalities can provide an indication of whether environmental policy fits the needs of public preferences. The rule for externalities valuation is to account for all costs, both market and non-market. In practice, it is problematic to obtain the full range of impacts, fully quantified in monetary values, due to lack of information and uncertainty about environmental effects, prices and valuation estimates. The aim of this research is to evaluate the appropriate method in estimating the impact of selected landfills on property values in Lagos State. Some specific objectives of the study are: to ascertain the externalities associated with local disamenities experienced by the residents in close proximity to landfills; to estimate the related economic values of externalities; to determine whether landfill has an effect on property values and to assess the suitability and reliability of valuation methods of affected property. Survey of properties within 6 kilometres from dumpsites will be randomly conducted. Questionnaire will be administered to estate valuers and interview of waste managers and residents. The impact will be ascertained through stated and revealed preference methods inferential analysis. The study is expected to provide a basis for valuers to utilize environmental valuation techniques and assist in integration of environmental issues in decision making. This might result in possible policy intervention in curriculum development and training programmes.

Keywords: externalities, valuation, environment, landfill, waste.

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A STUDY INTO THE RELATIONSHIP BETWEEN PROCUREMENT METHODS AND THE SUPPLY CHAIN MANAGEMENT OF THE CONSTRUCTION INDUSTRY – A CASE STUDY

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The construction industry is the largest industrial sector in the world, accounting for approximately 10% of the global gross productive effort. Products of the construction industry are built up on the sites where they will be used and require a wide diversity of components and functions which will provide the client with value for his money and satisfaction with the end product while the contractor will be satisfied that the resources used are well utilized to enable him make profit. In achieving the clients and contractors objectives various resources will need to be organized and well coordinated in the supply chain. The supply chains could be faced by many obstacles and barriers such as problems of unreliable supply, trust/relationship, degree of control between firms and difficulty due to the temporary nature of a project based industry. The study will develop a relationship on how a specific procurement method adopted in a project affects the supply chain with the overall aim of identifying the benefits and problems faced as result of using a specific procurement method. The study will contribute to knowledge and be beneficial to be both clients and contractors' by helping to identify how a procurement method adopted will be beneficial to the supply chain management with the aim of achieving high productivity in the construction industry and meeting the client's requirement in terms of value for his money.

Keywords: gross productive effort, supply chain, procurement method, productivity.

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A STUDY ON THE USE OF BENCHMARKING IN FACILITIES MANAGEMENT IN NIGERIA

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Until lately, facilities management (FM) and the function of benchmarking in FM are practices that have yet to gain wide acceptance in Nigeria. The application of benchmarking in Facilities management in Nigeria will be examined. The study population includes facilities managers within major organizations in Lagos and Abuja. Given the emergent stage of facilities management in Nigeria the study should be restricted to major organizations. Smaller organizations should be excluded from the study on the grounds that they are unlikely to have a formal facilities management structure. Suitable respondents to the questionnaires are to be identified by enquires with the companies that will be selected from the list using purposive sampling method. Population (sample frame) of estate managers in Lagos and Abuja are obtainable from business directory of top companies in Nigeria of which a sample size of is considered appropriate. Questionnaires are considered appropriate to be sent to the person who has responsibility for implementation of facilities management policy and performing facilities management benchmarking practices within their organizations. The data analysis is best done using descriptive and inferential statistical methods. It is expected that in Nigeria there is barely anything said about benchmarking in facilities management. Rather, the process is hindered due to lack of specified processes for data management. Some practitioners believe that facilities management is not different from property management and tend to conduct their services traditionally. The study will improve standards within the FM industry and identify training needs of Nigerian practitioners by providing a framework for best practices in benchmarking in FM in Nigeria.

Keywords: benchmarking, facilities management, framework, standards, Nigeria.

