PROCEEDINGS OF THE CONSTRUCTION BUSINESS & PROJECT MANAGEMENT CONFERENCE 2022

THEME:
Building Innovation and Sustainable Construction Practices

22 – 24 JUNE 2022

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DECLARATION

Ninety submissions were received for the Conference from authors based in 33 Universities, Polytechnics and Organisations located in Australia, Ghana, Malaysia, Nigeria, South Africa, the United Kingdom and Zambia, out of which 40 full papers were accepted. All full papers in this publication went through a double-blind peer-review process which involves abstracts assessment by the scientific committee, feedback to authors on abstracts submitted, submission of full papers for the accepted abstracts, review of full papers by the scientific committee and panel of reviewers, feedback to authors on full papers submitted which included a decision on acceptance and evaluation of the revised papers by the scientific committee and reviewers to ensure the quality of content.

Instituitional Affiliation	**Count of Affiliation**	**Affiliation%**
Accra Technical University	3	2.50%
Ahmadu Bello University Zaria	2	1.66%
Ambrose Alli University	3	2.50%
Covenant University, Nigeria	7	5.80%
CPD Partnership Ltd	1	0.83%
Denel	1	0.83%
Durban University of Technology	14	11.66%
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Federal University of Technology, Akure, Ondo State, Nigeria	7	5.80%
Federal University of Technology, Minna	5	4.16%
Federal University of Technology, Owerri,Imo State, Nigeria	2	1.66%
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London SouthBank University	1	0.83%
Malawi University of Business and Applied Sciences	1	0.83%
Mangosuthu University of Technology, Durban	1	0.83%
Nelson Mandela University	8	6.66%
Stellenbosch University	1	0.83%
The Polythecnic Ibadan	1	0.83%
Universiti Tinku Abdul Rahman	6	5.00%
University of Cape Town	7	5.80%
University of Hong Kong	1	0.83%
University of Johannesburg	19	15.83%
University of Jos	2	1.66%
University of KwaZulu Natal	2	1.66%
University of Manchester	3	2.50%
University of Nigeria	1	0.83%
University of South Africa	10	8.33%
University of the Witswatersrand	4	3.3%
University of Zambia	1	0.83%
Zutari	1	0.83%
Total	**120**	**100%**

PREFACE

On behalf of the organizers of the Construction Business and Project Management (CBPM) conference, I thank everyone present or connecting remotely for being here with us today. We are very pleased to welcome those who participated in the maiden edition of the conference in 2021 and those attending the conference for the first time. This year's edition focuses on building innovation and sustainable construction practices. We are proud that this started with a successful workshop and continues today with the conference with all of you present.

Before we start this event, I would like to express my sincere appreciation to those who contributed to the success of the maiden and current editions of the CBPM conference, including authors, reviewers, scientific committee members and organizers from the University of Cape Town and Durban University of Technology. The conference couldn't have been possible without your contributions. Thank you all.

It is worth mentioning that during the maiden edition of the conference, keynote speakers delivered four speeches, and authors from 32 institutions and 13 countries presented 41 peer-reviewed papers. These made the event highly inspiring and successful. I am glad to inform you that five speakers will deliver five keynote speeches in this year's edition. The authors from 33 institutions consisting of 27 universities, four companies and two polytechnics will present 40 peer-reviewed academic papers. With these strong statistics, we are convinced that there is a future for the CBPM conference.

I want to thank the contributors of this year's edition especially. You are here because you have submitted your research works (ongoing or completed) for our assessment. Your papers went through a double-blind peer-review process, and the feedback received has improved the quality of your articles published in the proceedings for the benefit of the policy, decision-makers, researchers, and students. This wouldn't have been possible without your contributions, and we sincerely advocate for your continuous support.

The conference started with a workshop with the theme, "Managing a Successful Academic Career", with presentations by erudite scholars - Prof. Pantaleo M. D. Rwelamila, Dr Mazlina Zaira Mohammad and Dr Nnedinma Umeokafor. Over the next two days, you will engage in intellectual debates and learn new research thinking through keynote speeches by Prof. Vivian W. Y. Tam, Prof. George Ofori, Dr Ntebo Ngozwana, Dr Erik Bean and Ms Tamsin Faragher, technical sections and other support activities. I hope these will make your attendance at the conference worthwhile and enhance your knowledge of sustainable construction practices, building innovation, practices in project business, health and safety, construction industry, real estate and infrastructure development.

I warmly welcome each one of you again to the CBPM 2022 Conference. If you have any questions or need clarifications, feel free to contact me or any of the organizers.

Thank you very much for your attention.

June 22, 2022

Prof Abimbola Windapo
Chair of the Scientific Committee

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THE PEER REVIEW PROCESS

All the full papers in this publication went through a rigorous two-stage blind peer review process by no less than two acknowledged experts in the subject area. Experts, including industry professionals and academics, were assigned to ensure that high-quality scientific papers were produced and included in the proceedings.

The first stage of review
Submitted abstracts were double-blind peer-reviewed. Each abstract was reviewed in terms of relevance to the conference theme and objectives, academic rigour, contribution to knowledge, originality of material and research methodology. Authors whose abstracts were accepted were provided with anonymous reviewers' comments and requested to address the review comments when developing their full papers.

The second stage of review
The submitted full papers were first of all checked originality and inappropriate copying using Turnitin/Ithenticate software. After that, the papers were assigned to experts in the field based on their areas of expertise for review. The full papers were reviewed in terms of relevance to the originality of the material; technical writing; academic rigour; contribution to knowledge; pertinent literature review; research methodology and robustness of analysis of data; empirical research findings; and overall quality and suitability of the paper for inclusion in the conference proceedings.

The third stage review
Authors whose papers were accepted after the second review were provided with additional anonymous reviewers' comments on evaluation forms, and requested to submit their revised full papers. Evidence was required relative to specific actions taken by the authors regarding the referees' suggestions. Final papers were only accepted and included in the proceedings after satisfactory evidence was provided. To be eligible for inclusion in the conference proceedings, these papers were required to receive a unanimous endorsement by the Scientific Committee and Review Panel that the paper had met all the conditions for publication. Out of 90 submissions, 40 papers were finally accepted and included in the CBPM 2022 conference proceedings.

At no stage was any member of the Scientific Review Panel or the Organising Committee, or the Editors of the proceedings involved in the review process related to their own authored or co-authored papers. The role of the editors and the scientific committee was to ensure that the final papers incorporated the reviewers' comments and to arrange the papers into the final sequence as captured on the USB memory stick and Table of Contents.

Professor Abimbola Olukemi Windapo
Chair, Scientific Committee CBPM 2022 Conference

ENDORSEMENTS

The Construction Business and Project Management Conference is accredited by the South African Council for the Project and Construction Management Professionals (SACPCMP) for 8 CPD points. The conference is also supported by the Journal of Construction Business and Management.

