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CONSTRUCTION HEALTH AND SAFETY RESEARCH IN NIGERIA: TOWARDS A SUSTAINABLE FUTURE

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This paper presents a systematic review of Construction Health and Safety (CH&S) research in Nigeria, identifying and analysing the current trend, dissemination and implications including its alignment to addressing CH&S problems. Of the 6241 papers published in conference proceedings and found after systematic literature searches of journals and databases over a 36-year period, 49 relate to CH&S in Nigeria. There is evidence of growing interest in CH&S research, but it mainly centres on creating awareness on site safety and the causes of accidents (14 of the 49 studies); regulation and standards, and safety performance are six studies respectively; but none on design for safety and advanced technology. Twenty-two papers are in peer-reviewed international conference proceedings, eight are in highly rated journals, the rest are published in low-ranking (including non-referred) journals. Quantitative strategies remain dominant, 30 of the 49 papers, qualitative strategies are only three, and mixed methods account for 13. By implication, CH&S knowledge and improvement measures are lagging behind compared to other countries. There are indications that the direction of CH&S research may not be aligned to addressing the problems in the society. Hence, there is need for a shift in research focus and attitudes.

Keywords: Academics, Construction, Health and safety, Trend, Nigeria.

BACKGROUND AND RATIONALE

The roles of academics and research in socioeconomic development and policymaking have inspired much research, for example, Ejohwomu and Oshodi (2014) and Laryea and Leiringer (2012). Evidence shows the imperativeness of ensuring quality and currency in research, but most importantly, its ability to adequately address problems towards socioeconomic development (AlSehaimi et al., 2013; Laryea and Leiringer, 2012; Zou et al., 2011). Consequently, authors, for example, AlSehaimi et al. (2013), Ejohwomu and Oshodi (2014), Laryea (2011), Laryea and Leiringer (2012) and Zou et al. (2011) assess the research output of the built environment at various capacities including the topics covered, the research strategies and methods, and the practicality of the recommendations.

In a review of five high-ranking international journals and the International Council for Research and Innovation in Building and Construction (CIB) W099 proceedings, all in 2009, Zou et al. (2011) found that researchers mainly adopt the objectivist position in construction safety research—43.2% were quantitative methods papers. Further, 'organisational factors, such as safety policy, safety management frameworks and tools, and safety procedures, have been the main objects of construction safety research' (Zou et al. 2011: 957). Zou et al. (2011)

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indicate that the direction of construction safety research may not be aligned to addressing the problems of the construction industry including in Health and safety (H&S), which may have resulted in the non-implementation of safety management research findings. While the study of Zou et al. (2011) is indicative because of the limited duration of the conferences and journals reviewed, it offers insight into what may obtain. A review of 15 CIB W099 conference series from 1994–2012 shows that Africa is underrepresented but well represented when the conference was held in South Africa and New Zealand in 2005 and 2011 respectively (Finneran and Gibb, 2013). In terms of Nigeria, Ejohwomu and Oshodi (2014) indicate that CH&S research is underrepresented in construction management research, Nnaji et al. (2017) show the dearth of CH&S literature, and Umeokafor (2017) highlights the skewness of the CH&S research but not extensively and in detail as the current study. Nevertheless, CH&S research trend, dissemination and implications including alignment to addressing CH&S problems remain unexamined. The current study fills this gap. According to Zou et al. (2011), this would help avoid the non-implementation of research findings.

The record of CH&S in general is poor with fatality and injury rates the highest among other industries (Health and Safety Executive (HSE), 2016). The case is worse in developing countries. For example, in Nigeria, a study of 115 contractors in the South West, Agbede et al. (2016), found a low level of senior management involvement in H&S where 18% claim their directors have CH&S responsibilities and only 8% review H&S plans during construction. The regulatory system is dysfunctional and fragmented, compliance with H&S laws is very low, and there is little or no governmental attention to H&S (Umeokafor, 2017).

In improving CH&S in general, including Nigeria, there is the need for research that is robust and pragmatic in addressing CH&S issues but most importantly progress with time to ensure currency. Based on the premises established so far, this study examines and analyses the CH&S research output in Nigeria over a 36-year period with the overarching aim of identifying and analysing the current trend, dissemination and implications including its alignment to addressing CH&S problems. In doing this, these questions will be answered:

- What is the coverage of CH&S research during the period?
- What are the implications of the CH&S research coverage during the period?
- How did the theme or focus of the CH&S research change during the period?
- Where are the research outputs disseminated?
- What and how are the research contributions of its academics to current strategies for improving CH&S?
- What is/are the dominant research method(s) during the period?

The study shows the current trend of CH&S research in Nigeria, guides its future direction, improves its knowledge and skills (Ejohwomu and Oshodi, 2014), but most importantly aims to align it towards addressing problems in the industry including CH&S (Zou et al., 2011).