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AN INVESTIGATION INTO FEMALE CONSTRUCTION UNDERGRADUATES' EXPECTATIONS TOWARDS PRACTICE

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Previous research indicates that women are significantly under represented in the Nigerian construction industry and that there are barriers which prevent their entry into, and ability to succeed in the industry. This research aims to investigate the expectations of female undergraduates in construction disciplines in Nigerian Universities with a view to determining the factors which exert the greatest influence on their decision to enter the industry and also the perceptions on their ability to succeed in the construction industry. The scope of the study will include disciplines of Quantity Surveying, Architecture and Building from three Universities, one from the north, south west and south east regions of Nigeria. The methodology to be adopted includes a detailed literature survey on women in construction to develop theoretical sensitivity, a questionnaire survey and the use of interviews. Results of a pilot study involving 30 graduating students of the departments of Quantity Surveying (8), Architecture (17) and Building (5) in Ahmadu Bello University, Zaria show that the factors which influence female undergraduates include the poor image of the industry, sexual harassment and difficulty in gaining acceptance in the industry. The respondents were confident in their ability to perform their roles and were determined to be successful. Subsequent research will investigate the influence of religious affiliations on female students' future entry to the construction industry. The results of this study will provide a basis for policy formulations in respect of training women in construction disciplines and generate discussions on the empowerment of women.

Keywords: women, construction, undergraduates, Nigeria, universities.

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EVALUATION OF MAINTENANCE MANAGEMENT PRACTICES IN PRISON INSTITUTIONS SOUTH-WEST NIGERIA

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Prisons are conceived as corrective institution but investigation reveals that rather than being reformatory and rehabilitative, Nigeria's penal system is punitive, degrading and dehumanizing. The purpose of the research is to evaluate the maintenance management practices in prison institutions in order to develop a model that would assist maintenance officers in the choice of maintenance strategies and the operating of maintenance programs for effective reformatory and rehabilitation delivery. The research intends studying nineteen prisons across the south-west of Nigeria. The research via questionnaire survey would investigate maintenance officers and users' perspectives. Data to be collected would be analysed using descriptive and inferential analysis. The study will expose the devastating state of prison establishments. It would showcase how a conducive built environment will support the initial aim of establishing prison system. The study will develop a logical process to be used in selecting appropriate and cost effective maintenance strategies considering significant issues like health, safety, environment, utility and satisfaction of the users.

Keywords: prison institutions, maintenance management, south-west Nigeria.

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HEALTH AND SAFETY CONDITIONS OF BUILDING MAINTENANCE SITES IN NIGERIA: THE POST OCCUPANCY CONTAMINATIONS OF TIMBER BUILDINGS BY MICROORGANISMS

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This paper assessed the safety of the environmental conditions of timber buildings in Nigeria. Several illnesses attributed to microorganisms or their metabolites have led to poor quality of work and reduced productivity on construction sites. The research was carried out by collecting bulk samples of ten grammes on the timber buildings over the country and identifying the microorganisms available. Using cultivation technique, 650 NA and SDA dishes were prepared. The NA dishes were incubated for 24 hours at 35°C whereas those of SDA were incubated for 72 hours at 30°C. Biochemical tests such as Triple Sugar Iron test, Glucose Fermentation test, Catalase test, Methyl Red test, Voges Proskauer test, Indole test, Lactose Fermentation test, Motility test, and Citrate Utilization test were performed to classify the bacteria while the fungi isolates were identified by observations. The bacteria identified were; *Enterobacter agglomerons*, *Serratia liquefaciens*, *Enterobacter hafniae*, *Staphylococcus aureus*, and other species of *Enterobacter*, *Serratia*, *Klebsiela*, *Bacillus*, and *Micrococcus*. Among the fungi species were; *Penicilium*, *Mucor*, *Geotrichum*, *Alternaria*, *Trichoderma*, *Rhizopus*, *Paecilomyces*, *Gliocladium*, *Aspergillus*, *Syncephalastrum*, *Acrosporium*, *Mycelia sterilia*, *Cladosporium*, *Trichothecium*, *Chrysonilia* *Saccharomyces* and other yeasts. The highly dominant species encountered are generally ubiquitous and have been reported by Cooley et al; (1998) and Doctor Fungus (2007) to be saprophytes - deteriorating timber components, pathogen, and allergen. They are responsible for health problems, allergic reactions and sick-building-syndrome, resulting to absenteeism and loss of productivity on sites.

Keywords: microorganisms, prevalence, sick-building-syndrome and productivity.

