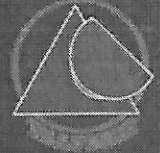


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**FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA**



**SCHOOL OF ENVIRONMENTAL TECHNOLOGY
INTERNATIONAL CONFERENCE (SETIC 2016)**

SETIC 2016 *Conference Proceedings*

EDITORS:

Yekeen A. SANUSI
Olatunde F. ADEDAYO
Richard A. JIMOH
Luqman O. OYEWObI

THEME:

**SUSTAINABLE BUILT ENVIRONMENT
AND CLIMATE CHANGE:
THE CHALLENGE OF POST 2015
DEVELOPMENT AGENDA**

DATE:
**TUE. 10TH - THUR. 12TH
MAY, 2016**

VENUE:
**SCHOOL OF ENVIRONMENTAL
TECHNOLOGY COMPLEX**

TIME:
**9:00AM - 5:00PM
DAILY**

CHIEF HOST:
PROF M. A. AKANJI
VICE CHANCELLOR, FEDERAL UNIVERSITY
OF TECHNOLOGY, MINNA

HOST:
PROF Y. A. SANUSI
DEAN, SCHOOL OF ENVIRONMENTAL TECHNOLOGY,
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

**School of Environmental Technology
International Conference
(SETIC) 2016**

10-12 May 2016

**Federal University of Technology Minna,
Niger State, Nigeria**

Conference Proceedings

Editors

**Yekeen A. SANUSI,
Olatunde F. ADEDAYO,
Richard A. JIMOH,
Luqman O. OYEWABI,**

Conference Proceedings of the School of Environmental Technology International
Conference (SETIC) 2016

Editors

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10th – 12th May 2016
School of Environmental Technology,
Federal University of Technology, Minna, Niger State, Nigeria.

TABLE OF CONTENTS

Table of Contents	iii
Foreword	iv
Acknowledgement	v
Copyright Statement	vii
Declaration of peer review and scientific publishing policy	viii
Review Panel	ix
Scientific Committee	xi
Profile of Keynote Speakers	xii
Programme for SETIC 2016	xx
List of papers in SETIC 2016 Conference Proceedings	xxix
Keynote Addresses	1
Conference Papers	11
Index of Authors	1466

FOREWORD

The organising committee of the 1st School of Environmental Technology International Conference is pleased to welcome you to Federal University of Technology Minna, Niger State Nigeria.

The conference provides an international forum for researchers and professionals in the built and allied professions to address fundamental problems, challenges and prospects that affect the Built Environment as it relates to Climate Change and Sustainable Development. The conference is a platform where recognised best practices, theories and concepts are shared and discussed amongst academics, practitioners and researchers. The papers and scope are quite broad but have been organised around the sub-themes listed below:

- Infrastructure Development and Financing
- Sustainable Practice Theories
- Urban Resilience and Energy Conservation
- Waste Management and Sanitation
- Health and Safety Issues
- Climate Change and Threat to Sustainability of the Built Environment
- Climate Change Induced Disaster
- Designing the Human Settlement for Climate Change
- Conceptual Issues on Climate Change and Sustainable Development
- Sustainable Materials
- Cross Cutting Issues

The peer review process saw us making use of 48 senior academics and specialist as reviewers drawn from institutions in Nigeria and England. There were some papers were outside the theme of the conference but we had to create a cross cutting issues to accommodate such papers this is in spirit that every knowledge is important.

We hope you enjoy your time at our conference, and that you have the opportunities to exchange ideas and share knowledge, as well as participate in productive discussions with the like-minded researchers and practitioners in the built environment and academia.

Professor Yekeen Adeeyo Sanusi
Conference Chair
School of Environmental Technology International (SETIC) 2016
Federal University of Technology Minna, Niger State Nigeria.
May 2016

ACKNOWLEDGEMENTS

The success of the 1st School of Environmental Technology International Conference holding at the Main Campus of the Federal University of Technology Minna, Nigeria is predicated on the support and goodwill from Vice-Chancellor of Federal University of Technology and many other highly motivated people.

I sincerely wish to appreciate you for attending this maiden event and to warmly welcome you to the city of Minna the capital of the *POWER STATE*. It is a great honour to have you in the beautiful campus of Federal University of Technology Minna, Nigeria, **THE MOST PEACEFUL UNIVERSITY IN NIGERIA**. I am aware of the great sacrifices made by many of you to be present in this occasion and I will definitely not overlook the long distances some of you have had to cover to get to this conference venue. We genuinely appreciate all your efforts. It is our singular hope and desire that the conference meets your expectations and gives you unquantifiable experience and tremendous developmental networking opportunities for a life fulfilling career.

We are grateful for the presence of the Vice Chancellor of the Federal University of Technology Minna – Professor Musbau Adewumi Akanji whose leadership and distinguished academic career has served as inspiration and encouragement to many young academics. His desire to see the University compete at International level has led to the upsurge in the organisation of International conferences, Public lectures and Seminars on regular basis within and outside the university. We are happy to have you as the Chief host to declare the conference open and deliver the welcome address.

We are grateful to the Dean of School of Environmental Technology, Federal University of Technology Professor Yekeen Adeeyo Sanusi for providing the robust platform, academic support and leadership for the organisation of the conference. You threw the challenge and provided the required resources and strategies for achieving its success, it is a great honour of having the opportunity to learn at your feet. We are happy to have you as the host and keynote speaker at the conference. I wish to thank also all the special guests particularly leaders of the Industry, Built Environment and Academia.

SETIC is beginning at the foundation this year and for this I wish to thank all those who have supported us through various forms of participation. Specifically I wish to thank the delegates and the partners for contributing significantly to the conferences. I wish to thank Prof. Oluwole O. Morenikeji (DVC Academic), Prof. Stella N. Zubairu and Prof. A. M. Jinadu who genuinely and consistently monitored the progress of the conference preparations. It is my desire that SETIC becomes a constant feature in the calendar of the university and global conference listings.

Delegates to SETIC 2016 are from 39 different academic and research institutions that are spread across six different countries. This offers participants a wonderful opportunity for exchange of cultural, social and academic ideas during the conference periods. It is also an opportunity to create awareness about programmes and events at the participants' individual institutions. I encourage you all to make good use of the networking opportunities that are available.

We received a total of 226 abstract, based on a quick review we were able to accept 175 of them and the authors were communicated on what they needed to focus on while developing the full papers. A total of (129) full papers were received and reviewed, the reviewers report for the authors to make corrections and submit revised papers. It was after the process that we were able to accept 112 papers for presentation at the conference, I therefore congratulate all the authors whose papers made it to the conference. We acknowledge the amount of hard work you had all put in producing these papers. It is my sincere believe that the presentation of the different ideas in your paper would go a long way in improving the knowledge of the participants and also generate meaningful discussions at the tea beaks, lunch and beyond.

I wish to express my utmost gratitude to each reviewer for a wonderful job done and for tolerating our deadlines and Oliver Twist syndrome. It is your dedication and expertise that has ensured that the conference is a success.

Special thanks to all our keynote speakers, Prof. Oluwole O. Morenikeji (Deputy Vice-Chancellor Academics, Federal University of Technology Minna), Prof. Hussein Makun (Director, Directorate of Research Innovation and Development, Federal University of Technology Minna), Prof. Musa Aibinu (Director, Centre for Distance Learning), Prof. Mustapha Zubairu (Director, Centre for Human Settlement and Urban Development), Dr. Appolonia A. Okhimamhe (Director, WASCAL) and Prof. Yekeen Sanusi, (Dean School of Environmental Technology, Federal University of Technology Minna).

It is important to appreciate the roles and efforts of the following people for their selfless and very significant contributions made towards the successful organization of the conference: Adedokun John, Idowu Oqua, Akhabue Oriwoh and Ailoyafen Dorcas (for being available to run around at very short notice), Arc. Oyetola Stephen and Tpl Samuel Medayese (for typesetting the papers for the conference proceedings).

I have come to realise that it is not easy to organize conference without dedicated individuals offering to serve. My heartfelt gratitude goes to Dr. R.A. Jimoh, Dr. L.O. Oyewobi, Dr. Taibat Lawanson, Dr. P. Ayuba, Dr. J.J. Dukiya, Dr. A.I. Anunobi, Dr. N.I. Popoola and Dr. O.A. Kemiki for their unflinching support all through the process.

It is our sincere hope that this conference will serve as a forum for the advancement of research in the urban sphere towards achieving a sustainable environment. It is our sincere believe that academics and professionals in practices will continually participate in this forum.

Once again I wish to thank you all for creating time out of your busy schedule to attend this conference. Please do enjoy your stay at Federal University of Technology Minna, and the city as a whole. Ensure that you make use of the different fora created throughout the conference to build new relationships for the future and strengthen existing relationships. I look forward to seeing you all in future.