METHODOLOGY

An extensive systematic search of the literature on Google Scholar, Scopus, five international journals and the proceedings of three international conferences, all highly ranked, was followed by content analysis of the relevant studies, and discussion. The selection of the journals builds on the framework in Zou et al. (2011: 955) and Laryea (2011). Firstly, the journals must meet the criteria for high rating set by Excellence in Research for Australia (ERA) for ranking

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journals and conferences and rated A+ or A by them (Zou et al., 2011). Secondly, they must relate to construction research. Analogously, Laryea (2011: 204) assesses the contribution of built environment academics by reviewing international highly-rated journals based on the ranking of Chau (1997) where the 'Bibliometric information available in Journal Citation Reports; Scopus; Journal Impact Factors; Thomas Reuters Web of Knowledge;' and ERA rating was used. The journals and conferences in both studies are in Table 1. Google Scholar and Scopus were also searched with keywords such as 'construction safety in Nigeria', 'accidents in Nigeria construction' and 'safety in building in Nigeria'. The initial searches were in December 2017 and early January 2018, but revised or repeated in March 2018. The last search for indexing in Scopus was on 30 March 2018. Importantly, while there is no agreement on the 'definite way of discerning "highly-ranked' journals' (Zou et al. 2011), as some high-quality journals are indexed in journal indexes such as Social Science Citation Index, the approach was adopted for internal validity.

Table 1: Journals, conferences, and databases reviewed in the current study

Journals, Conferences and databases	Period reviewed in the current study
Journal of Construction Engineering and Management *	1984–2018
Engineering, Construction and Architectural Management *	1994–2018
Construction Management and Economics *	1983–2018
International Journal of Project Management *	1983–2018
Safety Science **	1991–2018
CIB W099 Safety and Health in Construction Conference **	2010–2017
West Africa Built Environment Research (WABER) conference***	2009–2017
Association of Researchers in Construction Management (ARCOM)	2008–2017
Google Scholar	1983–2018
Scopus	2004–2018

* Examined by Zou et al. (2011) & Laryea (2011); ** examined by Zou et al. (2011);*** examined by Laryea (2011).

The journals in Table 1 were searched with the relevant keywords not limited to 'construction safety'; 'construction safety in Nigeria'; 'accidents in Nigeria'; 'hazard, safety in developing countries'; 'risk in construction' AND 'Nigeria'; 'health and safety' AND 'developing countries'. Also, the conference proceedings in the Table were analysed. In both cases, the titles were scrutinised for relevant ones after which the abstracts of the initially selected ones were further scrutinised. From the finally identified papers, the abstracts, methodologies, conclusions (but in some cases more than these) were analysed to answer the research questions of this study. The period reviewed is 1983–2018, overall. The collected data was analysed over seven arbitrarily selected intervals of six, five, five, five, five, five, and five years (1983–88, 1989–93, 1994–98, 1999–03, 2004–08, 2009–13, 2014–18).

From 2009, WABER conference was held annually until 2013 from when it became biannual. CIB W099, an international conference on CH&S organised by W099, a working commission of CIB, is held two years in a row, then one world congress, and another two years in a row.

FINDINGS, ANALYSIS AND DISCUSSION

The study found as follows: '2004–08'—one thesis, three conference and one journal papers; '2009–13'—seven conference and six journal papers; '2014–18'—one thesis, 12 conference and 17 journal publications. By implication, both conference and journal outputs more than doubled in the past fifteen years. Tables 2 and 3 show the research dissemination outlets of

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Nigerian construction academics, including high and low ranking (and even non-referred) journals. Drawing on the Tables, of the 49 papers found, 22 are published in peer-reviewed international conferences of which three are encouraged by CIB, eight are published in journals indexed in Scopus of which four are encouraged by CIB, and the rest are not indexed in Scopus. Does this mean that CH&S researchers do not consider the bibliometric information in Journal Citation Reports, Journal Impact Factors, to name but a few, or 'what'? Explanations are not limited to motives for publishing such as continuing professional development, job promotion (Adjei and Owusu-Ansah, 2016; Umeokafor and Windapo, 2017) and barriers such as the low acceptance rate of high-ranking journals (Adjei and Owusu-Ansah, 2016). Nevertheless, Laryea (2011) argues that while academics can publish in many places, high-quality research should be disseminated in leading journals in the field. The bibliometric information in Journal Citation Reports, Journal Impact Factors and Thomson Reuters Web of Knowledge indicate the leading journals in the field, and academics should consider this (Laryea, 2011). High-quality research publications 'is the most important feature of an academic CV… it is not just the quantity that matters but where they are published' (Hughes 2005 in Laryea 2011). It also counts toward the ranking of universities (Laryea 2011). The implications of this include that high-quality research outputs in low rated journals make a little impact (including readership) as against if published in highly ranked ones (Adjei and Owusu-Ansah, 2016). The publications count little to the promotion of the academics (Adjei and Owusu-Ansah, 2016), their ranking and that of the universities. Additionally, as Table 2 shows, 49 papers—the contributions of Nigerian academics—are a small fraction considering the size of Nigeria and its academics.

Table 2: Research in CH&S in Journals and conferences

Journals, Conferences and Databases	Total No of papers	No of papers on CH&S in Nigeria
Journal of Construction Engineering and Management	*530	0
Engineering, Construction and Architectural Management	*651	0
Construction Management and Economics	*545	0
International Journal of Project Management	*Over 500	0
Safety Science	*Over 1900	0
Association of Researchers in Construction Management	1090	0
CIB W099 Safety and Health in Construction Conference	411	8
WABER conference	610	9
Google Scholar	*46	**26
Scopus	*18	**6
Total	**6241**	**49**

*The papers (including those that appeared more than once) found with the keywords noted in the methodology;**The relevant papers obtained from those found after the searches.

Table 3: Details of the journals and conferences in Scopus and Google Scholar from 1983–2018

Databases	No	Indexed in Scopus and/or CIB encouraged.
Scopus		
Architectural Engineering and Design Management	1	Scopus, CIB
International Journal of Civil Engineering and Technology	1	Scopus
Jordan Journal of Civil Engineering	1	Scopus
Journal of Civil Engineering and Management	1	Scopus, CIB
Journal of Construction in Developing Countries	1	Scopus, CIB
Journal of Engineering, Design and Technology	1	Scopus, CIB

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Conferences on Google Scholar		
British Academy of Management 2016 Annual Conference	1	None of the above
CIB W107 (Construction in Developing Economies) and CIB TG23 (Culture in Construction)	1	CIB
CIB World Building Congress	2	CIB
cidb conference	1	None of the above
International Conference on Infrastructure Development in Africa	1	None of the above
Journals on Google Scholar		
American Journal of Social and Management Sciences	1	None of the above
British Journal of Economics, Management & Trade	1	None of the above
British Journal of Environmental Sciences	1	None of the above
FUTY Journal of the Environment	1	None of the above
International Journal of Business and Social Science	1	None of the above
International Journal of Civil Engineering, Construction and Estate Management	1	None of the above
International Journal of Health and Psychology Research	1	None of the above
International Journal of Innovative Research & Development	1	None of the above
International Science and Technology Journal of Namibia (ISTJN)	1	None of the above
IOSR Journal of Mechanical and Civil Engineering	1	None of the above
Journal for the Advancement of Performance Information & Value	1	CIB
Journal of Earth Sciences and Geotechnical Engineering	1	None of the above
Nigerian Journal of Environmental Sciences and Technology	1	None of the above
Nigerian Journal of Medicine	1	Scopus
Online Journal of Health Allied Sciences	1	Scopus
PM World Journal (Non-refereed)	1	None of the above
Science Journal of Environmental Engineering Research	1	None of the above
Thesis on Goggle Scholar		
MSc thesis, Eastern Mediterranean University, Cyprus	1	None of the above
Master's thesis, Covenant University	1	None of the above

Table 4 shows that CH&S research has gained recognition. From 1983–2004, there was no CH&S research, but it tripled from '2004–08' till '2009–13', and afterwards, more than doubled. This shows a growing interest in CH&S research, consistent with Nnaji et al. (2017) where a literature search of Google Scholar and Scopus shows that while H&S literature has grown in Nigeria recently—where only 35 of the 47 studies found on construction safety were relevant to workers safety and not duplications—70% were in the past seven years.

Table 4: Coverage and trend of CH&S research from 1983–2018

Focus/topic	1983–88	1989–93	1994–98	1999–03	2004–08	2009–13	2014–18	Total
Accidents e.g. causes	0	0	0	0	1	0	5	6
Behaviour-based safety	0	0	0	0	0	1	0	1
Contextual environment	0	0	0	0	0	0	2	2
Education in H&S	0	0	0	0	0	0	2	2
Environmental safety	0	0	0	0	0	2	0	2
Ergonomics	0	0	0	0	0	0	1	1
H&S in Procurement	0	0	0	0	0	0	1	1
H&S management (mgt) system & practices	0	0	0	0	0	0	5	5
Regulations & standards	0	0	0	0	0	2	4	6
Safety awareness and knowledge	0	0	0	0	0	0	1	1
Safety culture & climate	0	0	0	0	0	1	2	3
Safety innovation	0	0	0	0	0	0	1	1

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Focus/topic	1983–88	1989–93	1994–98	1999–03	2004–08	2009–13	2014–18	Total
Safety Performance & