

CONFERENCE PROCEEDINGS
10(f)



PROCEEDINGS OF THE CONSTRUCTION BUSINESS & PROJECT MANAGEMENT CONFERENCE

THEME: Conceptualising challenges and
opportunities in the construction industry

24 - 25 JUNE 2021

UCT GRADUATE SCHOOL OF BUSINESS, ACADEMIC CONFERENCE CENTRE
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Cape Town, South Africa, 24 – 25 June, 2021.

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Correspondence:

All correspondence relating to the Construction Business and Project Management
Conference should be addressed to:

Professor Abimbola Olukemi Windapo (Chair)
University of Cape Town, South Africa
Abimbola.windapo@uct.ac.za

Dr Ayodeji Olatunji Aiyetan (Co-chair)
Durban University of Technology, South Africa
Ayodejia@dut.ac.za

Editors

Professor Abimbola Olukemi Windapo	- University of Cape Town, South Africa
Dr Ayodeji Olatunji Aiyetan	- Durban University of Technology, South Africa
Dr Nnedinma Umeokafor	- Kingston University, United Kingdom
Dr Chioma Sylvia Okoro	- University of Johannesburg, South Africa
Dr Abdulrauf Adediran	- University of Johannesburg, South Africa
Mrs Amanda Mtya	- University of Cape Town, South Africa

DECLARATION

Eighty-one submissions were received for the Conference from 30 Universities, Polytechnics and Organisations located in Australia, Ghana, India, Malaysia, New Zealand, Nigeria, South Africa, the United Kingdom and Zambia, out of which 41 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.

CBPM 2021 Conference Stats

Abstract/Full Paper	Full Paper	
Institutional Affiliation	Count of Affiliation	Affiliation (%)
Durban University of Technology	4	7.02%
Ahmadu Bello University, Zaria	4	7.02%
University of Cape Town	4	7.02%
Nelson Mandela University	3	5.26%
University of South Africa	3	5.26%
Federal University of Technology, Minna	3	5.26%
Moshood Abiola Polytechnic, Abeokuta	3	5.26%
Obafemi Awolowo University, Ile-Ife	3	5.26%
University of Ilorin	3	5.26%
University of Kwa-Zulu Natal	2	3.51%
University of Johannesburg	2	3.51%
University of The Free State	2	3.51%
Kingston University, London	2	3.51%
Walter Sisulu University	1	1.75%
Niger State Polytechnic, Zungeru	1	1.75%
Curtin University	1	1.75%
Kwame Nkrumah University of Science and Technology	1	1.75%
Dereel	1	1.75%
Akwa Ibom State Polytechnic, Akwa Ibom	1	1.75%
Olabisi Orobango University, Ago-Iwoye	1	1.75%
Department of Science and Innovation, South Africa	1	1.75%
Stellenbosch University	1	1.75%
Modibbo Adama University, Yola	1	1.75%
University of the Witwatersrand	1	1.75%
University of Manchester	1	1.75%
Waziri Umaru Federal Polytechnic, Birnin Kebbi	1	1.75%
Dank Homes Limited, Abuja	1	1.75%
The Federal Polytechnic Ilaro	1	1.75%
Bayero University, Kano	1	1.75%
The Oke-Ogun Polytechnic Saki	1	1.75%
Grand Total	57	100.00%

PREFACE

Dear Conference Participants,

It is a pleasure to welcome you to the Construction Business and Project Management (CBPM) Conference, 24-25 June 2021. The conference is organised under the auspices of the University of Cape Town and Durban University of Technology.

The construction industry plays a vital role in the economy of any nation, and it is a significant contributor to economic growth. It creates employment, especially for unskilled workers, which can be used in the development and transfer of technology, creating many opportunities for enterprises and contributing directly to improving the quality of life of its users. The construction industry is more than a single industry comprising a complex cluster of sectors, including banking, materials and equipment manufacturers, contracting organisations, consultancies and suppliers of goods and services.

In 2013, the construction sector in South Africa contributed 13% of the GDP with expectations for an increase to 15% by 2020. However, a dismal contribution of the construction industry to the GDP has been observed in South Africa and globally. The current COVID-19 pandemic has now worsened this dismal performance. Furthermore, society faces numerous problems concerning infrastructure delivery and management and the failure of construction companies. In the ten years leading up to the Covid pandemic in 2020, many small and medium-sized construction companies underwent business rescue. However, the challenges also extend to large companies whose failure has also led to the collapse of many smaller companies – their appointed sub-contractors.

This conference aims at conceptualising the various challenges and opportunities in the construction industry by providing a platform that brings all stakeholders involved in the construction industry, both academia and practitioners, to collaborate and brainstorm on the challenges of, opportunities and the future directions for construction business and project management. It is believed that through its collaborative motive, this forum will bring about changes in the delivery of sustainable construction businesses, professional practices and projects. Furthermore, sharing experiences and ideas in infrastructure delivery, management and procedures should be an ongoing priority as infrastructure is required for economic growth and development.

To stimulate interaction between the conference participants, the organising committee has designed a programme that enables networking, learning, and discussion opportunities. In addition to four keynote addresses and the presentation of 41 papers, the conference takes place immediately after a public lecture on "Leading inclusive change in Affordable Housing and Development in African cities," and a workshop on "The use of Local Building Materials/Alternative Technologies in housing construction."

Based on examination of the abstracts and full papers submitted by the Keynote speakers and authors from 30 institutions and 13 countries, I am convinced that this will be an inspiring event. Furthermore, the event will generate new insights and solutions to the myriad challenges facing the construction industry, identifying opportunities for growth and research collaborations.