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BRIDGING THE EQUITY GAP IN THE EVALUATION OF PUBLIC HOUSING ENVIRONMENTS IN LAGOS-NIGERIA

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This paper reports a recent doctoral research which evaluated the process and products of public housing of Lagos State Development and Property Corporation (LSDPC) from the conceptual perspectives of equity and residential satisfaction. The study analyzed LSDPC's institutional framework and housing delivery process, assessed the physical characteristics of selected LSDPC schemes, and examined residents' socio-economic characteristics and their responses to the housing schemes and delivery process. It also investigated the relationships between user responses, user characteristics, and the physical characteristics of the schemes. Primary data were obtained from key management staff responsible for decision making by means of in-depth interviews, and structured questionnaire administered on a systematic sample of 806 household heads, from a sampling frame of 8,060 housing units, based on a purposive sample of 5 low-income and 3 medium-income estates. The qualitative data were subjected to content analysis, while the quantitative data were analyzed using descriptive and inferential statistics. The results revealed a gap in quality between the medium- and low-income estates, as the values of total physical quality (TPQ) for the medium-income estates were higher than for the low-income estates. Correlation analysis showed a high positive correlation between perception of equity and residential satisfaction levels of residents ($r = 0.761$). In addition, the R^2 value of 0.737 from the regression analysis showed that residents' satisfaction with the physical characteristics of their neighborhood, the management of the estates, the procedure for obtaining their housing, and residents' perception of equity in relation to privacy, housing fit, housing choice, and housing flexibility, explained 73.7 per cent of the total variation of residential satisfaction. The study concluded that perception of equity was significant in determining the level of residential satisfaction in the LSDPC public housing estates, and there is need to reflect this in housing policies and practices related to public housing delivery.

Keywords: equity, evaluation, Lagos-Nigeria, public housing, residential satisfaction.

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POST OCCUPANCY EVALUATION OF OGUN STATE HOUSING ESTATES IN NIGERIA

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In spite of the efforts of the State Governments in Nigeria in providing housing estates for their citizens, there is still inadequacy in terms of quantity and quality of housing estate delivery. Post Occupancy Evaluation is carried out on Ogun State Housing Estates in Nigeria towards providing proper policy guidelines that will ensure adequate housing delivery. The study examines the factors that influence the levels of satisfaction of the residents in the housing estates, examines the physical conditions of the building in the housing estates, determines the level of satisfaction of the residents of the housing estates and provides feedback that will assist the State Government manages their operational facilities effectively. The research methodology adopted for the study is exploratory, and descriptive in nature, yielding qualitative and quantitative data. The data will be analysed using some statistical tools such as Descriptive Statistics for the categories of housing estates and the occupiers characteristics, Ranking will be used to show the significance of the factors affecting satisfaction of the occupiers, ANOVA, Correlation Matrix and Multiple Regression Analysis will be used to investigate how these factors such as physical, social and economic factors are interrelated. The findings of this study will assist the State Governments in Nigeria become more effective in their housing delivery and be customer-oriented in the planning, design, construction and operation of their housing estates and consequently provide long term benefits to the occupiers of these housing estates.

Keywords: post occupancy evaluation, housing estates, housing policy, housing delivery, residents' satisfaction.

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A COMPREHENSIVE STUDY OF SOUTH-SOUTH PLACES IN NIGERIA

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The focus of this study is to examine traditional architecture in palaces of the south-south zone of Nigeria. The study will collect data by means of firstly, field survey in the study area. There has not been any documentation of information with respect to this topic in the area. The study will focus mainly on Oba of Benin palace, Oroje of Okpe palace, Obi of Issele-Uku and Obong of Calabar palace. The data collected will be through the use of oral interviews of 12 kings and 48 chiefs in the south-south zone. There are 12 kings and about 120 chiefs in the zone to be covered. Also pictures and diagrams of some selected places and buildings will be taken. Some cultural, environmental, technological and architectural elements in the study areas are to be highlighted. The data analysis is best done using descriptive statistical methods and pictures. The study is expected to find that palaces in the south-south zone have mainly modern attributes and as such the buildings have European and Brazilian features. Some of the motifs used are however traditional. There are some false attitudes about African traditional architecture that Africans lived in unstructured communities with barely any use of aesthetics in town design. This may have restricted enquiry into indigenous African architecture and therefore needs further enquiry.

Keywords: buildings, south-south palaces, traditional architecture, indigenous, Nigeria.

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EVALUATION OF THE ROLE OF WATER-BASED FACILITIES IN TOURISM DESTINATIONS IN LAGOS LITTORAL ASPECTS

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Nigeria, just like most African countries, is in the process of metamorphosing into a developed country. In its quest for developing other sectors of the economy to diversify from its main stay which is oil, Nigeria is looking to tourism as a possible alternative income earner for the nation. Growing statistics indicate the increasingly financial gains in exploiting the untapped wealth of waters tourism: it is increasingly an area of interest whose potential lies hugely unexploited in Nigeria. Lagos, its former capital, is one of Nigeria's coastal cities. Water-based sites in the city are largely neglected or grossly under-utilized thereby wasting their natural recreational potentials. This research seeks to examine the existing water tourism destinations, identify the problems causing lack of popularity, and subsequently proffer solutions enabling policy makers in government and private sector plan better. Data will be collected through the administration of structured questionnaires and interviews from users and industry practitioners in existing water-based tourism sites in Lagos. Data collected will be analyzed using descriptive statistics and mean item score. Some of the expected problems of the destinations include: lack of infrastructure, most especially functional ferries or other water transport, piers, canoes and boats for pleasure rides and sightseeing, properly designed areas for relaxation and passive leisure, lack of security and non availability of restaurants, shopping facilities and conveniences. The provision of these infrastructures will definitely improve the current state of water tourism in Lagos.

Keywords: water tourism, water-based facilities, potentials, littoral Lagos.

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REDUCING CONSTRUCTION COSTS BY USING MECHANICALLY ACTIVATED POZZOLANAS AS PARTIAL SUBSTITUTES TO ORDINARY PORTLAND CEMENT

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Inadequate provision of shelter in Ghana has rendered about 12.5% of the population homeless leading to the springing up of slums, increase in communicable diseases and generally a decrease in productivity. This problem arises directly from the over-dependence on imported inputs into buildings, especially Portland cement clinker which makes the cost of housing construction high. Alternative and cheaper materials to Portland cement clinker such as activated clay pozzolana can be employed to reduce the cost of construction. The study focused on evaluating cost reduction in components of housing construction using mechanically activated pozzolana for up to 50% replacement of Portland cement. Mechanically activated clay pozzolana was produced by milling clay pozzolana produced at the BRRI pozzolana factory to an amorphous state. The mechanical properties of the pozzolana cement mortars were examined in the laboratory after which it was used to replace up to 50% of OPC and for housing construction. Components such as plain concreting, masonry and finishes were particularly looked at. Cost analysis of the buildings based on current trends in cement pricing showed that at 50% replacement about 25% savings is made in the materials cost in finishes whilst the corresponding cost reduction in masonry and concreting are 15 and 10% respectively. Thus, the use of the activated pozzolana will reduce the cost of housing construction considerably thus making housing delivery more affordable and also reducing homelessness in Ghana.

Keywords: activated clay pozzolana, housing, finishes, concreting, masonry.

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SELECTED MECHANICAL PROPERTIES OF MORTAR FOR MASONRY INCORPORATING ARTIFICIAL POZZOLANNA

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Pozzolanic materials and their utilization in mortar for masonry are uncommon in Ghana. However in many developed countries and part of Asia, mortar formulation prepared from Portland cement and a pozzolan is common. In this work clay pozzolana was produced from local technology and used to replace up to 40% OPC for masonry mortar formulation. Physical, chemical and mineralogical characterizations were investigated on the powder clay pozzolana sample. Clay pozzolana content at 10%, 20%, 25%, 30% and 40% were used to replace Portland cement to prepare binary paste and mortar. Water demand and setting time test were determined on the binary paste and compared to the plain cement paste. Compressive strength test was performed on a 1:3 binder to sand ratio and water to cement ratio of 0.5 which was cured under water for 3, 7, 28 and 90 days. Masonry mortar strength values were analyzed in accordance to the ASTM C270 standard specification. The test results indicated that the clay pozzolana specimen satisfied the ASTM C618 standard specification. Compressive strength analysis indicated that the optimum pozzolana content in Portland cement mortar that satisfied ASTM type M and S mortars were at 20% and 40%. The incorporation of clay pozzolana to replace part of Portland cement would provide alternative mortar formulation for builders and engineers in the construction industry in Ghana.

Keyword: clay pozzolana, local technology, ordinary portland cement, masonry mortar, compressive strength.

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