Olatunde Folaranmi ADEDAYO
Chairman SETIC 2016 Organising Committee
May 2016

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DECLARATION

PEER REVIEW AND SCIENTIFIC PUBLISHING POLICY STATEMENT

10th May 2016

TO WHOM IT MAY CONCERN

I wish to state that all the papers published in SETIC 2016 Conference Proceedings have passed through the peer review process which involved an initial review of abstracts, blind review of full papers by minimum of two referees, forwarding of reviewers' comments to authors, submission of revised papers by authors and subsequent evaluation of submitted papers by the Scientific Committee to determine content quality.

It is the policy of the School of Environmental Technology International Conference (SETIC) that for papers to be accepted for inclusion in the conference proceedings it must have undergone the blind review process and passed the academic integrity test. All papers are only published based on the recommendation of the reviewers and the Scientific Committee of SETIC

Names and individual affiliation of members of Review and Scientific Committee for SETIC Conference 2016 are published in the SETIC 2016 Conference Proceedings and made available on www.futminna.edu.ng

Olatunde Folaranmi ADEDAYO
Chairman SETIC 2016
Federal University of Technology, Minna, Nigeria

Papers in the SETIC 2016 Conference Proceedings are published on www.futminna.edu.ng.

REVIEW PANEL

We wish to express our deepest and sincere gratitude to the following people in no particular order who provided comprehensive scientific reviews and made commendable suggestions towards improving the over 200 abstracts and 100 full papers submitted to SETIC 2016. They provided constructive comments to authors regarding their papers, it is necessary to state that there was no reported case of conflict of interest by any of the reviewers or the authors.

Dr. J.J. Dukiya, Department of Transport Technology, Federal University of Technology, Minna
Dr. Naomi I. Popoola, Department of Estate Management, Federal University of Technology, Minna
Dr. Anthony I. Anunobi, Department of Architecture, Federal University of Technology, Minna
Dr. Philip Ayuba, Department of Architecture, Federal University of Technology, Minna
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Dr. Emmanuel Daniya, Department of Crop Production, Federal University of Technology, Minna
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Mr. Ismail Ojetunde, Department of Estate Management, Federal University of Technology, Minna
Dr. Luqman Oyewobi, Department of Quantity Surveying, Federal University of Technology, Minna
Dr. Ifeanyi Onuigbo, Department of Surveying & Geoinformatics, Federal University of Technology, Minna
Dr. Rasheed Ojutiku, Department of Water Aquaculture & Fisheries Technology, Federal University of Technology, Minna

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Dr. Richard Jimoh, Department of Building, Federal University of Technology, Minna
Mr. Shien Kuma, Department of Estate Management, Federal University of Technology, Minna
Dr. Yakubu Mohammed, Department of Quantity Surveying, Federal University of Technology,
Minna
Dr. Aishetu Abdulkadir, Department of Geography, Federal University of Technology, Minna
Dr. Kwasi Awuah, University of West England, UK
Dr. Rotimi University of West England, UK
Dr. Babatunde J. Olawuyi, Department of Building, Federal University of Technology, Minna
Dr. Bashir Nuhu, Department of Estate Management, Federal University of Technology, Minna
Dr. Olatunde F. Adedayo, Department of Architecture, Federal University of Technology, Minna

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- Prof. Oluwole O. Morenikeji, Urban and Regional Planning, Federal University of Technology, Minna
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- Prof. Dalha A. Muazu, Department of Building, Federal University of Technology, Minna
- Prof. I. J. Nwadiakor, Surveying and Geoinformatics, Federal University of Technology, Minna
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- Dr. Kwasi Awuah, University of West England, UK
- Dr. Rotimi University of West England, UK
- Dr. Olatunde F. Adedayo, Department of Architecture, Federal University of Technology, Minna

PROFILE OF KEYNOTE SPEAKERS

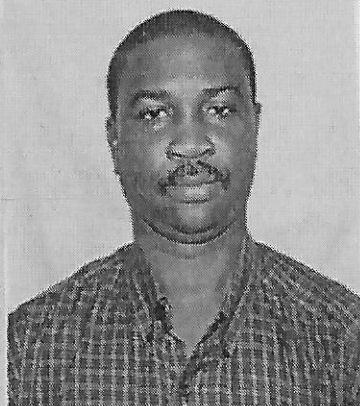
SETIC 2016 organisers wishes to thank our keynote speakers for accepting to create time to share from their rich wealth of knowledge and interact with delegates and participants on varied issues being examined at this year's conference. A brief profile of each keynote speaker is provided here, this would allow for future interaction and networking with them.

Prof. Hussaini Anthony MAKUN

Federal University of Technology, Minna

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Hussaini Anthony Makun is currently working as Professor of Biochemistry in the Department of Biochemistry, Federal University of Technology, Minna where he has been since 1992. He completed his PhD in 2007 in Biochemistry (Toxicology) from same University. The researcher was a National Research Foundation Postdoctoral Fellow (PDF) with Food Environment and Health Research Group of the University of Johannesburg (UJ) between 2008 and 2010. He is teaching basic and advanced courses in biochemistry, and toxicology related courses at both undergraduate and postgraduate levels.



He has supervised and graduated over seventy B-Tech and ten M-Tech students and two PhDs. He is currently the Lead Researcher of the Food and Toxicology Research Group (FTRG) of the University which has 2 Senior Researchers, 3 M.Tech and 4 PhD students. FTRG conducts researches on environmental health monitoring and mycotoxins at national and international levels. The researches focus on detection and health impacts of mycotoxins and establishing novel integrated intervention strategies approach against mycotoxins. The intervention strategies include exploration of natural preservatives from African traditional medicinal plants with fungicidal effects for production of fungicides for storage of crops. Other approaches at animal farms include formulation of nanoparticle based multi-mycotoxin feed binder against exposure to common, toxic mycotoxins. The research group is also involved in studies to produce simple medicinal supplements encapsulated in

nanoparticles with protective effects against diseases induced by mycotoxins from African traditional medicinal plants; such supplements will alleviate the adverse health impact of mycotoxins in animals and human beings. The research group is also interested in toxicological studies of medicinal plants used in the folkloric treatment and drug toxicology. Following the trend of drugs abuse in Nigeria, the research group is embarking on research titled "Elucidation of the chemical composition and biomonitoring of substances of abuse in the Northern region of Nigeria". The focus of this research is to establish the current state of art of drugs of abuse in the Northern region of Nigeria; to elucidate the chemical composition and active ingredient of new psychoactive substances (NPS); to modify validated analytical methods for the detection of new psychoactive substances in blood, urine and hair.

In last 5 years, 6 research projects were granted with funding from NRF, South Africa and TETFUND, Nigeria. He is a member of Mycotoxicology Society of Nigeria (Vice President (North), Experts on Mycotoxins in Food, Food Hygiene, Food Import/Export Inspections and Certification System of the National Agency for Food and Drug Administration and Control (NAFDAC) of Nigeria, National Codex Committee of Nigeria, African Union Expert Committee on Contaminants in Food (2011 to date) and Joint FAO/WHO Expert Committee on Contaminants in Food (JECFA) (2012-2016). He coordinated the writing of the "discussion paper on fungi and mycotoxins in Sorghum" which was adopted as a document of the Joint FAO/WHO Experts Committee on Food Additives (JECFA) in 2012 and participated in the writing of "Proposed draft annex for "prevention and reduction of aflatoxins and ochratoxin A in sorghum" in the existing code of practice for the prevention and reduction of mycotoxin contamination in cereals (CAC/RCP 51-2003)".

Prof Makun has 57 publications, mostly on mycotoxins in peer review journals, technical papers and books and is currently the Director of Research, Innovation and Development, Federal University of Technology, Minna.

Dr. Appollonia A. OKHIMAMHE
Federal University of Technology, Minna

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Dr A. A. Okhimamhe is the Director of the Masters Research Programme on Climate Change and Adapted Land Use (MRP CC & ALU) of the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL), a German sponsored graduate research programme with its Headquarters in Accra, Ghana.



In collaboration with colleagues, 20 West African students from Nigeria, Ghana, Benin, Togo, The Gambia, Cote D'Ivoire, Mali, Niger and Burkina Faso graduated with Master of Technology (M.Tech) in Climate Change and Adapted Land Use from the University. Another Batch of 10 students are expected to commence their programme in mid 2016. Aside from her academic qualifications, her participation in various training activities organized by the United Nations in Regional Centre for Mapping of Resources for Development in Nairobi, Kenya (1992); University of Stockholm, Sweden (1994); Harare, Zimbabwe (1995); and European Space Research Institute in Frascati, Italy (1997, 1998) had prepared her professionally for her career. Additionally, in 2000, she secured a 6 months fellowship-traineeship for a colleague in the Department and herself at the European Space Research Institute in Frascati, Italy. Dr Okhimamhe is an alumni of the International Visitor Leadership Programme (IVLP), U.S. Department of State's Bureau of Educational and Cultural Affairs' (ECA) premier professional exchange program. Currently, she is an Associate Professor of Geography with a research focus on application of remote sensing and GIS in geographical sciences including climate change.