Finally, I wish to thank all our Local Organising Committee and Scientific Committee members who gave their time selflessly to the organisation and realisation of the CBPM conference. I also want to thank all other individuals who played an important role in the logistical support of the conference. I wish you all a stimulating conference, and to those who made it to Cape Town, I wish you a pleasant stay.

Prof. Abimbola Windapo

Chair, Scientific Committee CBPM 2021 Conference

ORGANISING COMMITTEE

Abdulrauf Adediran	University of Johannesburg, South Africa
Amanda Mtya	University of Cape Town, South Africa
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Cecilia Mewomo	Durban University of Technology, South Africa
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Kehinde Alade	University of Cape Town, South Africa
Nnedinma Umeokafor	Kingston University London, United Kingdom

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Zakheeya Armoed	Durban University of Technology, South Africa

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 81 submissions, 41 papers were finally accepted and included in the CBPM-2021 conference proceedings.

At no stage was any member of the Scientific Committee, 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.

Prof. Abimbola Windapo

Chair, Scientific Committee CBPM 2021 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.

Dr Kgosientsho Ramokgopa



Dr Kgosientsho Ramokgopa is currently the **Head of the Investment and Infrastructure office** in the office of the President of South Africa. Before this, Dr Ramokgopa was Gauteng MEC (Member of Executive Committee) for Economic Development, Agriculture and Environment. Previously, he has held the position of Executive Mayor of the City of Tshwane between 2010 and 2016, at the time he was one of the youngest Mayors of a Metropolitan in the country. Dr Ramokgopa's previous positions include holding the position of CEO for both the Metropolitan Trading Company and the Johannesburg Market and he has previously been the Deputy Chairperson of the board of Trade and Investment in Limpopo.

Dr Ramokgopa holds a PhD and a Masters of Public Administration from the University of Pretoria, and a Masters of Business Leadership from the University of South Africa. He completed his BS in Civil Engineering at the University of Durban Westville in 1998. MEC Ramokgopa's political participation dates back to the '80s when he was 14 and participating in the Atteridgeville-Saulsville Residents Organisation (ASRO). Dr Ramokgopa offers lessons in leadership and public management at various tertiary institutions as a guest lecturer, something he does pro-bono. Dr Ramokgopa lives by the motto: "If you live truthfully, you shall prevail against all adversity."

Prof Chimay Anumba



Professor Chimay Anumba is Dean of the College of Design, Construction and Planning at The University of Florida. He is a Fellow of the Royal Academy of Engineering, FREng (the United Kingdom's National Academy of Engineering). He holds a PhD in Civil Engineering from the University of Leeds, UK; a higher doctorate – D.Sc. (Doctor of Science) – from Loughborough University, UK; and an Honorary Doctorate (Dr.h.c.) from Delft University of Technology in The Netherlands. He has over 500 scientific publications and his work has received support worth over \$150m from a variety of sources. He has also supervised 52 doctoral candidates to completion and

mentored over 26 postdoctoral researchers. He is the recipient of the 2018 American Society of Civil Engineers' Computing in Civil Engineering Award and a member of the US National Academy of Construction (NAC).

Prof John Smallwood



Prof John Smallwood is the Professor of Construction Management in the Department of Construction Management, Nelson Mandela University, and the Principal, Construction Research Education and Training Enterprises (CREATE). Both his MSc and PhD (Construction Management) addressed construction health and safety (H&S). He has conducted extensive research and published in the areas of construction H&S, ergonomics, and occupational health (OH), but also in the areas of the environment, health and well-being, primary health promotion, quality management, and risk management.

Prof Bhekisipho Twala



Bhekisipho Twala is the Executive Dean of Engineering and Built Environment and Professor in Artificial Intelligence and Data Science at the Durban University of Technology, South Africa. Before then, he was the Director of the School of Engineering at the University of South Africa and the Institute for Intelligent Systems at the University of Johannesburg. Prof Twala's current work involves promoting and conducting research in Artificial Intelligence within the Big Data Analytics field and developing novel and innovative solutions to key research problems in this area. He earned his Bachelor's degree in Economics and Statistics from the University of Swaziland in 1993; followed by an MSc in Computational Statistics from Southampton University (UK) in 1995; and then a PhD in Machine Learning and Statistical Science from the Open University (UK) in 2005. Prof. Twala was a post-doctoral researcher at Brunel University in the UK, mainly focussing on empirical software engineering research and looking at data quality issues in software engineering. His broad research interests include multivariate statistics, classification methods, knowledge discovery and reasoning with uncertainty, sensor data fusion and inference, and the interface between computing and statistics. He has particular interests in applications in finance, medicine, psychology,

software engineering and most recently in robotics and has published over 180 scientific papers. Prof Twala is currently an associate editor of the Information Sciences Journal, Intelligent Data Analysis Journal, Journal of Computers, International Journal of Advanced Information Science and Technology, International Journal of Big Data Intelligence, Journal of Image and Data Fusion, Journal of Information Processing Systems, and a fellow of the Royal Statistical Society. Other professional memberships include the Association of Computing Machinery (ACM); the Chartered Institute of Logistics and Transport (CIT), South Africa and a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE). Twala is the recipient of the TW Kambule research and its outputs award, the highest honour bestowed by the South African government on outstanding scientist for up to fifteen years after the award of a PhD or equivalent.