SACPCMP

The South African Council for the Project and Construction Management Professions

https://journals.uct.ac.za/index.php/jcbm/login

KEYNOTE SPEAKERS

The Conference Organising Committee would like to thank our keynote speakers for accepting our invitation to come and share their presence and thoughts with us. Thank you very much.

Erik Bean

An educational technology professional and researcher who is widely recognized for leadership to improve the pedagogy and andragogy in higher and secondary (K-12) educational markets. Dr. Bean is the associate university research chair, Center for Leadership Studies & Organizational Research. He was appointed to serve as section editor *Journal of Leadership Studies* (John Wiley & Sons). He facilitates the commission of peer reviewed articles for publication consideration with an international team of academicians to present the latest in research findings as well as conceptual and best practice presentations and articles in several disciplines including psychology, cultural competence, bias, mindfulness, business, customer experience (CX), humanities, science, and leadership. He holds a doctorate in educational leadership, has presented internationally at Oxford University, in London at Lord's Cricket Stadium, at Jerusalem Technical College, in Brussels, and Barcelona for the International Leadership Association, for example, and is founder of the Healthy Mind Express, a Michigan mental health 501(c)3 non-profit charity. Dr. Bean has written numerous peer reviewed academic books including his most popular titles, *Social Media Lesson Plans* and *Rigorous Grading Using Microsoft Word AutoCorrect* (An All-Time Best-Selling Top 100 Microsoft Word book according to CNN and Forbes), Westphalia Press; Washington, D.C. He also is co-author of the book series 20/20 Prudent Leadership. His latest book *Bias Is All Around You: A Handbook for Inspecting Social Media & News Stories*, is a byproduct of the misinformation associated with the 2020 U.S. election, the pandemic, and uncivil unrest and features a foreword by Michigan State University School of Journalism Director, Tim Vos, Ph.D. Finally, Dr. Bean also is a recipient of several 2020 to 2022 literary awards in top three or finalist positions for fiction and non-fiction mass media books.

George Ofori

Dr Ofori obtained a B.Sc.(Building Technology in Quantity Surveying) (First Class Honours) at the University of Science and Technology in Kumasi, Ghana in 1975. He worked in that university as a Teaching Assistant before studying for an M.Sc.(Building Economics and Management) (Distinction) degree at University College London, awarded in 1977; and a Ph.D. degree at that university in 1981. He was awarded a Higher Doctorate D.Sc. degree by the University of London in 1998. He is a Fellow of the Ghana Academy of Arts and Sciences. Dr Ofori is also a member of professional built environment institutions. He is a Fellow of the Chartered Institute of Building; Fellow of the Royal Institution of Chartered Surveyors; and Fellow of the Society of Project Managers (Singapore).

Dr Ofori is currently the Dean of the School of the Built Environment and Architecture, London South Bank University, UK which he joined in 2017. He was the Director of Research and Enterpise in the school from 2017 to 2019, and became the Dean in July 2019. He was a Senior Quantity Surveyor with G.A. Takyi and Partners (Cost Consultants) in Accra, Ghana, in 1981-83. From 1983 to 2017, he worked at the National University of Singapore (NUS), where he was promoted to Full Professor in 1999. He was the Head of the Department of Building at NUS in 2002-07; and Director of the university-level multi-disciplinary M.Sc.(Environmental Management) programme at that university in 2010-16.

Dr Ofori has been a consultant to several international agencies including the Commonwealth Secretariat, International Labour Office, and the then United Nations Human Settlements Programme on construction industry development, since 1978. Over the same period, he has also undertaken consultancy assignments for many governments (including Bahrain, Singapore, South Africa, Tanzania and the UK).

The modules which Dr Ofori taught at undergraduate and post-graduate levels at NUS include: Building and Development Economics; Environmental Management; Sustainable Cities; Project Management; and International Project Management. At LSBU, he has been teaching: Construction Management Project; Construction and Procurement Management; and Information and Human Resource Management. He has been invited to deliver lectures at universities in a number of countries including China, Ghana, Hong Kong, Malaysia, South Africa. Other countries include: Bahrain,

Dr Ofori has been an External Examiner of academic programmes at under- and post-graduate levels in Malaysia, Singapore, South Africa and the UK. He has also examined doctoral theses for universities in many countries including Australia, Finland, India, Malaysia, the Netherlands, Singapore, South Africa, Sri Lanka, Thailand, Uganda and the UK.

Dr Ofori specialises in Construction Management and Economics, at the project, company and industry levels. His main subject of research is the improvement of the capacity and capability of the construction industry, especially in developing countries. His other research subjects are: Sustainable Construction; Productivity; Human Resources in Construction; And Professionalism and Ethics. He has written 125 journal papers, 5 books,

30 chapters in books and 6 reports published by major international agencies. He has presented keynote papers at some 70 major conferences, and given public lectures and special talks to professional institutions in many countries.

Dr Ofori has written some of the seminal works on various topics in Construction Management and Economics including: Construction Industry in Developing Countries; International Construction; Human Resource Development in Construction; Leadership Development in Construction; Construction and the Environment; and Professionalism and Ethics in Construction. His works are quite frequently cited, and many of the frameworks and concepts he has developed have provided the basis for further research. One of his papers (Ofori, 2007)1 has been the most read in the leading journal, Construction Management and Economics for several months. He has been the Founding Editor of one international refereed journal (Journal of Real Estate and Construction at NUS). He is a member of the Editorial Boards of over 20 such journals, including some of the top ones: Construction Management and Construction; and Engineering, Construction and Architectural Management.

Dr Ofori has been the Principal Investigator of a number of research projects awarded by the Building and Construction Authority of Singapore, Ministry of Manpower in Singapore, and Ministry of National Development, Singapore, and National University of Singapore. He has also been a Co-Investigator on research projects funded by the Workplace Safety and Health Institute in Singapore. He has reviewed research grant applications for the Australia Research Council; Engineering and Physical Sciences Research Council, UK; Hong Kong Research Grants Council; and National Research Foundation of South Africa.

Dr Ofori was a Visiting Chair Professor at Tsinghua University in China for a number of years. He has also been a Visiting Professor at the Hong Kong Polytechnic University; University of Reading, UK; University of Science Malaysia; and Universiti Tun Hussein Onn Malaysia. He was the Founding Co-ordinator of the International Council for Research and Innovation in Building and Construction (CIB) Working Commission 107 on Construction in Developing Countries; and is currently the Joint Co-ordinator of CIB TG95 on Professionalism and Ethics in Construction. He was a member of the Board of the CIB for three years. He is the Deputy Chairman of the International Board of CoST, the Infrastructure Transparency Initiative; and a Member of the Board of Trustees of Engineers Against Poverty.

Dr Ofori has won a number of awards for teaching including the Excellent Teacher Award at NUS; and for research. He won the CIB Best Coordinator Award, 2004-07 in 2007. He was also given the Award for for International Collaboration at the 100th Anniversary of the University of Zagreb, Croatia.

[1] Ofori, G. (2007) Construction in developing countries, *Construction Management and Economics*, 25:1, 1-6, DOI: 10.1080/01446190601114134

Ntebo Ngozwana

Dr Ntebo Ngozwana is the Director for Research and Development, Construction Industry Development Board (cidb), with over 30 years of combined experience in research, skills development, enterprise development and sector policy development. She has been with the cidb for 15 years. Her key achievements include the development of policy instruments to advance skills development in the construction industry, leading the development and getting of standards for subcontracting skills, and enterprise development on major infrastructure projects.

Her main interest is the development and sustainability of women enterprises and young entrants to the construction industry, with a special interests in Technical and Vocational Education and Training Colleges. Ntebo has been actively involved with driving the participation of the construction trade in World Skills International Competitions with the cidb supporting bricklaying competitors.

She is responsible for managing the Cidb's engagement with higher education instituitions through the Postgraduate Conference, the Doctoral Workshop as well as the newly initiated Cidb centre for excellence. One of her current key responsibilities at the Cidb is the establishment of industry research agenda to inform industry development and transformation.

Tamsin Faragher

Tamsin Faragher is a built environment specialist (landscape architect) with experience both locally (Cape Town) and internationally (London, Dubai and Abu Dhabi). She has worked across disciplines in the private and public sector (provincial and local government) within the planning, built environment, infrastructure planning, environment, water and most recently - food "spaces".

Tamsin's interest in development policy has matured and includes an interest in the nexus between policy, practice and implementation, particularly as it relates to sustainable, resilient city-making and the contrasting, competing demands between the environment and development.

Tamsin's most recent work has allowed for the exploration of this focus and includes the application of systems thinking to water policy such as water sensitive design, ecological infrastructure and nature-based-solutions; food systems and public open space. Integral to this work is collaboration and innovation. Other interests include writing for publication and lecturing.

Vivian Tam

Professor Vivian W. Y. Tam is a world-leading researcher in the field of construction engineering and management. Her findings have found applications and impact for tackling climate-change issues for green buildings and recycled concrete. She is currently the Associate Dean (Research and HDR), Associate Dean (International) and Discipline Leader (Construction Management) at School of Engineering, Design and Built Environment, Western Sydney University, Australia. She is nominated to the College of Expert, Australian Research Council, Australian Government. She is currently the Editor-in-Chief of International Journal of Construction Management and Senior Editor of Construction and Building Materials. She has published over 260 referred journal articles. She has been awarded fifty-three research grants (totalled over $4.5 million), including six national competitive projects from Australian Research Council, Australian Government. Her work has been recognised by peers nationally and internationally, which has been exemplified by six Australian Research Council projects and over 19,000 citations with a h-index of 72. Vivian is also named as 100,000 Top-Scientists (Top 2% Scientists) in the World since 2017.

CBPM 2022 WORKSHOP SPEAKERS

Dr Mazlina Zaria Mohammad

Dr Mazlina Zaira Mohammad is a Senior Lecturer at the School of Civil Engineering (SCE), College of Engineering Universiti Teknologi MARA (UiTM), Malaysia, where she is currently the Safety, Health and Environment Coordinator and Risk Coordinator of the SCE. She holds a PhD degree from the Asian Institute of Technology, Thailand. She is currently leading a project on multi-organizational integration funded by the Ministry of Education, Malaysia and has been involved in several projects funded by public and private organisations. Her research mainly concentrates on construction safety management, construction safety culture, prevention through design and project management. More than five of her papers were published as articles in various scientific and professional construction journals and conferences. Her recent international book publication in collaboration with international authors on Construction Health and Safety in Developing Countries has been awarded a '2019 Taylor & Francis Outstanding Book and Digital Product Award in the Outstanding Monograph Category'.

Professor Pantaleo M. D. Rwelamila

Prof. PD Rwelamila is a professional project manager and a project procurement systems expert. Until December 2021, he was a Professor of Project Management & Procurement Systems at UNISA – School of Business Leadership & Currently Professor Emeritus – UNISA-SBL. He read Construction Engineering Economics, Project Management and Construction Project Procurement at ARI (Tanzania), Brunel University (United Kingdom) and University of Liverpool and later University of Cape Town. He has experience of more than 35 years in consulting in construction economics, policy development and conducting studies in project appraisal, construction project planning, procurement, contract formulation and management, project performance evaluation and strategic project management. Prof. Rwelamila was a non-executive director and board chairman of Msingi Construction Project Management (Pty) Ltd; and Proceedings Editor, African Academy for Business and Development (AABD). He has been a consultant to various public and private organisations in South Africa, across the African continent and beyond. Prof. Rwelamila is also the joint co-coordinator of CIB W107 and past president of South African Council for the Project and Construction Management Professions (SACPCMP). Since 1999, he has been a resource person at the Stellenbosch University's Prestigious Executive Programme for the South African Construction Industry – Construction Management Programme (CMP) in the Department of Civil Engineering. He is also a current Director of Professional and Scholarly Support (Pty) Ltd – South Africa.

Dr Nnedinma Umeokafor

Dr Nnedinma Umeokafor is a Chartered Construction Manager and a Senior Lecturer in Quantity Surveying at Liverpool John Moores University, United Kingdom. Before joining Liverpool John Moores University, he was a Senior Lecturer in Construction Law and the Course Leader for all undergraduate BSc programmes (Quantity Surveying Consultancy, Building Surveying, and Construction Management) in the Department of Civil Engineering, Surveying and Construction Management) at Kingston University, London, United Kingdom (UK). He has held academic positions in other higher education institutions in the UK, for example, the University of Greenwich, University of East London, and University College of Estate Management, all in the UK.

He is research-active with over 65 research outputs including publications in leading reputable refereed built environment and safety, health and environment journals (e.g. Elsevier Safety Science), international conferences (e.g. International Council for Research and Innovation in Building and Construction (CIB) W099), book chapters and reports. He is the first or sole author in, at least, 40 of them and the second in, at least, seven. He is a Member of CIB W078 — Information Technology for Construction and a Member of CIB W099 — Safety, Health and Wellbeing in Construction. While Nnedinma is a socio-legal scholar with a focus on regulation and compliance, other areas of his research are health, safety, environment and well-being; higher education research; diversity, equality and inclusion; construction & project management; and construction procurement.

He holds a PhD degree, his thesis examines complex regulatory systems in construction health and safety at the PhD level. Other academic qualifications include an MSc in Project Management, another MSc in Quantity Surveying and Commercial Management and the National Compliance and Risk Qualifications (NCRQ) and AIM Level 6 Diploma in Applied Health and Safety (Dip NCRQ) (equivalent to an undergraduate honours degree). While he is a Fellow of Advance HE (previously Higher Education Academy) (FHEA), a full member of Association for Project Management (MAPM), he holds a chartered membership status within the Chartered Institute of Building (CIOB) (MCIOB) as a Chartered Construction Manager.

WORKSHOP PROGRAMME - MANAGING A SUCCESSFUL ACADEMIC CAREER

Introduction

The academic career includes a unique career path. However, academics career progression is still dependent on key milestones, different challenges including work tensions between the individual and the department, tensions between work strategies and departmental recognition, balancing academic work life and private life, and career facilitators which need to be managed successfully, to progress along the academic career path.

Workshop Objectives

The workshop delivered an interactive three-hour workshop on the challenges, tensions to the academic career and career facilitators that need to be managed successfully. The audience engaged in activities including discussions, quizzes, Q&A sessions and learned from each other.

Dr Mazlina Zaria Mohammad
Managing your health and safety as academics: A focus of Display Screen Equipment (DSE)

The health and safety of academics are as important as that of other workers in other sectors, but this has received very little attention. When it does, the focus is on its research. Many academics that receive training on various aspects of health and safety such as DSE are likely going to experience that this is more of a tick-box exercise. On the other hand, many, especially, in developing countries do not receive any training on this key aspect of health and safety relevant for them. This workshop session seeks to draw the attention of academics to different technologies (DSE), how it is applied to academics and outline steps they can take to prevent associated risks.

Professor Pantaleo M. D. Rwelamila
Planning for a successful academic career in higher education

Many academics seem to have a little plan before or shortly after joining academia. Some with plans either lose focus or even leave academia because the plans fail. However, some achieve their plans if not more. Consequently, there is the need to prepare Doctoral students or those who newly joined academia for the career. In doing this, some questions that will be answered in this presentation are: 1) How do academics plan and achieve successful academic careers? 2) How do we manage research, teaching and day-to-day activities toward an effective and efficient academic career? 3) What are the relevant project management skills that academics need for a successful career? 4) What makes a successful academic career?

Dr Nnedinma Umeokafor
Integrating innovative teaching strategies into learning and teaching in Higher Education

Traditional methods of teaching, passive strategies, do not deliver the expected level of student engagement expected. In some cases, there are negative implications as a result such as a reduction in student attendance, low student interest in the subject, and poor student experience and satisfaction. Despite the potential of innovative methods of teaching to increase student engagement, interest in the subject and experience, a lot of academics still adopt passive methods of teaching. This workshop session seeks to introduce academics (especially those new to the sector) to innovative teaching strategies and demonstrate how they are integrated into learning sessions in higher education.

KEYNOTE ADDRESSES

Curtailing bias in scholarship and civil discourse to improve rigor and avoid false narratives

Erik Bean

How can one mitigate bias in the research process? From study design and sampling to trial implementation and data analysis, bias can occur anywhere along the investigation process. For civil discourse, information can outsmart anyone regardless of their education or experience since we are bombarded by false narratives, aggressive algorithms, and click bate designed to make separating fact from fiction more challenging than ever before. Join Erik Bean, Ed.D., Leadership Perspectives section editor of the Journal of Leadership Studies, associate research chair, University of Phoenix, Director, Healthy Mind Express, a Michigan non-profit mental health foundation, and author of the 2021 book Bias Is All Around You: A Handbook for Inspecting Social Media & News Stories, for an introspective keynote address as he discusses how our personal biases can affect research as well as our personal interactions with 7 sources of all potential biases found in all published materials. Finally, he will share how bias can affect our mental health if we avoid the critical thinking process and tools like the ancient Greek rhetorical styles that are designed to foster objectivity.

Keywords:
Data analysis, methodology, research bias, sampling study design

The MDGs, SDGs and construction: The responsibility of researchers

George Ofori
London South Bank University
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Introduction

This is a short note to supplement the keynote presentation on "The MDGs, SDGs and the construction industry" at the Construction Business and Project Management Conference (CBPM 2022) in Cape Town on 22-24 June 2022.

The history and the record

The keynote presentation I made at CBPM 2022 is based mainly on a keynote paper I presented at a CIB Conference in 2015 in London.[1] I had earlier done two other previous papers:

1. A paper as Chief Guest at the University of Moratuwa M.Sc. in Project Management programme's 10 years anniversary in Colombo, Sri Lanka
2. A keynote paper at the 25th Anniversary Conference (CME25) of the journal, *Construction Management and Economics*.[2]

I also wrote a chapter on the "Construction and Millennium Development Goals" in Ofori, G. (2012) New Perspectives of Construction in Developing Countries. Routledge, Abingdon, pp. xxx. More recently, I was a Co-editor of a Special Issue of the journal, Resources, Conservation and Recycling on "Construction and the SDGs", entitled: "The Sustainable Development Goals, Organisational Learning and Efficient Resource Management in Construction" (VSI: Construction & SDGs)".[3]

Currently, I am working on a chapter for a book being edited by Alex Opoku. In the near future, I plan to write papers on the subject for possible publication in journals considering, first, industry level issues; and then on project level issues.

Earlier history

How did my interest in global agendas start? It began with the interest I had in the development process. This led to my decision to do my doctoral research on the subject on the nexus between socio-economic development and construction industry development. This approach was considered to be too broad for a Ph.D. study, but I persisted. The thesis is available online.[4]

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[1] Egbu, C. (Ed.) (2015) Proceedings of Going North for Sustainability: Leveraging knowledge and innovation for sustainable construction and development. London, UK, 23-25 November 2015.

[2] Ofori, G. (2007) Millennium Development Goals and construction: a research agenda. In Hughes, W. (Ed) Proceedings of the inaugural construction management and economics 'Past, Present and Future' conference CME25, 16-18 July 2007, University of Reading, UK, pp. 1-14, https://centaur.reading.ac.uk/31329/1/CME25-Whole_Procs.pdf

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Following my Ph.D., one of the main subjects on which I do research is “Construction in Developing Countries”. Apart from my research, I have also done much work on construction in developing countries for agencies such as the International Labour Office on its then programmes of Construction Management and Construction Industry Development in Africa. I also worked for the then United Nations Centre for Human Settlements, now the United Nations Human Settlements Programme (UNHabitat), based in Nairobi, Kenya. I have also done studies at the national level in many countries. My research on construction industry development continues.

The CBPM 2022 presentation

The United Nations Millennium Declaration, signed in September 2000, contained eight Millenium Development Goals (MDGs) which were: to eradicate extreme poverty and hunger; to achieve universal primary education; to promote gender equality and empower women; to reduce child mortality; to improve maternal health; to combat HIV/AIDS, malaria and other diseases; to ensure environmental sustainability; and to develop a global partnership for development. Each MDG had targets set to be achieved by 2015 and indicators to monitor progress from 1990 levels. The 2000 to 2015 programme had some significant achievements. However, the ambitious targets were not met.

The post-2015 programme, seeks “to build on the Millennium Development Goals and complete what they did not achieve”. It was put together by the United Nations, governments, civil society, business and other partners. The 17 Sustainable Development Goals (SDGs) and 169 targets form the basis for the realisation of the development agenda contained in the UN declaration, "Transforming Our World: the 2030 Agenda for Sustainable Development" of 2015. In the declaration, the agenda is described as “a plan of action for people, planet and prosperity”.

The document states also that: “We recognize that eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. All countries and all stakeholders … will implement this plan. We are resolved to free the human race from the tyranny of poverty and want and to heal and secure our planet”.

The construction industry creates the physical basis for development. Thus, it should play a role in the attainment of the aims and objectives of global development agendas. These questions are considered in the presentation:

- What role did construction play in the implementation of the MDGs?
- How can its performance be assessed?
- What is the link between the MDGs and the SDGs, where the role of construction is concerned?
- What can construction contribute towards the attainment of the SDGs?
- In the declaration presenting the SDGs, there are rousing calls for action and pledges of commitment from all countries. It is now midway towards the end of the SDG period.
- What progress has been made?
- What needs to be done to reach the targets?
- What can construction do to accelerate progress towards the attainment of the targets?

It is suggested that administrators and researchers of construction should take account of, and contribute to, the development of relevant global agendas.

The future

As researchers on construction, we should be aware of, and contribute to the solution of, global challenges. Thus, our motivation should go beyond enhancing our research profiles through the building up of output and increasing our metrics. Our work should have an impact on practice and on society. In order to do this, we should keep ourselves educated about the global challenges. While one of the nine challenges outlined by the World Economic Forum (WEF) (2016)[5] was: "Long Term Investing, Infrastructure and Development", there are implications for construction, both direct and indirect, from the other challenges.

On the SDGs, we should:

- Frame every activity in terms of the SDGs. Thus, for example, in terms of project parameters, we should not just consider time, cost, quality, health and safety and the environment, but also, contribution to the attainment of particular SDGs
- Work to build an index for assessment of sustainability in construction.

Keywords:

Global agenda, goals and targets, MDGs, professionalism, researchers' tasks, role of construction, SDGs, sustainable development

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Building innovation and sustainable construction practices

Tamsin Faragher

Urban resilience is a one of the favourite buzzwords in development circles. Conflated with sustainability, its real meaning is not always understood, compromising correct adoption and integration that is not necessarily appropriate or effective. The core of urban resilience lies with anticipating shocks and stresses for preparation to ensure rapid recovery, towards even greater resilience. The causal factors of shocks and stresses create complex scenarios which necessitate a multidisciplinary, transversal approach across all spheres of government, the private sector, all built environment professions, developers, facilities management companies, academics and others. The construction industry plays an active role in shaping our cities and therefore is important in building urban resilience. The global climate emergency is no longer a future phenomenon. Every global citizen is living 'the change'. Construction business and project management sectors are significant city-shapers and wield the power to effect transformative change in how we build our cities. It is therefore urgent that we collaborate and pool our resources to innovate so that our cities of today, and those of the future are equipped for great uncertainty through resilience.

Keywords:
Innovative construction, sustainable construction, sustainable practices, urban resilience

Proposed Construction Industry Development Board: University partnership for construction industry innovation, transformation, and sustainability

Ntebo Ngozwana

The South African construction industry has been identified as a key sector for economic recovery and reconstruction following the constrained and catastrophic economic performance experienced during the COVID-19 pandemic. Historically, the industry has struggled with performance issues (such as low social sustainability compliance considering the numerous site accidents), adoption of technology solutions, productivity, stakeholder management, ageing construction workforce and transformation in a changing socio-political climate. The COVID-19 pandemic exposed the key growth areas and challenges of the industry with the opportunities that are provided by the technologies of the Fourth Industrial Revolution (Construction 4.0) to support industry growth and sustainability. The pandemic has likewise laid bare the challenges facing our educational systems and their readiness to support a move towards a technological ready and enabled industry that supports high-level training and skills needed to implement these new technologies in the changing world of work.

This presentation summarises the current challenges facing the South African construction industry and the glaring opportunities; and thereafter, proposes ways in which the Construction Industry Development Board (cidb), in partnership with academic institutions, can support the construction industry adopt construction 4.0 technology solutions to drive transformation, sustainability, and economic growth.

Keywords:
4IR, construction performance, COVID-19 pandemic, innovation, productivity, sustainability, transformation

Future trends of sustainable construction

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Construction and demolition waste is one of the largest contributors to landfills. Unfortunately, the utilisation of construction and demolition waste as recycled aggregate in concrete is not common. Recycled aggregate is only currently utilised in low-grade applications including road bases and footpaths. Carbon-conditioning is the process by which carbon dioxide (CO_2) is injected into recycled aggregate within a pressurised chamber to improve upon overall properties. The accelerated dosage of CO_2 is able to deliver a chemical reaction in which calcium hydroxide is converted into calcium carbonate. Calcium carbonate crystals are smaller than that of calcium hydroxide and consequently, recycled aggregate is made denser. The enhancement of the recycled aggregate manifests within the final concrete product, a high performance recycled concrete know as CO_2 Concrete. However, whilst there is an understanding of carbon-conditioning and the mechanism of generating CO_2 Concrete, there are many that have not yet been investigated. The overall performance of CO_2 Concrete is improved in all characteristics. These trends are predictable and consistent. The enhancement of CO_2 Concrete alongside the consistency that the material can display provides a great deal of future value.

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Academic training evaluation of building technology programme

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Abstract:
Training evaluation is one method through which tertiary institutions examine the effectiveness of the training they deliver in order to establish their students' readiness for the workplace. However, several higher institutions' evaluation methods have been confined to assessment in tests and exams without considering the knowledge and competencies acquired by students via training in fulfilling workplace expectations. Hence, the study assessed the training received by Building technology graduates in construction management and construction technology courses. The study adopted the Kirkpatrick model's first two stages of training evaluation (Reaction and Learning levels) with a questionnaire distributed to purposively selected Building technology graduates from two polytechnics in Southwestern Nigeria using a snowball sampling technique. Data obtained were analysed using descriptive statistical tools. The study's findings show that respondents were satisfied with the training acquired and possess the basic competency from the training. However, the graduates lack sufficient knowledge of laws and regulations governing construction work, the use of computer programme for planning and scheduling projects and the ability to use tools and equipment for construction work. The study findings imply that building graduates would be unable to work adequately in the construction industry without additional training, putting enormous strain on construction firms to re-training them to meet their expectations. Tertiary institutions need to revamp their training strategies and methods for students to improve their competency to strive in the construction industry.

Keywords:
Building technology, competencies, construction management, construction technology, construction industry, training evaluation.

1 Introduction

Tertiary education plays a vital part in any society's development. Its products form the core of nation-building in terms of contributing to capacity and human resources development in every area of the economy (Nyerere et al., 2016). Ekene and Oluoch-Suleh (2016) suggested that tertiary education transforms individuals and promotes greater work efficiency and productivity. Römgens, Scoupe and Beausaert (2020) opined that the primary focus of tertiary education should be to prepare students for an uncertain and unpredictable future in their chosen careers. According to the National Policy of Education in Nigeria (Federal Republic of Nigeria [FRN], 2014), one of the goals of tertiary education is to contribute to the national development through high-level human resources training. However, many employers in Nigeria have expressed dissatisfaction with the quality of graduates produced by tertiary institutions. Oviawe, Uwameiye and Uddin (2017) revealed that although graduates are academically qualified, they are unemployable because they lack the required competencies to get and succeed in the job. Graduate underperformance in the workplace has been a source of worry for several employers, governments, and tertiary institutions. As a result, most higher institutions have made employability a priority, with the quality of their training now being measured by the employability of their graduates (Römgens Scoupe & Beausaert, 2020). Tertiary institutions are now adjusting their training approaches and methods to meet the current realities of the economy and the world of work (Clarke, 2018).

One of the tools for determining the effectiveness of the training acquired by students is training evaluation. According to Igwenagu (2014), training evaluation is a vital component of the teaching and learning process. It is an important instrument for assessing the quality of teaching and learning. Dotong *et al.* (2017) also argued that evaluating the training acquired by graduates will help determine the quality of training they received and gauge the programme's relevance and responsiveness to industry demands. Although training assessment is the last phase in the training cycle, it is critical in measuring the efficacy of the training provided to students (Al-Mughairi, 2018). Al-Mughairi (2018) further revealed that many institutions overlook this final phase or that the techniques utilised to perform the evaluation are ineffective. Igwenagu (2014) also acknowledged that the evaluation procedure of Nigerian higher institutions had become a major source of worry. The assessment procedure is only dependent on the student's learning outcomes as determined by tests and examinations, with no consideration given to the knowledge, qualities, or skills acquired by students during training. The evaluation of the student's training is intended to enhance the training delivery or the student's competence.

Furthermore, the assessment input would aid in establishing if the course met its objectives and deciding on future training. Therefore, this study assessed the training received by Building technology graduates in some construction management and construction-related courses in some selected polytechnics in Nigeria to determine their satisfaction with the training and the competencies attained from the training. Although several studies have been carried out to evaluate the training received by students; however, these studies are unrelated to the built environment programmes.

2 Literature Review

2.1 Training evaluation

The evaluation of training programmes assesses the various approaches and strategies used in training delivery (Tripathi & Bansal, 2017). It is used to identify the weakness of the training programme, thus helping to create a secure connection between training and performance in the job place. Noe (2016) describes training evaluation as a systematic method of gathering and analysing information about a training programme used for decision-making and assessing various training components' importance, efficacy, and impact. Bhasin (2020) argued that training evaluation defines the relevance of the training programme and to what degree the training meets the needs of individuals and organisations. According to Prachi (2015), training evaluation guarantees that the required skills are acquired and the learning outcomes are not compromised, it serves as input to the trainers during the training process and enhances the quality of employee and creates new skills within the employee.
Tertiary institutions must thus review their programmes to see whether specific training objectives are met. The evaluation will assist in identifying performance standards for students as well as areas of weakness and strength. Furthermore, the assessment process will enable tertiary institutions to discover gaps in their training, adjust their teaching technique or strategy, and enhance and reorganise the curriculum to fulfil the programme's intended goals.

2.2 Models for training evaluation

Training evaluation models are a systematic framework to evaluate and examine the effectiveness and success of the training. Training evaluation models are targeted at determining whether the training objectives are achieved, the trainees learnt something, the training impact the performance of the trainees, achieve value for money and determines ways of improving the training (Prachi, 2015). Although several models have been developed to evaluate training, such as the Return of Investment model, Context Input Reaction Outcomes (CIRO) model, Context Input Process Product Evaluation model and Kaufman's five levels evaluation model. However, Kirkpatrick's training evaluation model is widely used to measure training effectiveness due to its simplicity and ease of use. The model was developed by Donald Kirkpatrick in 1959. The model became popular because of its ability to divide a complex topic into manageable stages. It considers both formal as well as informal styles of training.

Kirkpatrick (1998) divided the evaluation model into four parts: Reaction, Behaviour, Learning and Result. Reaction level measures the level of satisfaction with the training programme by the participant. The reaction stage measures the students' satisfaction with the training acquired. Student satisfaction is a subjective assessment of the multiple outcomes and experiences associated with the education received (Elliott & Shin, 2002). The reaction evaluation usually occurs after the individual has finished the programme. It also requires evaluating participants' feelings or attitudes regarding different programme components such as content, subjects, teachers, and approaches. The learning level, on the other hand, defines how learners master the knowledge and skills.

It assesses the level of knowledge obtained by participants before and after the training programme (Srivastava & Walia, 2018). In other words, learning evaluation seeks to quantify the gap between what they knew before training and what they learned throughout the training programme. Kirkpatrick argues that if learning is not transferred to the workplace, it cannot influence the job or the company. The behavioural level determines if the acquired knowledge, abilities, and behaviours are transferred to the workplace to exhibit positive behaviour and job performance gains. The behaviour assesses how much the trainee's work behaviour has improved at the end of the training. The testing will reveal how much the training regimen affects the results. This model's main strength is that it focuses on the behavioural outcomes of the learners who participate in the training. Finally, the result level influences the participants' better performance in the business or environment. It also examines the organisation's reaction to the training intervention. The complete success of the training programme is identified through the results. Nonetheless, Kirkpatrick (1998) stated that for this model to be efficient, the evaluation should begin with the level of reaction and proceed to the other levels one by one since each level affects the following level.

2.3 Building technology programme in Nigeria

Building technology is taught at Nigerian polytechnics and universities. Building technology is taught in Polytechnics over two academic years at the National Diploma and Higher National Diploma levels and a five-year university degree. The courses offered in Building technology programmes are designed to produce qualified graduates with a solid understanding of the science and management of construction processes, as well as specialists in any of the following areas of construction technology, construction management and economics, building materials and structure, and building maintenance. According to the Nigeria Institute of Building (NIOB), tertiary education training in Building technology is intended to produce academically qualified and licensed students as professionals to be in charge of building production management, construction administration, and building maintenance for human use and safety. According to National Board for Technical Education [NBTE] (2001), the Building Technology curriculum in Polytechnics is aimed to increase students' ability to take an active position in the construction sector, notably in the management of building production processes. Students in building technology will also learn how to manage human, material, and financial resources in construction projects in order to develop a structurally sound and appealing structure. The Builder's job in the Nigerian construction industry is enshrined in the National Building Code (NBC), which gives them sole authority over the execution of building projects and the supervision of craftsmen and artisans on construction sites. According to NBC (2006), the Builder is also responsible for preparing the following pre-construction documents: project quality management plan, construction programme, and project health and safety plan. Given the critical responsibilities that builders play in the construction sector, their performance is critical to ensuring the long-term viability of the construction industry in Nigeria.

3 Research Methodology

This study adopted a quantitative research approach to evaluate the training acquired by Building graduates in courses relating to construction management and construction technology in the study of Building technology. The quantitative approach entails collecting numerical data and analysing them (Ghani et al., 2020). The evaluation was carried out using the first two levels of the Kirkpatrick model of training evaluation (reaction and the learning levels) to measure the level of satisfaction in the training Building graduates had received in the 12 identified courses relating to construction management and construction technology and the competencies attained from the training. These two levels were chosen because it focuses on the feedback from the trainee on their learning experiences and what they had learnt. The study population consists of Building graduates in 5 academic sessions (2015 to 2020) from two purposively selected polytechnics (Yaba College of Technology [Yabatech] Lagos and The Polytechnic Ibadan) in the Southwestern zone of Nigeria with a sample frame of 590. A questionnaire survey was used as the data collection instrument to get feedback from Building technology graduates on their training experience and competencies attained from the training. The questionnaire was designed with Google form and administered to 234 calculated sample size (Krejcie & Morgan, 1970) to Building graduates through the social media platforms of the institution's Alumna associations. A Google form is a template or worksheet-based application that may be used individually or in tandem to collect user information (Nurmahmudah & Nuryuniarti, 2020). The questionnaire comprised twelve courses relating to construction management and construction technology in the first section and sixteen expected learning outcomes from the courses in the second section. In the first section, the respondents were asked to rank these courses in order of their level of satisfaction in the training they had received using a 5-point Likert scale (1 = dissatisfied, 2 = not satisfied, 3 = moderately satisfied, 4 = satisfied and 5 = very satisfied. The respondents were also required to rank the competencies they had acquired from the training received from the sixteen (16) expected learning outcomes drawn from the course's curricula in the second section of the questionnaire using a 5 point Likert scale of 1 (not Competent) to 5 (very competent). Frequency distribution, percentage and mean score were used for data analysis.

4 Findings and Discussion

4.1 Respondents' details

The frequency distributions of the participants' data were employed in this study to create a comprehensive picture of the respondents' profiles. Out of the 234 questionnaires administered, 231 were received from the two institutions.

Background data were acquired from respondents' institutions, educational degrees if they worked for a construction firm and post-graduate years of experience. These statistics were required to identify the respondents' academic training experience and knowledgeability to improve the presented data's trustworthiness. According to Table 1, 51.9% (N-120) of the entire population attends Yaba College of Technology Lagos, whereas 48.1% (N-111) attend The Polytechnic Ibadan. As shown in Table 1, 71.9%

(N-166) of the population possess a Higher National Diploma degree, while 22.1% (N-51) of the population are with a Post Graduate Diploma degree. The large proportion of respondents holding a Higher National Diploma degree reflects the high quality of responses gathered throughout the field survey. The bulk of the respondents work in a construction-related organisation, representing 74.5% (N-172). A closer look at Table 1 shows that 96.9% of the respondents had more than three years of post-graduation working experience, implying that the respondents have enough experience to relate their academic learning experience with knowledge of what is available in the construction industry.

Table 1: Background data of respondents

	Frequency	**%**
Respondent's Institution		
Yaba College of Technology Lagos	120	51.9
The Polytechnic Ibadan	111	48.1
Total	231	
Respondents' Educational qualification		
Post Graduate Diploma	8	3.5
Master's Degree	51	22.1
Bachelor's Degree	6	2.9
Higher National Diploma	166	71.9
Total	231	
Working in a construction-related organisation		
Yes	172	74.5
No	59	25.5
Total	231	
Post-Graduation working Experience		
1-2	7	3.0
3-4	184	79.7
5 and above	40	17.3
Total	231	

4.2 Students' satisfaction with the training in construction management and technology courses

Table 2 shows the different categories of students rated their satisfaction with construction management and technology-related courses. The results in Table 3 revealed that construction technology, construction management, project management, and tendering and estimating were the highest-ranked courses with mean values of 4.26, 4.21, 4.11 and 4.11, respectively, across the respondents' institutions. These most ranked courses are vital to building students' competence in the construction industry because they provide theoretical and practical knowledge of the construction processes. Studies by Alakavuk (2016) and Babalola and Oladipo (2018) agree that construction technology is one of the most relevant courses for the construction industry. The finding indicates that students are satisfied with the training in construction technology. It exposed them to construction activities, processes, and various techniques and technologies to construct structurally stable components and structures. Students' satisfaction in construction management and project management courses implies that they will be able to perform the core function of managing the activities of skilled and unskilled workers on construction sites using appropriate management techniques and

tools, owing to the fact that these courses emphasise the importance of human relations management skills that are essential for the construction industry's success. As a result, Building students must be thoroughly taught about contract administration, allocation and management of various resources available for construction using various management and information communication tools. This knowledge is needed in the construction industry to succeed as a construction manager (Adinyira & Abankwa, 2015). In addition, students' satisfaction in tendering and estimating course will enable them to be competent in preliminary cost estimating of materials, labour, and machines in construction work. It will also expose them to contract administration and the understanding of the rights and responsibilities of parties to the construction contract. Sitanggang *et al.* (2019) attest to the need for effective estimating training, stating that faulty estimating in construction works might result in an under or over-allocation of resources, both for commercial. Because of the difficulty in developing an accurate estimate in the execution of construction projects, Regmi and Willis (2018) proposed a well-thought-out curriculum of cost estimating for efficient teaching of the course. Overall, Building students' satisfaction with the teaching and learning in Building technology courses is important to their competency and success in the construction industry. Students' satisfaction in training is a key sign of their success. The conduct of students' satisfaction surveys often highlights areas for improvement and offers the best possible learning environment for their students (Waller, Foust & Panthi, 2021).

Table 2: Students' satisfaction with the training in construction management and construction technology courses

Construction Management and Construction Technology related courses	**Yabatech**		**PolyIbadan**			
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
Construction technology	4.27	2	4.25	1	4.26	1
Construction management	4.28	1	4.14	2	4.21	2
Project Management	4.27	2	3.94	7	4.11	3
Tendering & Estimating	4.22	4	3.99	4	4.11	3
Contract laws & Arbitration	4.18	5	4.01	3	4.10	4
Entrepreneurship development	4.15	6	3.98	5	4.07	5
Estimating & Price Analysis	4.23	3	3.89	8	4.06	6
Budgeting & financial control	4.14	7	3.97	6	4.06	6
Technical report writing	4.15	6	3.86	10	4.01	7
Architectural drawing & Design	4.18	5	3.81	12	4.00	8
Measurement of Building & Civil works	4.10	9	3.88	9	4.00	8
Engineering Surveying	4.12	8	3.82	11	3.98	9

4.3 Competencies attained from the training in construction management and technology courses

Table 3 presents the competencies attained from the training in construction management and technology courses ranked by the respondents according to their degree of competency. The highest-ranked knowledge gained by the respondents were the capability to carry out construction layouts for various types of buildings, knowledge of the construction of various components of buildings, knowledge of construction standards and practices, and the ability to decipher building plans and specifications. The finding aligns with Gimba (2011) study, which identified the

capacity to carry out building layout as one of the employability skills that Building students must acquire to be employable in the construction industry. This skill is necessary for the construction sector to convert the building plan from paper to land before the actual construction process begins. It also aids in precisely positioning the building in its form and design. Husain *et al.* (2017) study also agreed with the findings in that students' understanding of the construction of various building components is essential to properly execute construction jobs. Another highly ranked competency gained by graduates is in construction standards and practises. This competency is essential for graduates' success in the construction industry since it will aid in assuring quality and safe building operations, as well as lowering costs, eliminating waste, and enhancing efficiency (Mbereyaho et al., 2019). It is also a necessary skill for building professionals to create the project quality management plan document for the construction project (Ogunbiyi, 2015).

In line with the studies of Gimba (2011) and Obaju, Fagbenle and Amusan (2022), the ability to understand building plans and specifications is a critical competency needed in the construction industry for Building students. It is a necessary skill for a job in the construction industry and is critical in finishing the project within the specified quality, budget, and time. This ability is crucial for building graduates in drafting construction documents such as project quality management plans, construction programs, and project health and safety plans as recommended by the National Building Code (NBC, 2006). A contract is an essential aspect of the construction process because it guides the conduct of each party in the project, prevents unanticipated risk, and outlines the methods and rules for guaranteeing the project's successful completion. Du Plessis and Oosthuizen (2018) argue that construction contracts have evolved into a management tool for effectively executing construction projects. As a result, knowing contract processes is critical for building students entering the construction industry. Findings from the study on the competency in health and safety practices by students align with the study of Farooqui and Ahmed (2009), which rated the knowledge of health and safety as one of the essential skills for construction undergraduates and graduates. This competency requires Building students to create a health and safety plan in order to identify potential health and safety issues in the building process and adopt policies and methods to address them.

Table 3: Competencies attained from the training in construction management and technology courses

Areas of Competencies	**Yabatech**		**PolyIbadan**		**Overall**	
	Mean	**Rank**	**Mean**	**Rank**	**Mean**	**Rank**
Carrying out construction layout for various types of buildings	4.27	4	4.17	1	4.22	1
Construction of various components of buildings	4.24	5	4.17	1	4.21	2
Construction standards and practices	4.28	3	4.13	3	4.21	2
Decipher building plans and specifications	4.31	1	4.05	9	4.19	3
Procurement and contracting procedures	4.19	8	4.17	1	4.18	4
Health and safety practises	4.30	2	4.05	6	4.18	4
Construction professionalism and practices	4.24	5	4.09	4	4.17	5
Supervision and Coordination of skilled and unskilled individuals on construction sites	4.23	6	4.05	6	4.14	6

Prediction and estimation of building materials, labour, and plant resources.	4.14	11	4.14	2	4.14	6
Effective communicate on the construction site	4.18	9	4.06	5	4.12	7
Construction site dispute management and resolution ability	4.16	10	4.06	5	4.11	8
Reading, understanding, and interpreting contract documents	4.22	7	3.99	8	4.11	8
Preparation of construction status reports.	4.18	9	3.99	8	4.09	9
Use of variety of construction tools and equipment	4.11	12	3.99	8	4.05	10
Knowledge of various tools for project planning and scheduling	4.04	13	4.02	7	4.03	11
Construction regulations and laws	4.04	13	3.99	8	4.02	12

Nevertheless, the results of the study revealed knowledge of construction regulations and laws and knowledge of various tools for project planning and scheduling as the least ranked competencies attained by the respondents. The lack of competency of graduates in construction rules and legislation would add to the already existent average level of building regulation practice in the Nigerian construction industry, as reported by Osuizugbo (2019). Building graduates will need this skill to contribute to the formulation of standards and regulatory requirements for designing and erecting buildings that will safeguard the safety and health of building users. The lack of knowledge in project planning and scheduling tools is not limited to graduates alone. AlNasseri and Radhlinah (2015) studies also found a lack of sufficient knowledge of project planning and scheduling tools and their application among construction stakeholders. Project planning and scheduling have become two of the most significant elements for project success because it helps establish procedures and define project activities and durations to determine the goals, scope, and quality of the project.

5 Conclusion and Further Research

One of the most important aspects of training evaluation is identifying areas of strength and weakness in the training. This study was able to identify training and competency gaps in building technology training, as well as provide a basis for future research in training evaluation in the built environment courses. According to the findings, Building technology graduates are satisfied with the training acquired and possess the essential competencies from the expected learning outcomes of the courses. However, there is a need for improvement in the training in engineering surveying in order to improve the competency of the graduates in the use of tools and equipment to carry out construction work accurately. The study also observed that the graduates lack sufficient knowledge of laws and regulations guiding construction work and various construction project planning and scheduling tools. These findings imply that building graduates would be unable to work adequately in the construction industry without additional training, putting enormous strain on construction firms in re-training them to meet their expectations while also calling into question the quality of their training. This study recommends revamping the training method and strategies in the less competent areas identified in the study and the involving of construction professionals in the training of students for the construction industry. Because of the study's population size limitation, other tertiary institutions can be studied to generalise the findings. Furthermore, investigations in other specialised areas of building and other fields in the built environment can be conducted.

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