Dr Okhimamhe has served her country as a Technical Delegate at the UNFCCC COP in Cancun, Mexico (2010), Durban, South Africa (2011), Doha, Qatar (2012) and Warsaw, Poland (2013). She has supervised more than 30 postgraduate students and has several publications and is still publishing. In collaboration with her students in the last 3 years, she has focused on urban climate change studies using geospatial techniques.

Prof. Abiodun Musa AIBINU
Federal University of Technology, Minna
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Abiodun Musa AIBINU (PhD), is a highly motivated career driven achiever with over Eighteen (18) years working experience in the field of: Mechatronics Engineering; Telecommunication Engineering; Spectrum Management; Industrial Automation; Teaching; Research and Project Development.



He received: National Diploma award from The Polytechnic, Ibadan, Nigeria; B.Sc degree from Obafemi Awolowo University (OAU), Ile-Ife, Nigeria; M.sc degree from Blekinge Institute of Technology (BTH), Sweden and Doctoral degree award from International Islamic University Malaysia, (IIUM), Malaysia. He has been actively involved in teaching and research activities at various universities since the completion of his post-graduate studies. However, prior to that he has worked with: MTN Communication (Nigeria) Limited; GS Telecom (Nigeria) Limited; DCC Satellite and Networks Limited; Oganla Consulting and Investment (OCI) limited; Communications Associates (COMSAC) (Nigeria) Limited just to mention but a few.

Engr. Aibinu has participated and won several awards at various international and national exhibitions and was nominated for 2012 promising researcher award and best teacher award at IIUM Malaysia. He has also won several research grant awards in and outside Nigeria and has authored/co-authored several publications in both local and international journals and conferences.

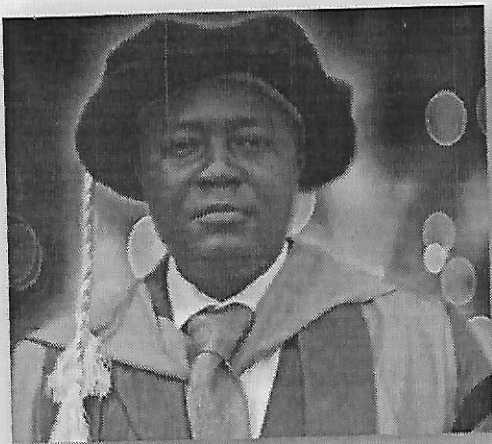
He is presently, the Head of Department, Mechatronics Engineering Department, Federal University of Technology, Minna and the Director, Center for Open Distance and e-Learning (CODEL), Federal University of Technology, Minna.

Prof. MORENIKEJI, Olakanmi Oluwole

Federal University of Technology, Minna

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Morenikeji, Olakanmi Oluwole joined the services of the Federal University of Technology, Minna in 1990 as an Assistant Lecturer and rose to become a Professor of Urban and Regional Planning in 2006. He obtained his B. Sc in Geography and Regional Planning from the University of Calabar in 1983 and M. Sc Urban and Regional Planning from the University of Benin in 1998. He enrolled for his Ph.D in Transport Planning in 1992 at FUT Minna and won a Nigerian-Italian Ph.D scholarship which enabled him to do part of his Ph.D work at the University of Trieste, Italy. He bagged his Ph.D in 1998 and utilized his post-doctoral Commonwealth Fellowship at the Instrumented City, Institute for Transport Studies, University of Leeds, UK (2004/2005).



Morenikeji served as the Head of Department of Urban and Regional Planning from 1995 – 2002 and later, Director of the Centre for Human Settlements and Urban Development established in collaboration with the UN-Habitat in FUT, Minna. He was also the Dean of the School of Environmental Technology from 2008-2012. He has also participated in a number of internationally funded research projects and published several papers in learned journals. His areas of interest include transportation planning, human development studies, spatial analysis and Research Methods.

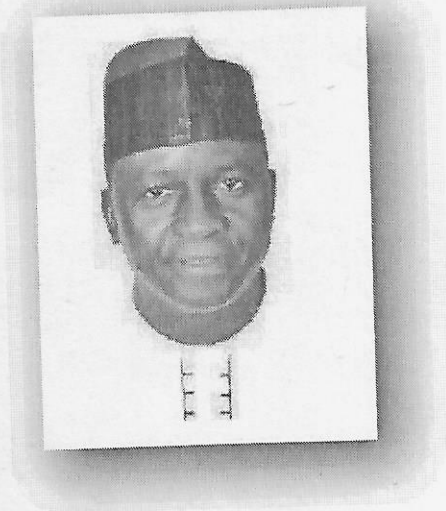
He is currently participating in a collaborative research between The Construction and Property Research Centre, University of the West of England (CPRC-UWE), Bristol, UK and the Federal University of Technology (FUT), Minna being funded by DFID. He has been appointed by the West African Science Centre on Climate Change and Adapted Land Use (WASCAL) as a visiting Lecturer at the Joint Facility for Language and Common Courses (JFLCC) 2016 which is a collaborative programmes for Masters (MRP) and Doctoral Research Programme (GRP) students from 10 participating Universities.

He is currently the Deputy Vice-Chancellor (Academics) Federal University of Technology, Minna, Niger State, Nigeria.

Prof. Mustapha ZUBAIRU
Federal University of Technology, Minna

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Mustapha Zubairu is currently a Professor in the department of Urban and Regional Planning and the Director Centre for Human settlement and urban development (CHSUD) in the Federal University of Technology, Minna. He received his B.Sc. and M.Sc. degrees in architecture from the Ahmadu Bello University Zaria, Nigeria, in 1975 and 1977 respectively. He also holds M.Sc. and Ph.D. degrees in urban and regional planning from the University of Strathclyde, Glasgow, Scotland 1983 and 1990. He is a Member of the Royal Planning Institute, Member, Nigerian Institute of Architects, Fellow, Nigerian Institute of Town Planners and a Member, Nigerian Institute of Management.



Prof. M. Zubairu was amongst others, a principal architect in the Ministry of Works and Housing, Minna, Niger State from 1979-1981, a Chief Architect/Planner in the Niger state housing corporation between 1983 – 1984 after which he became the general manager Niger State Housing Corporation, Minna between 1984 and 1992. He eventually became the General Manager, Urban Development Bank of Nigeria PLC, in charge of the Lagos Regional Office from 1992 to 1999 where he was trained by World Bank on Project development and appraisal.

In 1999 he was appointed the position of Managing Director/Chief Executive, Federal Housing Authority, Abuja where he stayed until 2001. Through a large portion of his tenure (1995 till date) to be exact, he established and was also involved in private practice as principal partner in an architecture and urban planning consultancy firm. In 2003, he was appointed as director, Centre for Human Settlements and Urban Development in the Federal University of Technology, Minna and has retained this position till date. Since his appointment he has been servicing the department of urban and regional planning and architecture as mentor, supervisor and all round resource person.

His area of specialization includes; Housing, Urban design, Urban Management and Slum upgrading.

Professor Yekeen A. SANUSI
Federal University of Technology, Minna
vasanusi@googlemail.com +2347063848372

Yekeen A. Sanusi is a Professor of Urban and Regional Planning at the Federal University of Technology, Minna. His lecturing experiences span over 20 years and has lectured at both undergraduate and postgraduate classes. His academic works cover issues on urban environmental quality, urban dynamics, urban governance and green economy (poverty, service delivery and deprivations, water and sanitation, energy and climate change).



He also has studies and reports sponsored by international bodies and Research Board of the Federal University of Technology, Minna. His teaching areas cover planning theory, development control and settlement of disputes, urban governance, project planning and evaluation, energy planning, environmental impact assessment and tourism planning. He has successfully supervised many postgraduate theses (PhD, Master and Postgraduate Diploma). On administrative front,

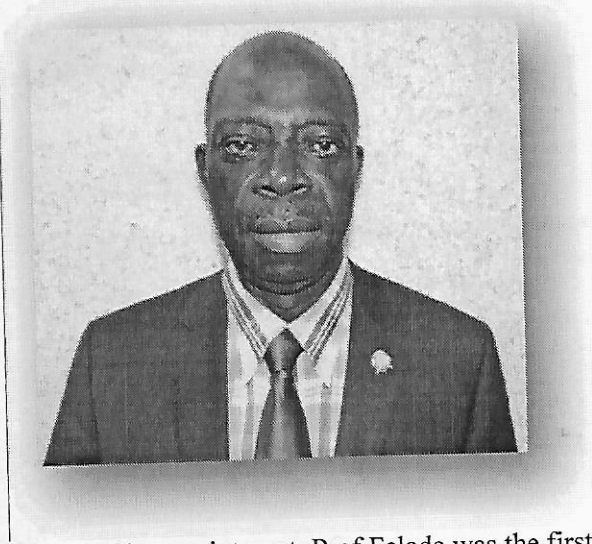
He was Deputy Dean, School of Environmental Technology of the Federal University of Technology, Minna between 2006 and 2008 and the Head of Department, Urban and Regional Planning between 2008 and 2012. Since 2012, he has been the Dean of the School of Environmental Technology. He is a Registered Town Planner (RTP) and a member of Nigerian Institute of Town Planners (NITP).