PROGRAMME

Construction Business and Project Management Conference, 24-25 June 2021

Venue: UCT Graduate School of Business, Cape Town/Online

Theme: *Conceptualising Challenges and Opportunities in the Construction Industry*

Day 1 - Thursday, June 24th			
2021-06-24	8:30-09:00	Registration and Welcome (Prof Bheki Twala)	
2021-06-24	09:00-09:30	Keynote Address 1	
	09:00-09:30	S1	Dr Kgosientso Ramokgopa. Contextualizing Infrastructure Delivery and Management in South Africa
2021-06-24	09:30-11:10	Session 1: Day 1: Session A. Session Chair - Prof. Abimbola Windapo	
	09:30-09:48	2	Kehinde Alade and Abimbola Windapo. A leadership and strategic decision framework for construction company survival.
	09:48-10:06	36	Luyanda Ngomane and Nthatsi Khatleli. Rethinking Resilience: A review of the infrastructure management capability maturity levels in South African category B4 municipalities: The Case of Nyandeni Local Municipality
	10:06-10:24	58	Oluwole Olatunji and Ephraim Osaghae. Dynamic Capabilities in Multicultural Project Teams: Conceptual Review, Framework Analysis, and Practical Implications
	10:24-10:42	61	Tselane Chicks and Makgopa Tshehla. Procurement Innovation and Transformation in Commercial State-Owned Enterprises (SOES) – Infrastructure Projects
	10:42-11:10	81	Amit Rambaruth, Jamila Khatoon Adam and Suresh Babu Naidu Krishna. Strategic Management in construction firms with focus on small and medium enterprises: A case study of eThekweni, South Africa
2021-06-24	11:10-11:30	Session: Tea Break	
2021-06-24	11:30-13:00	Session 2: Day 1: Session B. Session Chair - Dr Ayodeji Aiyetan	
	11:30-11:48	18	Chinedu Adindu, Chioma Okoro, Ikechukwu Diugwu and Saheed Yusuf. Prospects of Multi-skilling as Strategic Construction labour response to Covid-19 Pandemic: A Study of selected Projects in the Federal Capital Territory area councils, Nigeria.

	11:48-12:06	22	Afia Attrams and Professor Makgopa Tshehla. Determinants of small and medium enterprises financing sources: evidence from Ghana
	12:06-12:24	32	Sihle Mbekushe and Christopher Amoah. Impact of unskilled labourers on the construction productivity
	12:24-12:42	55	Athenkosi Sogaxa and Stoffel Fourie. Sustainable Construction Project delivery: A Skills Availability Assessment in the Eastern Cape Province of South Africa
	12:42-13:00	75	Justin van Wyk, St John Wilson and Mochelo Lefoka. Management Tools and Techniques Impacting On-site Labour Productivity
2021-06-24	13:00-14:00	Session: Lunch Break	
2021-06-24	14:00-14:30	Keynote Address 2	
	14:00-14:30	S2	Prof. Chimay Anumba. Towards Smart and Resilient Built Environments
2021-06-24	14:30-16:10	Session 3: Day 1: Session C. Session Chair - Dr Emmanuel Nkeleme	
	14:30-14:48	8	Bello Mahmud Zailani, Mu'awiya Abubakar, Yahaya Ibrahim Makarfi, Kabir Bala and Muhammad Sadiq Abdallah. Integrating Building Information Modelling (BIM) Tools and Techniques in Construction Organizations: Effect on Culture and Structure
	14:48-15:06	26	Dillip Das and Ayodeji Olatunji Aiyetan. Exploring the use of Drones for sustainable construction in developing countries
	15:06-15:24	41	Lily Dixon and Nnedinma Umeokafor. Determinants of Smart Technology adoption in the Construction Phase of Projects: A Scoping Study of the United Kingdom
	15:24-15:42	62	Micayla Prozesky, Shweeta Bagoandas, Amanda Mtya and Abimbola Windapo. Benefits of the adoption of digital technologies on South African construction projects
	15:42-16:00	63	Tinotenda Chirenda, Ellis Chitakatira, Reyaboka Mpeke, Amanda Mtya and Abimbola Windapo. Capability factors influencing the adoption of Building Information Modelling (BIM) by South African AEC organizations
2021-06-24	16:10-16:30	Session: Tea Break	
2021-06-24	16:30-18:00	Session 4: Day 1: Session D. Session Chair – Mr Kenny Alade	

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	16:48-17:06	19	Jan Wium and Chris Jurgens. Benefits of the application of data sciences in construction
	17:06-17:24	38	Ikechukwu A. Diugwu, Haruna Musa, Nnedinma Umeokafor and Yekeen Sanusi. A scoping study of barriers and drivers of sustainable design and construction in Nigeria
	17:24-17:42	74	Momoh Ohiomah Oboirien. Artificial neural network models: conceptualized and improved method of contingency assessment for Construction Projects in Nigeria
	17:42-18:00	78	Emmanuel Ifeanyichukwu Nkeleme, Ikem Mbammali and Winston Shakantu. Effects of combustion generated pollutants on the indoor air quality of university laboratories.
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	09:00-09:30	53	Prof John Smallwood. Adaptation, Resilience and Mental Health Post-Covid
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	09:30-09:48	17	Hassan Ahmadu, Kabiru Nasiru, Mustapha Abdulrazaq and Muhammad Aliyu Yamusa. Assessing Barriers and Facilitators to Adoption of Design for Safety by Construction Organisations in Nigeria
	09:48-10:06	37	Muziwandile Mabaso and John Smallwood. Fatal Trench Collapses on Sewer Reticulation Projects in the Construction Industry
	10:06-10:24	48	Ayodeji Olatunji Aiyetan and Opeyemi Ayobami David. Causes of fatality relative to construction site accidents in the KwaZulu-Natal construction industry
	10:24-10:42	53	Mwewa Mambwe, Erastus Mwanaumo, Wellington Thwala and Clinton Aigbavboa. Employee Wellbeing Factors for Improving Occupational Health and Safety Performance by Small-Scale Electrical Contractors in Zambia
	10:42-11:00	60	Takalani Sigama, Mabila Mathebula and John Smallwood. The impact of Business Forums on Construction Health and Safety (H&S) in South Africa