He is a member of many international research networks. Among these are Environment, Health and Development Network and Renewable Energy Policy Network for the 21st Century.

PROF Johnson Bade FALADE

Executive Director of the Foundation for Development and Environmental Initiatives (FDI)

He is currently the Managing Director/Chief Executive Officer of Gotosearch.Com Ltd and Executive Director of the Foundation for Development and Environmental Initiatives (FDI) from July 20012-date. He is currently a Senior Programme Advisor for the Urbanisation Research Nigeria Project.



Prior to this appointment, Prof Falade was the first Country Director of UN-HABITAT Programme Support office for Nigeria (2003-2012); UNDP (Programme Analyst in the Governance Team (2000-3), UNDP Zonal Officer for the North-West Zone of Nigeria (1998-2000); Programme Officer for Economic Management Team (1994-98); Programme Officer for Water and Sanitation (1992-94).

He was appointed Pupil Town Planner, County Planning Department, County Durham, Durham, UK (1977-78) and Air Mapping Assistant with the Photogrammetry Department, Ministry of Lands and Housing, Ibadan, Nigeria (1968-1970).

Professor Falade has a vast teaching and research experience. He was appointed Assistant lecturer (1982-83), Lecturer 1 (1985-87), Senior Lecturer (1987-91) with the Faculty of Environmental Design and Management fo the Obafemi Awolow University Ile-Ife. He was a Visiting Professor, Department of Geography and Regional Planning, Adekunle Ajasin University, Akungba, Akoko, Ondo State (2005-7); He was Visiting Associate Professor, Department of Urban and Regional Planning University of Lagos, Lagos (1998-90); Visiting Lecturer Department of Geography and Regional Planning Lagos State University, Ojoo (1998).

Professor Falade is member of several Professional Bodies: namely Nigerian Institute of Town Planners (1984-till now), Fellow of the Institute (1999-till date); Town Planners Registration Council (1986-till date); Nigerian Construction Industry Academy (1986-to-date); Nigerian Institute of Management (NIM) and International Union on Parks and Recreational (2004-to-date).

Professor Falade has been awarded many national and international awards. He has several publication to his credit in the areas of urban planning, landscape design and conservation and urbanization and urban governance.

ASSESSMENT OF WHEELCHAIR ACCESSIBILITY IN FACULTY BUILDINGS AT THE FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

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In order to achieve sustainability in any design, there is a need to create an enabling environment for all kinds of people, including the physically challenged. These physically challenged; Mobility impaired or wheelchair users in this case are rarely considered during the design and construction of institutional buildings. This has led to the promulgation of laws by the government of Nigeria on the design of accessible schools for all. Even at that, a lot of institutional buildings still do not cater for these wheelchair users. This paper seeks to assess the level of accessibility for wheel chair users in faculty buildings in the Federal University of Technology in Minna, which has two campuses, the main campus in Gidan kwano and the Bosso campus respectively. The data will be gathered using a descriptive survey method and analyzed using the SPSS software. The result of the analysis will reveal the extent of provision for wheel chair users and suggestions and recommendations will be made to ensure that spaces are designed to cater for the physically challenged.

KEYWORD: *Accessibility Physically Challenged, Faculty Building, Circulation.*

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INTRODUCTION

Since 2000 In Nigeria, the Disability Rights Education and Defence Fund have collected country-based laws that protect the rights of individuals with disabilities. Between that period and now there has been a rise in the inclusion of the physically challenged in our public and private buildings, these can be said to be a good and welcome idea in the society, however, much still needs to be done. The idea of having an inclusive design does not mean that we have a section of the building where the physically fit stay at a place and the physically challenged are sectioned elsewhere (Otto, 1998). That is a misconception that needs to be cleared. In building terms, Inclusion is a term used by people with disabilities and other disability rights advocates for the idea that all people should freely, openly and without pity accommodate any person with a disability without restrictions or limitations of any kind (Otto, 1998). Accessibility refers to how available something is to everyone. When something is accessible, everyone has the opportunity to use it or to participate in it. Inclusive building design can then be said to be the design that is accessible to and for every kind of person inspite of their physical, social or economic state (Lacey, 2002). Achieving this on paper will require a deep and critical look at the various types of disabled persons with a focus to take care of their needs within the same building as those who are not physically challenged. Their movements and their activities must not conflict themselves. In other words, there must be a good flow within the people to take care of everyone's needs.

ASSESSIBILITY, INCLUSION AND CIRCULATION

Accessibility means that everyone has equal access to the built environment with no discrimination based on one's level of ability. It can be defined as being the opportunity that an individual, at any given location and of any given ability, possesses to take part in a particular activity or a set of activities within the built environment (Jones, 1975). It implies that the built environment must be truly usable for all.

Accessibility happens when we discover and break down the barriers and create opportunities for everyone to participate fully in their school and community. If everyone cannot use something, such as a door, staircase or hallway, it is considered inaccessible. Something that can be used by everyone, such as an automatic door, a ramp or wide hallway, is considered accessible. People often take for granted how easy it is to enter a room, eat at a restaurant, play in a park, go for a walk or even visit a washroom. For a person with a disability, these daily tasks and outings can be very difficult if there is limited or no accessibility to them.

WHY IS ACCESSIBILITY IMPORTANT?

Out of every 100 people in a community, there could be as many as 15 who have a disability. If this is expanded, it means that a good number of people in the city or country have a form of one disability or the other. Despite this large number, there continues to be a lack of

understanding of and concern about accessibility. Without a continued effort to promote full accessibility, the basic rights of too many people will continue to be neglected (Bar, 1999).

Every society is known for its value as well as equality and human rights. It is believed that everyone who obeys the law and plays by the rules of society should be given these equal rights. Having equal rights implies that everyone – no matter what cultural, religious, ethnic or physical differences there are – has an equal opportunity to experience everything society has to offer. This means the opportunity to go to school, enjoy popular forms of entertainment and even something as simple as taking a walk down the street. In other words, everyone has the right to access and to enjoy the same places, events, services and products as everyone else (Richard, 2000). When those basic rights are unavailable, it means that basic human rights are being violated. Accessibility, then, ensures that everyone within a community has access to the same activities and opportunities.

Inclusion is a term used by people with disabilities and other disability rights advocates for the idea that all people should freely, openly and without pity accommodate any person with a disability without restrictions or limitations of any kind (Barnes, Oliver, Barton (2002). Although disability rights has historically existed as a relatively cohesive movement, the movement centered on inclusion has only recently begun to take shape and position itself in the eye of the general public (Jones, 1975).

The Findings Are Explored Under Two Sections:

1. External design features, which will include different elements of the external built environment in schools, and highlights key areas for consideration in relation to accessibility such as Arrival and Departure areas, external circulation routes, car ports and ramps, entrance porch as well as walkways.
2. Internal design features, which includes elements such as doorways and corridors, flooring, ramps, stairs and lift.

EXTERNAL DESIGN FEATURES

Car Parks

- Cars are the only practical method of transport for some disabled people, whether they drive themselves or ride with someone else; therefore it is vital to provide accessible parking with unhindered access to building entrances.
- The car park space for disabled people should be conveniently located and clearly signed.

Walkways and Building Entrances

Wheelchair access to the walkways can be made with a minimum of 1.50m. Two people can sit closed to each other.

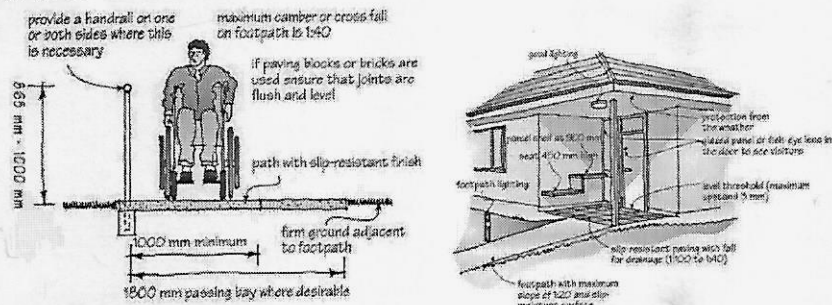


Plate 1. Source: Architecture (AIA); 2004

Access into Building

The elements which make the entrance accessible are: A good lighting, A parcel shelf at 99000, footpath/ with light, protection from the weather, glazed panel or fish-eye lens in the door to see visit, level threshold (maximum up stand 3mm), slip-resistant paving with fall for drainage (1:100 to 1:40), footpath with maximum slope of 1:20 and slip-resistant surface. Special measurements are required to open the door.

INTERNAL DESIGN FEATURES

Lifts

Besides the minimum measurement of 1.10 m (width) x 1.40 m (depth), the lifts shall have control buttons outside and within the lift cage. Control buttons shall be placed approximately 1.0 m above the floor and minimum 0.5 m from the corners. Door(s) shall be placed at the narrow end(s) of the lift. (If the doors are placed at a right angle to each other, the size of the lift shall be minimum 1.8 x 1.8 m.

Doors

If the door opens outwards, there must be an additional 0.2 m along the facade of the building. The area outside external doors must be flush with the internal floor. The area outside external doors must have tactile markings or be of a different colour from the surrounding surface finish. If the door opens towards the person, there must be no less than 0.5 m on the side of the door opposite its hinged side. Doorsteps may be no more than 25 mm high.

Corridors and Shared Access

The dimensions of an offset hinged door that allows room for a wheelchair user to move beside and through the minimum wide of a corridor is 0,90m which permit to someone

walking to cross or pass over someone in a wheelchair BUT it is not enough for two people crossing in a wheelchair with a standard size of 75 cm. For more comfort, the wide of the corridors can be 1.40m. It is necessary to make some turning diameter of 1,50m in front of the doors, ends of corridors.

STUDY AREA

Federal university of University is located in Bosso Local Government Area. It is the only Federal university in the Niger State. For the purpose of this research, the term "schools" will be used for "faculty". Just so that your understanding is not lost within this discourse. It has two campuses with a total of 6 schools; the temporary site in Bosso and the permanent site in Gidan Kwano. The Bosso campus has only one faculty building. Other schools represented there are the Pre-Degree and IJMB schools. All these eight (8) schools will be assessed based on the topic. It is expected that at the end of this research, the observations and analysis will aid even other non-academic buildings on how the issue of wheel chair accessibility should be tackled.

The schools studied include;

1. School of Science and Science Education (SSSE)
2. School of Environmental Technology (SET)
3. School of engineering and Engineering Technology (SEET)
4. School of Information and Communication Technology (SICT)
5. School of Agriculture and Agricultural Technology (SAAT)
6. School of Entrepreneurship and Management Technology (SEMT)
7. The Centre for Remedial Study Hall (CRES)
8. The IJMB Hall.

RESEARCH METHOD

Observation schedules were used in gathering the data. The research encountered limitations from some schools which were locked at certain periods of the day, making access very difficult. To analyse these data obtained, SPSS software was used and the results were displayed using charts and tables.

FINDINGS AND DISCUSSION OF RESULTS

Table 1: the table shows the relationship of each of the faculty buildings to the number of physically-challenged (PC) in them.

LOCATION: ARE THERE P.C. PEOPLE THERE?

		ARE THERE P.C. PEOPLE THERE?		Total
		YES	NO	
LOCATION	SSSE	1	0	1
	CRES HALL	0	1	1
	IJMB HALL	0	1	1
	SET	0	1	1
	SEET	0	1	1
	SICT	0	1	1
	SAAT	0	1	1
	SEMT	0	1	1
Total		1	7	8

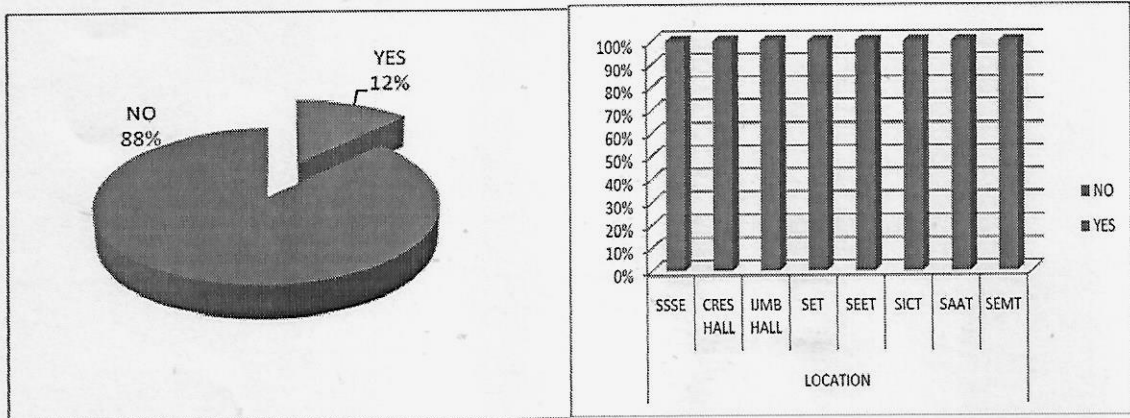


Fig. 1: Number of physically challenged individuals in these faculties.

Table 2: Relationship between the location and the Accessibility of the Entrance. LOCATION IS THE ENTRANCE ACCESSIBLE?

		IS THE ENTRANCE ACCESSIBLE?		Total
		IS	THE	
		ACCESSIBLE?	ENTRANCE	

LOCATIO		YES	NO	
N	SSSE	0	1	1
	CRES HALL	0	1	1
	IJMB HALL	0	1	1
	SET	1	0	1
	SEET	1	0	1
	SICT	1	0	1
	SAAT	0	1	1
	SEMT	0	1	1
Total		3	5	8

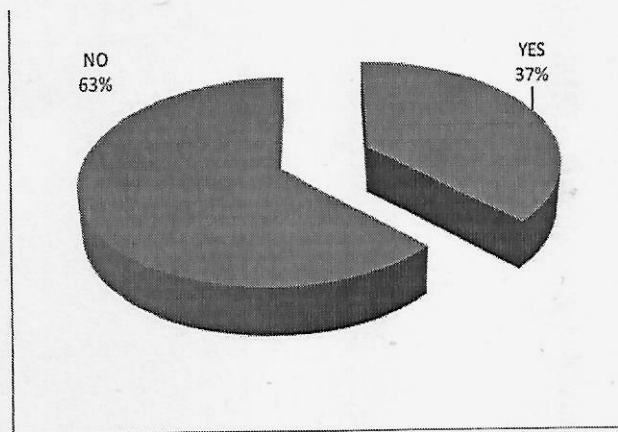


Fig. 2: Picture showing the impact of accessibility on each of the schools.

There is a large percentage of schoolshere which do not have clear entrances for wheel chair users. Only 37% have entranrces that can allow simple assess of wheelchairs. The other 63% will have factors like; high kerbs at entrances, no ramps at entranaces and, inadequatedoor width.

Checking The Availabiliy Of Ramps In Each Of The Schools.

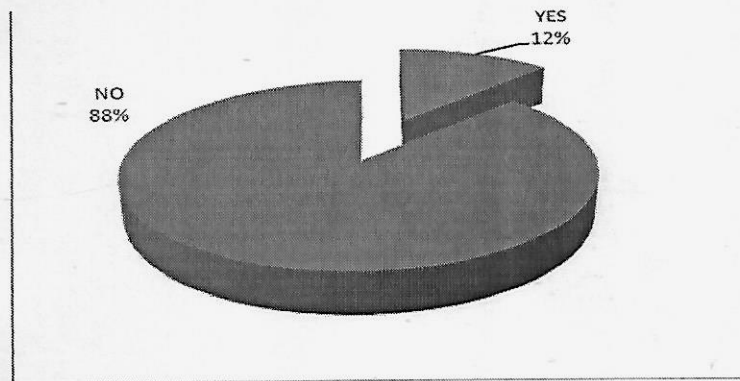


Fig.3: The piechart above represents the analysis of the percentage of ramp availability in each school buildings.

88% of the schools do not have ramps there. This shows the alarming rate at which we are excluding the physically challenged from our schooling system. If the situation is this way in future where a large number of these school buildings were built more than a decade ago, remains to be seen how other older schools will fare. This analysis has shown that architects are faced with an enormous task of designing and constructing more inclusive school buildings.

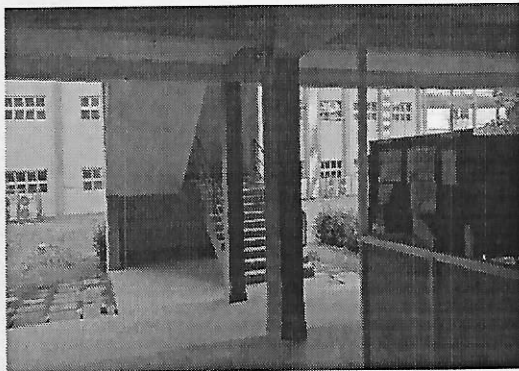


Plate 2.School of Environmental Tech.
steep)
Source : Reseachar's fieldwork 2015



Plate3.Ramp at the School of Science and Science Tech (Too steep)

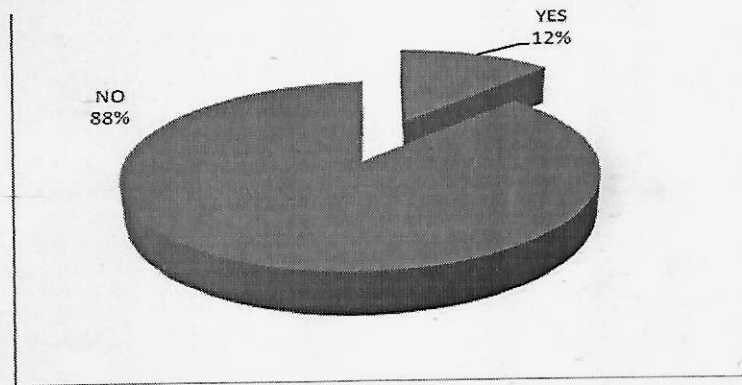


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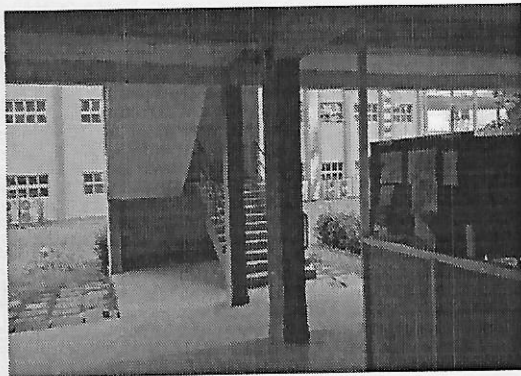


Plate 2. School of Environmental Tech.
steep)
Source : Reseacher's fieldwork 2015

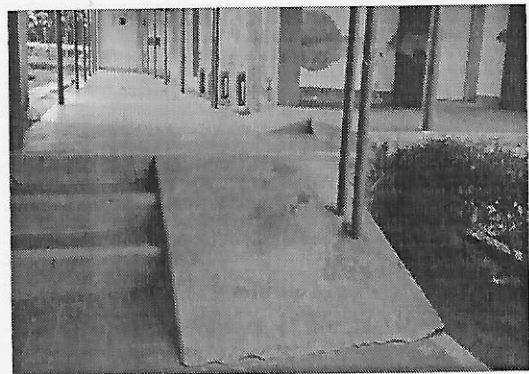


Plate3. Ramp at the School of Science and Science Tech (Too

Table3: table representing the level of obstructions at the premises.

LOCATION * ARE THERE OBSTRUCTIONS LOCATED IN THE PREMISES?				
LOCATION		ARE THERE OBSTRUCTIONS LOCATED IN THE PREMISES?		Total
		YES	NO	
SSSE		0	1	1
CRES		1	0	1
HALL				
IJMB		1	0	1
HALL				
SET		1	0	1
SEET		1	0	1
SICT		0	1	1
SAAT		1	0	1
SEMT		0	1	1
Total		5	3	8

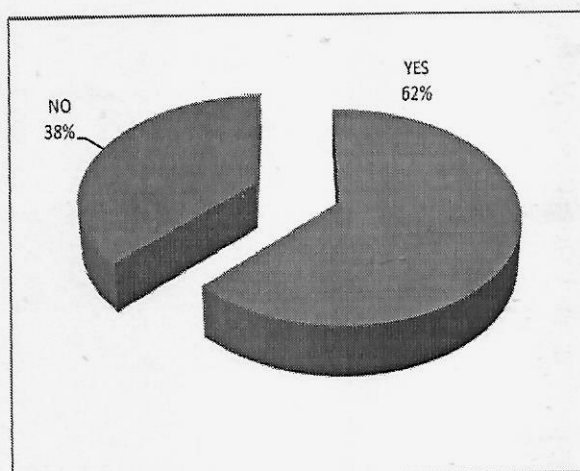


Fig. 4: Chart representing the level of obstructions at the premises.
 Source: Researcher's fieldwork 2015

The analysis carried out has shown that only 38% of the schools assessed do not have obstructions at the premises. This tells us that for the remaining 62%, there will be difficulty for wheelchair users to conveniently move around the building. This means that we must ensure that these school buildings attend to these situations but removing such obstructions.

CONCLUSION

There is a rising need for all-inclusiveness designs. It cuts across farther than just school buildings. The concept of inclusion is to create a medium where the physically challenged can stay in, and get to take part in the same activities as those who are not. Looking into a school setup, the aim is to be able to look into the exterior and internal environments. Looking at how the built environment can support the physically challenged. They must have ability to use similar entrances, use same exits, use same classrooms, same toilets and every other part of that school building. From the Research carried out in all the six (6) schools of FUT Minna as well as the CRES Hall and IJMBhalls, four areas of accessibility were critically assessed. The presence of the physically-challenged in these schools, The availability of clear entrances, the availability of ramps, obstruction objects at entrances. It was discovered that only one school had physically challenged persons. The entrances were not clear for easy access for wheelchair users. Ramps were majorly not in those buildings. Only one school had ramps at 12%. The other 88% didn't. In general, the physically challenged people will still face a lot of obstructions even when they move within these buildings.

From the summary of the findings this research conducted, it has shown clearly that only 12% of the faculty buildings was able to achieve inclusion in the design of these buildings. Furthermore, this implies that mobility impaired were not thought of while the construction of these buildings were being done, probably because most of these buildings were constructed about 15 years ago. The school of Information and Communication Technology (SICT) was seen to consider inclusion as well as accessibility for the mobility impaired within the school and this can be attributed also to the fact that it is a new building constructed recently. All of these implies that awareness on effective design consideration for physically challenged in the society is gradually increasing. For all the existing buildings assessed, elements that aid easy access and inclusion can still be adopted, and for new buildings, strict guidelines have to be adhered to to include all physically challenged found with University building and the society at large.

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REDUCING ACCIDENTS AND HEALTH HAZARDS IN THE NIGERIAN BUILDING INDUSTRY

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Accidents and health hazards owing to building collapse have been the talk of the day in the Nigerian building industry. The building team such as the architect, quantity surveyor, builder, engineer, and contractor are always blamed as a result of their indiscriminate attitude toward the construction of such building which has led to numerous lives wasted and injuries sustained. A descriptive research method through the conduction of oral interview and observation in some construction sites has shown that source of accidents and health hazards in the Nigerian building industry can be traced down to three main areas such as: design, construction and physical/environmental elements. This paper therefore, discussed the sources of accidents and health hazards in the building industry, and proffered ways to reducing such menace. It finally advocates that the National building code now in place should be enforced so that Developers would avoid the uncaring attitude of developing the Environment.

Keynotes: *Accidents, Building Industry, Construction, Design, Environment*

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INTRODUCTION

The building construction industry carries with it its fair share of accidents and health hazards. Accidental occurrences continue to show construction in a poor light, and this is understandable. The construction industry as a whole is often considered to be complex and unique. For instance, two buildings are rarely identical and the work on each construction site changes from day to day and this takes place mainly when it is open and exposed to the weather. Safety and health should be a major concern to the whole building team. Building personnel can contribute to safety at work by carrying out building operations correctly. Contracting organizations too, must safeguard the safety, health and welfare of the people who work for them as far as it is reasonably practicable. There should be the incorporation of safety working practices in the process of building. Tudunwada (1987) posited that injuries, industrial hazards and deaths need not be accepted as an inevitable price to be paid for industrial progress. Accidents do not just occur. They are mostly caused by people. Also occupational diseases are caused by unsafe work method and processes.

According to St. Paul's Steiner School (2013), accident is an unplanned event which has the capacity to cause injury or damage, and is attributed to either damage to plant or product, loss of production; increased cost, pollution of the environment and injury to person, few of which may even lead to death. According to Prokopenko (1981), a health hazard is the risk or danger of occurrences of work related disease, illness or serious discomfort, which could harm the physical or mental well being of a worker or the public.

Sources of accidents in the building industry have been channeled toward abuse of responsibility and error by workers. McCormick and Tiffin (1975) have highlighted the tendency towards error as a pervading human trait. They opined that errors of various kinds can of course, affect the quality of work people do and can also contribute to injuries and fatalities. Not only that, the factory inspector should also sit up to enforce the workplace health and safety standards.

The Factory Inspectorate Department is empowered to enforce workplace health and safety standards, ensuring that all workplaces maintained minimum standards of health and safety prescribed by the Factories Act, 1990 (Chapter 126, Volume VIII of the Laws of the Federation of Nigeria). Apart from carrying out workplace inspections, the department also conducts workplace surveys, investigates accidents, provides some occupational health and safety information, registers factories including construction sites and struggled to proactively promote workplace health and safety through enlightenment programmes, safety awareness, workshops, lectures and seminars.

The sources of errors and accidents are not entirely to be found in the individual in question, however; situational variables such as the nature of the work activities, the design of equipment and structure, the work procedures and the work environment can have a significant bearing upon the frequency and nature of errors and accidents. In the construction industry, however, sources of accidents can be traced generally to the three main areas which this paper shall dwell on: design, construction and physical/environmental elements.

SOURCES OF ACCIDENTS IN THE BUILDING INDUSTRY

Design:

In the conventional process of building industry, the design team directly employed by the client consist of:

- i. Project manager (Team leader)
- ii. The architect (designer)
- iii. The Quantity surveyor (who serves as financial adviser)
- iv. The Builder (who serves as a building construction expert)
- v. The structural engineer (who serves as specialist consultant to structural works)
- vi. The Electrical engineer (who serves as specialist consultant to electrical works)
- vii. The Mechanical engineer (who serves as specialist consultant to mechanical works)
- viii. The Acoustic engineer (who serves as specialist consultant to Acoustical works)

The architect produces and supervises an architectural plan of a building after generating a design brief from the client, Structural engineer basically produces the structural design; while the builder and/or contractor construct the building with the specification of the designer and specialist consultant and delivers same to the client. According to Ward (1978), building must be well planned, suitably sited and satisfy not only the numerous regulations regarding standards of construction, planning and safety, but also the need of the client in all climatic and environmental conditions. According to Ayininuola and Olalusi, (2004), buildings are structures, which serve as shelter for man, his properties and activities. They must be properly planned, designed and erected to obtain desired satisfaction from the environment. The design team primary concern during the design stage should be structural reliability, risk of consequence of fire, storms, flood, earthquakes and tremors and details, precision and appropriateness of specifications.

Ayodele (2003) asserted that a large number of accidents have occurred in building sites due to failure of temporary or partially complete structures and poor specification. Olalusi (2004) described failure as an unacceptable difference between expected and observed performance. A failure can be considered as occurring in a component when that component can no longer be relied upon to fulfill its principal function and therefore this can cause a health hazard. Bush (1973) noted that safety should be a prime consideration during planning, designing and construction in the building industry.

Construction:

In the construction of buildings, issues to be considered as sources of accidents in the building industry include:

- i. Feasibility of Construction Method: Many building failures have been linked to poor unrealistic construction method adopted.

- ii. Sufficient technical expertise by contractor: Some buildings have failed as a result of engaging wrong hands who don't have the technical knowledge on how to build. This as a result has endangered many lives and destroyed properties worth billions of naira.
- iii. Quality and Availability of Supervisor and craftsmanship: Poor and irregular supervision by the architect or those that stand on the gap has jeopardized the quality of buildings which has led to accident in the site. Supervisors and craftsmanship should be engaged in the building sites.
- iv. Satisfactory Construction Materials: Quality materials should be specified and be used for building construction in order to save lives and properties. For instance, use of sub-standard material has led to building collapse as shown in Plate 1.
- v. Site Layout: None serious attention to the site layout during the setting- out operation and its construction has caused a lot of accident on the site. To less accident on building sites, contractors should strictly adhere to the ideology of the site layout.
- vi. Adoption of realistic safety practices on site: Unconcerned (don't care) attitude toward the use of safety measures has caused more injuries to accident victims on site.



Plate 1.: A collapse building due to use of sub-standard material.
Source: Amadi, Eze, Igwe, Okunlola & Okoye(2012)

Ayodele (2004) observed that many accidents in Nigeria have occurred in building sites due to lack of sufficient technical expertise by the builder. Odumusu (1986) opined that the building industry involves the application on skills in areas of programming and design, construction management and erection, and in the prudent use of materials. He observed that absolute lack of knowledge and improper coordination of the various areas of inputs are responsible for the numerous failures, cracks, vibration and excessive deflection of the structural system. When a construction method is not feasible, this constitutes a accident risk (Perry and Hayes, 1985). A large number of accidents have occurred in building sites due to failure of temporary or partially complete structures and poor specifications. Bush (1973) has noted that safety should be a prime consideration during planning, designing and construction in the building industry.

Odumusu (1986) noted that the building industry involves the application of skill in areas of programming and design, construction management and erections and in the prudent use of materials.

Hazards may be encountered when inexperienced or unqualified personnel are employed in the building process. Bush (1973) opined that safety must be put into the hands of practical men with knowledge of the industry. Usage of unsatisfactory construction materials, especially concrete has been known to cause accident in many building sites. Odumusu (1986), observed that defective workmanship and materials often arise in projects under construction as a result of lack of proper understanding of the nature and properties of a major material like concrete.

According to Ogunjobi (2003), concrete has been responsible for the serious cracks which develop in some structures where it has also been known to have created both hazards to the public, and in some cases risks of instability within the system itself.

On the part of contractor, they should ensure that building site is laid out in the most effective manner is an essential part of a good planning process. Ogunjobi (2003) opined that a contracting organization produces a site layout showing the proper position of such item as site accommodation, materials sheds, compounds and storage areas, temporary roads, mechanical plants and scaffoldings, services, and hoarding. They should ensure that there is ease of movement of labour, materials and some plant items in order to prevent unnecessary accident. Scaffolding should be erected in such a manner as to provide a safe method of working and means of access. A temporary service like electricity should be provided where there will not be a likelihood of electrocution. Hoarding is another safety measure that should help ward off unnecessary interference of work on site by the public, and especially children. Non-adoption of realistic safety practices on site has been a major source of accident in the building construction industry. According to Ogunjobi (2003), under normal circumstances, the contracting organization should have a person specifically in charge of safety; but in Nigeria this aspect is practically non-existent.

The international Labour Office [ILO] (1969) pointed out names of the unsafe practices on site to include:-

- a) Non-shop prefabrication of building members earmarked for high-building elevation as an aspect of materials handling.
- b) Equipment failure through lack of proper maintenance
- c) Use of inappropriate tools
- d) Inadequate sharing of trenches
- e) Improper use of electric and gas welding equipment (Bush 1973)
- f) Improper construction of ladders, scaffolds and guards for floor opening
- g) Poor housekeeping like incorrect ways of piling materials, storing combustibles.

Physical/Environmental Factors

Physical/environmental factors that can contribute to accidents at construction sites include:- rain, sun, fumes, ice vapours, unlevel or uneven surfaces, radiation, snow, fog and heat, confined space, noise, gas and humidity (Prokopenko 1981). Perry and Hayes, 1985 also

identified fire, earthquake, flood, landslip to be among factors that can cause accidents and health hazards at construction sites.

Mechanical:

Vehicles and/or tractors can as well be a contributing factor to accident in construction industry. According to European Agency for Safety and Health [EASH] (n.d) about one in three fatal accidents at work involve vehicles. The main categories of transport accidents at work include:

- (i) People are struck or run over by moving vehicles (e.g. during reversing);
- (ii) Falling from vehicles
- (iii) Struck by objects falling from vehicles
- (iv) Injured because of vehicles overturning.

It follows that by removing or reducing the risk of accidents involving vehicles on construction sites, there can be a significant reduction in the number of fatal accidents in this sector.

RESEARCH METHODOLOGY

A descriptive research method was employed in this research which incorporates conduction of oral interviews and through observation in the building construction site. The choice of study area is based on the fact that there is rampant increase of building construction as well as site accident in Nigeria. A single case study of Abuja was conducted whereby information from the Factory Inspectorate Department was assessed to find out their compliance when accident and/ or health hazard occur in construction industry.

Method of Data Collection

The research scrutinizes the various sources of accidents, ways of reducing accidents and health hazards in Nigeria building industry. This was done through conduction of oral interviews, literature review and observation in order to have firsthand information.

DISCUSSION

A record from the Factory Inspectorate Department has shown that some construction industry do not comply with the obligation of given information to factory inspectorate department when accident and/ or health hazard occur in construction industry. The department is headed by a qualified director who oversees the activities of the department and has various factory inspecting officers (headed by a qualified inspector of factories) who visit sites and on health and safety at workplaces and report directly to the director of factory.

The most frequently undertaken activities of the department are general factory inspections, construction site inspections, and accident and incident investigations as shown in Table 1.

Table 1: Major Activities Undertaken by Factory Inspectorate Department

Activity	Frequency at which activity is carried out
General factory inspection	Carries out inspections throughout the country within the limits of resources
Construction site inspection	Carries out inspections of some sites that have been registered with the Factory Inspectorate Department
Scrutiny of factory plans	Examines all factory plans brought to its notice in order to give approval
Safety awareness seminars	Organizes seminars and workshops with health and safety stakeholders and some employers about twice a year or depending on availability of fund and logistics
Accident and incident investigation	Investigates all reportable accidents and dangerous occurrences notified to the department
Occupational Diseases investigation	Investigates all reportable occupational diseases notified to the department

Source: Umeokafor, Evaggelinos, Lundy, Isaac, Allan, Igwegbe, Umeokafor, and Umeadi, (2014).

Reporting of accidents and incidents to Factories Inspectorate Department was low because most employers were ignorant of their duties under the Part IV of the Factories Act 1990 and partly, for the fact that some employers were not aware of the different roles played by the Factory Inspectorate Department and Labour Department (Umeokafor *et. al.*, 2014). Even at the visit of Factory Inspectors to the sites some workers exert fear to give sincere account of the actual severity of accidents or dangerous occurrence because they are afraid of being sacked by their employers. This was evident from the numbers of accidents reported to the Factory Inspectorate Department which is shown in Table 2. Dangerous occurrences, fatal and over three-day accidents are reportable to the Factory Inspectorate Department. Most employers do not report these reportable incidents as also shown in Table 2.

Table 2: Accidents Reported to Factory Inspectorate Department from 2007 to 2012

Year	Number of Injuries	Number of Deaths	Number of Near Misses	Number of Accidents Reported
2007	4	1	1	3
2008	8	6	-	2
2009	3	2	-	16
2010	5	1	1	3
2011	8	2	-	7
2012	14	4	1	6

Source: Table structure, partly adopted from Umeokafor *et al.* (2014) and modified by author; content from accident reports collected from the Factory Inspectorate Department (2007-2012).

In Plate 1, owing to nonchalant attitude or lack of knowledge of being in existence, a typical Work Place Accident occurred which would have been preventable through regular Factory and Labour Inspections. This is an evidence of an accident which could have been prevented if there was proper registration of site by the contractor and site inspection by the Factory Inspectorate Department.



Plate 2: A typical Work Place Accident preventable through regular Factory and Labour Inspections.
Source: Wogu (2013)

Figures 1 and 2 present the trend of accidents record of the construction SMEs in terms of severity for a five-year period (2009 - 2013). Figure 1 reveals that over the five-year period accidents resulting to minor injuries of less than one day off work summed to 733 cases; accidents leading to injuries of 1 – 3 days off work summed to 353 cases; accidents resulting to injuries of 4 or more days off work amounted to a total of 181 cases; and accidents leading to permanent disabilities or death summed to 55 cases only.

Figure 2, on the other hand, reveals that over the five-year period accidents resulting to minor injuries of less than one day off work summed to 55.45% of total cases recorded; accidents leading to injuries of 1 – 3 days off work amounted to 26.70% of total cases recorded; accidents resulting to injuries of 4 or more days off work amounted to 13.69% of total cases recorded; and accidents leading to permanent disabilities or death amounted to 4.16% of total cases recorded only. This implies that the construction SMEs incurred more minor accidents than fatal accidents over the five-year period. This shows further that the construction SMEs had very good accidents record.

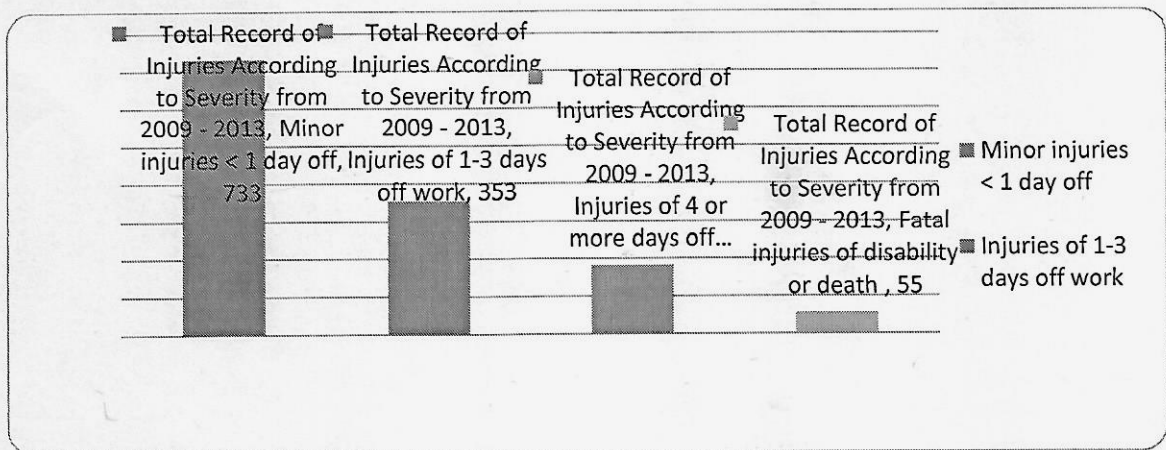


Fig. 1: Total Record of Injuries According to Severity from 2009 – 2013
Source: Authors' Field Work (2014)

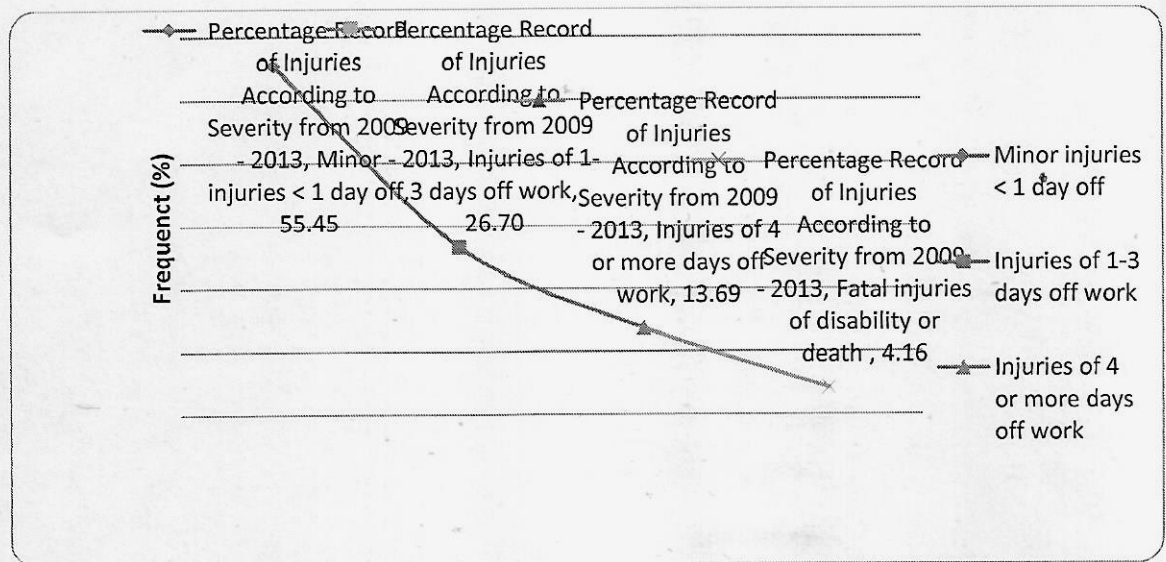


Fig. 2: Percentage Record of Injuries According to Severity from 2009 – 2013
Source: Authors' Field Work (2014)

SOURCES OF HEALTH HAZARDS

Protopenko (1981) identified sources of health hazards in the building industry to include physical hazards, chemical and stress hazards.

- i. **Physical hazard includes:** These consist of vibration, noise, heat, cold and ultraviolet in the built environment.
- ii. **Chemical hazards include:** Chemical, gases, fumes, vapours, metals/materials, which may damage the eyes, skin, lungs and other internal organs or bones. Ogunjobi (2003) observed

that lead which comes from such products as paints and petrol can enter the body through the respiratory tracts, especially when unclean paint-strained hands are used to eat. He observed that over 40% of lead inhaled is absorbed into the blood stream, accumulates in body organs the kidney and the nervous system and damage the brain over time. More so, environmental impact of concrete, its manufacture and application is complex which has harmful effect to the body. For instance, the carbon (iv) oxide (Co₂) emission for the cement factory (Mehta & Monterio n.d.)

- iii. **Stress:** According to American Heritage New Dictionary of Cultural Literacy (n.d.) it is a term which denotes the effects of mental and emotional pressure. It stressed that a building worker who is frightened may suffer from headaches palpitation, insomnia, nervous tension, instability or other symptoms. Stress is one health hazard which affects individuals very differently. People vary greatly in their ability to cope with this and very often a small amount of stress at work added to psychological pressure outside work can produce severe symptoms.

RECOMMENDATIONS

The following recommendations are made for the effective management of safety and health in the building industry:-

- i. All building should be designed by qualified professionals. There should be no compromise for the structural aspect, since the consequences of exempting any class of qualified member of building team from their specialized field are enormous and the risk must not be contemplated.
- ii. All registered building firms should be made to have an officer specifically in charge of safety so that the need for prevention of accidents and health hazards can be more actively appreciated.
- iii. The planning authorities of the various local governments should employ professionally qualified personnel to cope with the approval and supervision works within their local government areas. There must always be a follow-up to ascertain compliance of the building execution with architectural impressions, structural design and specification.
- iv. There is a great need for the Federal government to promulgate a national construction regulation, governing both building and civil works in the country.
- v. Proper soil investigation should always be done, whatever the type of structure to be built. The structural system of any building must not be made to suffer from inappropriate design solution.

The researchers believe that these recommendations as listed above will go a long way in making construction safer in Nigeria. Therefore, there is an urgent and a great need to safeguard the lives and health not only of building workers but also building users.

CONCLUSION

It has been found out that a majority of accidents and health hazards in construction industry is the handwork of human being. The design and construction aspects of building have been the veritable sources of accidents in the building industry in Nigeria, but it seems that serious attention is not being paid to them. Probably, this may be as a result of various mal-practices that have been noted in the construction industry. A situation whereby quacks design buildings and get approvals in local planning authorities is indeed worrisome. The National building code now in place should be enforced so that buildings do not pose any danger to the occupants.

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