	15:24-15:42	65	Modupe Mewomo and Ayodeji Aiyetan. Unethical Behaviour in Construction Industry – The South African Construction Professionals Views.
	15:42-16:00	76	Makgopa F Tshehla and Tsholofelo M Mokoma. The effect of Incubation Programme Small, Micro and Medium Enterprises Development: A cross-sectional survey
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	16:48-17:06	25	Dillip Das. Impact of construction for the expansion of National Highways on the local environment in India.
	17:06-17:24	43	Umar Obafemi Salisu, Nathaniel Oluwaseun Ogunseye, Ayobami Ademola Akanmu, Simeon Oluwagbenga Fasina, Wakeel Iyanda Solabi and Abee Olawale Olanipekun. Environmental Implications of Construction Activities in A Fast-Growing Nigerian City: A Study of Ota, Nigeria
	17:24-17:42	51	Fatimo Osho and Adeshina Dauda Adebayo. Effect of Moisture on Durability of Concrete Components in Residential Buildings
	17:42-18:00	73	Samuel Olatunbosun and Sunday Odediran. Impact of Energy Access on the Delivery of Construction Projects in Lagos Metropolis, Nigeria
	18:00-18:18	79	Dele S. Kadiri, Obiora K. Uroko, Babajide O. Onabanjo and Elijah O. Oyewole. An Evaluation of Planning Techniques Impacting Construction Project Performance in Nigeria
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Effect of Total Quality Management on the Safety Performance of Construction Firms in Nigeria: Construction Professionals' Perception in Federal Capital Development Authority, Abuja

Abdullateef Adewale Shittu¹, Yakubu Danasabe Mohammed², Rasheed Temitope Ayodele³, Ibrahim Inyass Adamu⁴, Sani Ibrahim⁵ and Shakirat Remilekun Abdulazeez⁶

^{1,2,3,4}Department of Quantity Surveying, School of Environmental Technology, Federal University of Technology, Minna, Nigeria

Email: funsho@futminna.edu.ng; latishittu74@gmail.com, yaksmoves@yahoo.com, mrtopeqs@gmail.com, iadamu640@gmail.com

⁵Department of Quantity Surveying, Niger State Polytechnic, Zungeru, Nigeria
Email: sahim10@gmail.com

⁶Department of Estate Management, Waziri Umaru Federal Polytechnic, Birnin Kebbi, Nigeria
Email: shakiratabdulazeez25@gmail.com

Abstract:

Past studies revealed that the lack of Total Quality Management (TQM) implementation in construction projects in Nigeria leads to poor safety performance on construction sites. This study assessed the effect of TQM on the safety performance of construction firms in Nigeria. A quantitative research approach was employed through the use of a questionnaire survey. One hundred twenty-seven copies of the questionnaire were administered to construction professionals in Federal Capital Development Authority (FCDA), Abuja, with a response rate of 48%. Relative Importance Index (RII), Mean Item Score (MIS) and Spearman Rank correlation analysis were employed for data analyses. It was revealed that: TQM practices have a significant effect on the safety performance of construction firms ($p < 0.01$), and strategies for improving TQM practices of construction firms are effective (Group MIS = 4.19). However, it was concluded that the effect of TQM on the safety performance of construction firms in Abuja is significant. It was recommended that management of construction firms adopt TQM practices right from the conception stage to implement TQM practices throughout the project life cycle. The study's findings are beneficial to construction firms and built environment practice by revealing effective strategies that can bring about 84% improvement in construction firms' safety performance.

Keywords:

Construction Firms, Effect, Safety Performance, Strategies, Total Quality Management.

1 Introduction

Total Quality Management (TQM) has been described as a modern system in the field of quality as defined by quality assurance and quality control. Nowadays, many firms have embraced the application of quality to improve construction practices' safety and improvement (Koutsougiannis,

2020). Lack of strict policies on building construction regulations often leads to TQM practices being neglected in Nigeria (Fde, 2016). This often leads to high rates of accidents, hazards and unsafe practices, among other issues in Nigeria, which affects construction workers' safety performance. In line with all these, one of the factors affecting safety performance is an organisational factor referred to as factors that could cause accidental conditions in the context of safety performance. Researches have revealed the relationship between organisational factors and worker's safety behaviour (Neal *et al.*, 2000; Zacharatos *et al.*, 2005) and safety outcomes such as injuries, incidents, and accidents (Hunag *et al.*, 2006).

From a theoretical standpoint, quality management and safety management programs have similar characteristics. In construction work, a company's ability to deliver a quality product safely is the key to business success. The similarity between quality management and safety management has been well articulated by researchers (Kwan, 2016). In the light of TQM principles, some safety management theorists have drawn an analogy and put forward different Total Safety Management (TSM) models in the hope of achieving a significant leap forward in safety management. Hence, a positive relationship exists between TQM and safety management (Husin *et al.*, 2008; Kwan, 2016). Therefore, TQM tends to bring about improved safety performance at construction sites.

Unfortunately, the use of TQM has not been adequately researched in the realm of health and safety (H&S) of construction workers on-site (OSTN, 2006; Issa *et al.*, 2020). Although TQM ideas have been around for many years, their concepts and principles have not been generally applied to continuous safety improvement as a management strategy in occupational safety and health (OSTN, 2006). On the other hand, TQM has been practised in developed countries while the concept is still new in developing countries (Issa *et al.*, 2016). This study, therefore, focused on the lack of implementation of TQM in construction projects which leads to injury and illness incidence rates in the construction industry being higher than in all other industries as a result of the frequent occurrence of accidents and injuries to workers at workplaces. This leads to poor H&S performance on construction sites.

Given the problem identified above, it is imperative to note that the safety performance of construction workers is paramount in getting a good return for human resources. Therefore, a quality manager is assigned to each project to be responsible for the implementation and coordination of quality control. However, there is still a failure of the safety performance of construction workers on-site as the number of accidents that occurs in the construction industry is still very high compared with other industries. In order to solve the problem identified, this study assessed the effect of TQM on the safety performance of construction firms in Abuja, Nigeria, to improve the safety performance of construction firms. The following objectives were pursued in order to achieve the study's aim:

- i. To identify the stages of construction projects where TQM practices are most required.
- ii. To examine the TQM practices required for the improvement of the safety performance of construction firms.
- iii. To determine the safety practices of construction firms most likely to be influenced by TQM practices.
- iv. To determine the relationship between TQM and the safety practices of construction firms.
- v. To propose strategies for improving TQM practices for the enhanced safety performance of construction firms.

In view of the fourth objective of the study and the review of literature relating to it (Section 2.4), the following hypothesis was formulated for the study:

H₁: There is a significant relationship between TQM and the safety practices of construction firms.

2 Literature Review

This section gives a detailed discussion of the main theme of the aim and objectives of the study. This provides a reasonable basis for identifying the major variables required for the study's fieldwork.

2.1 Stages of Construction Where TQM Practices Are Most Required

Several procedures must be undergone for a successful project outcome, from the simplest to the most complex stage of a construction project. In construction, projects usually vary based on size, the number of stakeholders involved, budget and date of delivery. Irrespective of the case, however, a construction project is always a long and demanding process. It is therefore interesting to note that management of the distinct phases of a project is easily achievable now with higher precision due to the continuous progress of digital solutions; because of this, six main stages of a construction project where the use of TQM may be required were identified (Koutsougiannis, 2020). These are: Conception of the project; Design Stage; Pre-construction stage; Procurement stage; Construction stage; Post-construction stage.

2.2 TQM Practices Required for the Improvement of Safety Practices of Construction Firms

The management leadership's most important responsibilities for effective implementation of TQM practices led to a significant correlation between leadership management and soft TQM practices. Therefore, it is essential to emphasise that management leadership is a key factor in successfully implementing TQM practices (Mokhtar & Yusof, 2010). Soft TQM practices include education and training, employees' relationship, client's focus, and supplier's management, while hard TQM practices include process management, quality & data reporting, and product & service design (Ahmad *et al.*, 2014). Reporting further on the factors influencing TQM practices, the following were identified: top management, human resources management, education & training, clients' focus, information & analysis, continuous improvement, process management, and supplier management (Faihan *et al.*, 2013). Going by the assertion of past studies (Mokhtar & Yusof, 2010; Faihan *et al.*, 2013; Ahmad *et al.*, 2014), TQM can therefore be viewed as a quality-oriented approach affecting quality performance that has been corroborated by leading studies (OSTN, 2006; Husin *et al.*, 2008; Kwan, 2016; Issa *et al.*, 2020). In view of this, it has been submitted that the characteristic features of TQM practices (management leadership, process management, employees' involvement, and client's focus), as earlier identified, are main parameters that have been generally agreed upon by past studies to be capable of improving the quality performance of organisations (Sadikoglu & Zehir, 2010). Critically viewing the attributes of TQM practices, it can be understood that the attributes can be very influential in the improvement of the safety practices of construction firms.

2.3 Safety Practices of Construction Firms Most Likely to be influenced by TQM

The adoption of TQM practices in a firm builds up a culture which seeks to enhance all pursuits consistently, and especially it concentrates on an entire knowledge of the numerous business

procedure by the usual daily participation of all involved (Neal *et al.*, 2000; Zacharatos *et al.*, 2005; Ughoro & Obeng, 2010). The construction industry becomes more popular with a fewer rate of accidents. Keeping workers aware of safety issues, training them on these issues, communicating and discussing ways to improve these safety programs and concerns, and documenting these issues are the leading measures for reducing the rate of accidents. Regardless of this, TQM can influence some of the safety practices undertaken by a construction firm through the following practices: Awareness, Training, Communication, Documentation, Proper Equipment, Supervision and Transparency (ILO, 2005; Adediran & Adediran, 2008; Health and Safety Authority, 2013; Faihan *et al.*, 2013).

2.4 Impact of TQM on Safety Performance of Construction Workers

In TQM, quality is everyone's business; it can be achieved only through mutual trust, coordination, and teamwork (Mohamed, 1997). It needs the Project Manager (PM) to participate in the process instead of inspecting it. As a foremost principle of TQM, top management entails a deep commitment from the PM on-site and leadership on his part. The responsibility of the PM is to ensure that proper equipment is given to workers and an adequate work area for the job at hand. Therefore, a lack of proper equipment leads to an unsafe construction site. This is because there may be an avenue for someone to get injured on-site, and workers are prone to errors without proper equipment. Provision of water always is also important to prevent dehydration. It is also essential to keep to time for rest and break of workers from the PM as lack of rest in time might impact their safety. From the perspective of supplier management at the TQM implementation level, it follows through with what quality and what standard of materials are being brought to the site. This significantly aids in avoiding any slight accident that is likely to occur due to low-quality material standards.

Furthermore, training is also an important principle of TQM. The preparation of employees for the TQM process is enhanced by organising training programmes. Therefore, these imply that TQM impacts workers' safety performance by making them go through rigorous training to help them be better at what they do (Husin *et al.*, 2008; Ali & Omran, 2016). Similarly, it was revealed that the safety performance of the workers might depend impactfully on the construction firm, out of the measures to be improved upon by TQM in the construction industry, as this assures of quality work to be done on-site, the good rhythm of working by the workers on-site and fast work on-site as the workers will be joyful that their safety is kept at the utmost of the construction (Hasse *et al.*, 2015).

In line with the above, it has been established by past studies that there exists a positive relationship between TQM practices and workers'/company's productivity or performance (Loushine *et al.*, 2006; Husin *et al.*, 2008; Kwan, 2016). This, therefore, implies that TQM is an ethical and holistic strategy of a firm in terms of continuous improvement in products/services or processes, including all stakeholders, to bring about clients' satisfaction and improvement of the performance and sustainability of firms. In view of this, all aspects of TQM practices should be effectively managed in a firm (Sadikoglu & Olcay, 2014).

2.5 Strategies for Improving TQM Practices for Enhanced Safety Performance

Studies have identified several Mohamed (1997) suggested the following strategies for improving TQM practices for enhanced safety performance (Mohamed, 1997; Willar, 2012; Kakkad & Ahuja,

2014; Ali & Omran, 2016). These strategies for improving TQM practices for improved project performance are summarised as follows:

- i. Organisations should ensure the availability of quality records that comply with quality procedures and the need to retain quality procedures for a specified period.
- ii. Strategic identification conduct should be employed to discover job competency gaps that will address skills and training.
- iii. Organisations should create standard working systems for the check to occur at all basic phases of procedures identified.
- iv. Evaluation exercises ought to show how the subcontractors' item will be confirmed; the area of review and test focuses, acknowledgement criteria; and witness check focuses.
- v. Persistent quality mindfulness programmes should be developed at all levels of the organisation.
- vi. Organisations should develop a multi-purpose planned prize framework to expand staff motivation.
- vii. Organisations should develop quality goals that can be estimated, with the outcomes being checked and conveyed.

It has been revealed by some of these past studies that these strategies are so effective that they can bring about 82% improvement in safety performance at construction sites (Ali & Omran, 2016). Imperatively, the studies reviewed have emphasised that these strategies are effective strategies for improving TQM practices for enhanced safety performance.

3 Research Methodology

A quantitative research approach was employed for the study. The use of a well-structured questionnaire was adopted for data collection. Descriptive statistical tools were used to analyse the data collected. Research population involves a large collection of individuals or object that is the focus of a scientific query. It refers to the total number of the considerable population for the research (Morenikeji, 2006). The targeted population for this research was made up of selected construction professionals (Architects, Quantity Surveyors, Builders and Engineers) working in Federal Capital Development Authority (FCDA) in Abuja. There are a total of 286 professionals in FCDA, and 194 of them are registered under their respective professional bodies. The population size is, therefore, 194. The sample size for the study is 127 based on Krejcie and Morgan (1970) Table. The representative sample size for a population size of 190 on Krejcie and Morgan (1970) Table is 127. Since the population size of 190 is the nearest number to 194 on Krejcie and Morgan (1970) Table, then the sample size for this population size (127) was adopted for this study. A simple random sampling technique was adopted to select the sample size from the entire population. Therefore, 127 professionals were randomly selected from the total number of professionals in FCDA (194).

The study considered Abuja and FCDA in Abuja because Abuja is the capital city of Nigeria, and as a result, it is the hub of all construction activities due to the rapid development that takes place there (Kadiri *et al.*, 2014). In addition, all the medium and large-sized construction firms in Nigeria usually have construction projects in Abuja. FCDA is a Government organisation in Abuja that is massively and actively involved in construction projects ranging from simple housing projects up to heavy roads and other related engineering construction projects. FCDA is also one of the major

clients and initiator of construction projects in Abuja. FCDA also have competent professionals who oversee project supervision and vested with the responsibilities of ensuring compliance to site safe and quality management. Because of this, construction professionals in FCDA were considered for the study.

The data for the study were collected with the aid of a questionnaire survey during the tail end of the COVID-19 pandemic lockdown up to the last quarter of 2020. A structured questionnaire was employed to collect data on the research objectives based on a five-point Likert's Scale format. The questionnaire contains five sections. The first section addressed issues relating to the profile of respondents, while the other section addresses the study's objectives respectively. Of the 127 copies of a questionnaire distributed, 61 copies were returned and used, giving a response rate of 48%. In order to validate the research instrument used, a reliability test was carried out on the data collected. The reliability test result shows that all the items loaded have a fairly good correlation coefficient ($r = 0.337 - 0.567$). A high Cronbach's Alpha of 0.773 was observed, indicating that the research data are reliable and hence the research instrument is valid.

Analysis of data was carried out using descriptive methods of analysis such as Frequency, Percentage, Relative Importance Index (RII), Mean Item Score (MIS) and Spearman's Rank Correlation analysis. RII was employed to examine stages of construction where TQM are most required. MIS was used to examine the TQM practices required to improve the safety performance of construction firms. MIS was also used to identify the safety practices most likely to be influenced by TQM practices. Spearman's Rank Correlation analysis was used to determine the relationship between TQM and safety practices of construction firms. MIS was also employed to examine the strategies for improving TQM practices for the enhanced safety performance of construction firms in order of effectiveness. The decision rule adopted for the RII and MIS is summarised in Table 1.

Table 1. Decision Rule for Data Analysis

SCALE	Cut-Off Point		Interpretation			Level Required
	RII	MIS	Level of Importance	Level of Significance	Level of Effectiveness	
5	0.81 - 1.00	4.51 - 5.00	Very Important	Very Significant	Very Effective	Very Required
4	0.61 - 0.80	3.51 - 4.50	Important	Significant	Effective	Required
3	0.41 - 0.60	2.51 - 3.50	Fairly Important	Fairly Significant	Fairly Effective	Fairly Required
2	0.21 - 0.40	1.51 - 2.50	Less Important	Less Significant	Less Effective	Less Required
1	0.00 - 0.20	1.00 - 1.50	Least Important	Least Significant	Least Effective	Least Required

(Source: Adapted and Modified from Shittu *et al.*, 2015)

4 Findings and Discussion

4.1 Results and Discussions on the Stages of Construction Projects where TQM Practices are most required

Relative Importance Index (RII) was employed to rank the identified stages of construction projects where TQM practices are most required in order of importance. This RII result is presented in Table 2.

Table 2. Stages of Construction Projects where TQM Practices are most required

CODE NO	STAGES	RII	RANK	DECISION
B1	Conception Stage	0.92	1st	Very Important
B4	Procurement Stage	0.87	2nd	Very Important
B5	Construction Stage	0.87	2nd	Very Important
B2	Design Stage	0.84	4th	Very Important
B6	Post-construction Stage	0.80	5th	Important
B3	Pre-construction Stage	0.78	6th	Important
	<i>Group RII</i>	<i>0.85</i>		<i>Very Important</i>

Table 2 shows the results of five (5) identified stages of construction projects where TQM practices are most required. The result shows that the conception stage is the most important stage, with an RII value of 0.92. This is followed by the procurement stage and construction stage, which are also very important, with RII values of 0.87 each. The design stage is the next ranked stage which is also very important with an RII value of 0.84. The least ranked are the pre-construction and post-construction stages, which are important with RII values of 0.80 and 0.78, respectively. Averagely, all the identified stages of construction projects where TQM practices are most required are very important (Group RII = 0.85). The study of Koutsougiannis (2020) slightly disagrees with this by indicating that the stages where TQM will be mostly required in the stages of construction projects are the pre-construction stage, construction stage and procurement stage. This study shows that all the stages are very important to TQM application, with the conception stage as the most important.

4.2 Results and Discussions on the TQM Practices Required for Improvement of Safety Performance of Construction Firms

Mean Item Score (MIS) was employed to rank the level of the requirements of the identified TQM practices required to improve the safety performance of construction firms. This result is presented in Table 3.

Table 3. TQM Practices Required for Improvement of Safety Performance of Construction Firms

CODE NO	TQM PRACTICES	MIS	RANK	DECISION
C1	Human Resources Management	4.52	1st	Very Required
C4	Suppliers Management	4.51	2nd	Required
C3	Process Management	4.31	3rd	Required
C6	Customer Focus	4.25	4th	Required
C5	Training	4.23	5th	Required
C2	Top Management	4.10	6th	Required
C7	Workers Relationship	4.08	7th	Required
	<i>Group MIS</i>	<i>4.29</i>		<i>Required</i>

Table 3 shows that seven major TQM practices are required to improve the safety performance of construction firms in Abuja. It was shown that Human Resource Management and Suppliers' Management are the most required TQM practices with MIS values of 4.52 and 4.51, respectively. The other five (5) TQM practices are also required. These range between Process Management (MIS = 4.31) and Workers Relationship (MIS = 4.08). On average, all the identified TQM practices for improving the safety performance of construction firms in Abuja are required (Group MIS = 4.29). The studies of Sadikoglu & Zehir (2010), Mokhtar & Yusof (2010), Ahmad *et al.* (2014) and Faihan *et al.* (2013) also confirmed, in agreement with the finding of this study, that the dimensions of TQM such as management leadership, process management, employee involvement and customer focus are commonly accepted activities to improve the quality performance of firms. This also shows that these TQM practices can be very influential in improving the safety performance of construction firms.

4.3 Results and Discussions on the Safety Practices of Construction Firms Most Likely to be Influenced by TQM Practices

MIS was also adopted for ranking the identified safety practices of construction firms most likely to be influenced by TQM practices. This MIS result is presented in Table 4.

Table 4. Safety Practices of Construction Firms Most Likely to be influenced by TQM Practices

CODE NO	SAFETY PRACTICES	MIS	RANK	DECISION
D1	Proper Equipment Usage	4.67	1st	Very Likely
D6	Supervision of work carried out.	4.25	2nd	Likely
D7	Transparency of duties and information.	4.23	3rd	Likely
D2	Awareness	4.20	4th	Likely
D3	Training of Staffs	4.20	4th	Likely
D5	Communication within Workers and management	4.17	6th	Likely
D4	Documentation of Work progress	4.15	7th	Likely
	<i>Group MIS</i>	<i>4.27</i>		<i>Likely</i>

As shown in Table 4, the study identified seven major safety practices of construction firms likely to be influenced by TQM practices. It was revealed that Proper Equipment Usage (MIS = 4.67) is the safety practice of construction firms most likely to be influenced by TQM practices. The remaining six (6) safety practices of construction firms also have high chances of being influenced by TQM practices. These range from Supervision of Work Carried Out (MIS = 4.25) to Documentation of Work Progress (MIS = 4.15). On average, all the safety practices of construction firms identified have a high likelihood chance of being influenced by TQM Practices (Group MIS = 4.27). The study of Adediran & Adediran (2008) slightly differs from the finding of this study by revealing that through training, workers can identify improvement opportunities as it is directed at providing the skills and knowledge required for all workers to be able to contribute to the ongoing quality improvement process of production. In this study, Proper Equipment Usage is the safety practice of construction firms most likely to be influenced by TQM practices instead of training in the study of Adediran & Adediran (2008).

4.4 Results and Discussions on the Relationship between the Level of Implementing TQM and Firms' Safety Performance

Spearman rank correlation was employed to determine the relationship between the level of implementing safety TQM practices and construction firms' safety performance. The correlation result is presented in Table 5.

Table 5: Relationship between the Level of Implementing TQM and Firms' Safety Performance

VARIABLES		OBSERVATIONS		INFERENCES		
X ₁	X ₂	R (%)	LOS	P _{value}	Strength of Relationship	Remark
Level of Implementing TQM Practices	Firms' Safety Performance	42.0 (0.420)	0.01	0.001	Slightly Strong	SS

KEY:

- SS = Statistically Significant
- R = Correlation Coefficient
- LOS = Study's Level of Significance
- P_{value} = Calculated Probability Value

It was observed from Table 5 that there exists a slightly strong, positive and significant relationship between the Level of Implementing TQM practices and Firms' Safety Performance. The correlation coefficient (R-value) observed was 42% (0.420), indicating a slightly strong association between the variables. The probability (P_{value}) value of 0.001 observed was less than the level of significance adopted for the study (0.01). This implies a significant relationship between the variables. The study's hypothesis (H₁) was therefore accepted. The positive correlation observed between the variables indicates a tendency that an increase in the level of implementing TQM practices will increase firms' safety performance and vice versa. In line with the finding of this research, Husin *et al.* (2008) reported that a positive relationship exists between TQM and safety practices. Sadikoglu & Olcay (2014) also reported that TQM practices improve various performance measures in the firms, including safety. Hasse *et al.* (2015) also revealed that training is another principle of TQM that aids the preparation of employees towards the TQM process. Therefore, TQM has a significant impact on workers' safety performance by making them go through rigorous training to help them be better at what they do.

4.6 Results and Discussions on the Strategies for Improving TQM Practices for Enhanced Safety Performance

MIS was also adopted to rank the identified strategies for improving TQM practices for enhanced safety performance in the order of effectiveness. This MIS result is summarised in Table 6. The result of the ten (10) identified strategies for improving TQM practices for the enhanced safety performance of construction firms in Abuja is presented in Table 6. It was shown that the most effective strategy for improving TQM practices for the enhanced safety performance of construction firms is Appointing a Quality Consultant with an MIS value of 4.48. The remaining nine (9) TQM practices for the enhanced safety performance of construction firms are also effective, with high MIS values ranging between 4.36 (Job Competency has to be ensured among workers on site) and 3.97 (Setting up persistent quality mindfulness program). On average, all the identified strategies for improving TQM practices for enhanced safety performance in Abuja are

effective (Group MIS = 4.19). Similarly, the studies of Mohamed (1997), Willar (2012) and Kakkad & Ahuja (2014) emphasised that these strategies are effective strategies for improving TQM practices for enhanced project performance. In addition, Ali & Omran (2016) revealed that these strategies are so effective that they can bring about 82% improvement in safety performance at construction sites.

Table 6. Strategies for Improving TQM Practices for Enhanced Safety Performance

CODE NO	STRATEGIES FOR IMPROVING TQM PRACTICES	MIS	RANK	DECISION
E1	Appointing a Quality Consultant	4.48	1st	Effective
E10	Job Competency has to be ensured among workers on site.	4.36	2nd	Effective
E2	Making a Quality standard	4.28	3rd	Effective
E4	Make available education and training requirements for all levels of staff.	4.20	4th	Effective
E3	Create organisational structures and assign responsibilities	4.18	5th	Effective
E7	Planning prize framework to expand staff inspiration and fulfilment	4.18	6th	Effective
E5	Assessment and testing exercises (counting any examination and test plans)	4.15	7th	Effective
E9	The field managers ought to be very responsive to workers.	4.08	8th	Effective
E8	Successful costing of administration or item is given.	3.98	9th	Effective
E6	Setting up a persistent quality mindfulness program	3.97	10th	Effective
	<i>Group MIS</i>	<i>4.19</i>		<i>Effective</i>

5 Conclusion and Further Research

The study revealed that the Conception Stage is the most important stage of construction projects where TQM practices are required. Human Resource Management and Suppliers' Management are the most required TQM practices. Proper Equipment Usage is the safety practice of construction firms most likely to be influenced by TQM practices. The relationship between TQM practices and the safety performance of construction firms is significant. The most effective strategy for improving TQM practices for the enhanced safety performance of construction firms is Appointing a Quality Consultant. Therefore, it can be concluded that the effect of TQM on the safety performance of construction firms in Abuja, Nigeria, is significant. Therefore, proper implementation of TQM practices improves the safety performance of construction firms. Based on the findings and conclusions of this study, the following recommendations were made:

- i. The management of construction firms should adopt TQM practices right from the conception stage of a project to ensure that TQM practices are implemented throughout the project life cycle.
- ii. Construction firms should focus more on Human Resource Management and Suppliers' Management when implementing TQM practices to build up a mechanism for improving the safety performance of construction firms.

- iii. Construction firms should prioritise the strategy of Appointing a Quality Consultant when setting up a mechanism for improving the safety practices of workers on site. This will ensure continuous improvement of the relationship between TQM practices and the safety performance of construction firms.

The findings of this study will make a significant contribution by enabling construction firms to cajole their Quality Managers into doing more to improve the safety performance of construction workers on site. This will also improve the safety performance of the built environment practice at large in Nigeria.

In the light of the limitations of this study, the following are suggested for further studies: Impact of TQM practices on the performance of safety supervisors in construction projects; Comparative analysis of the effect of TQM practices on the safety performance of small, medium, and large-sized construction firms in Nigeria; and Comparative analysis of the effect of TQM practices on the safety performance at various stages of construction projects in Nigeria.

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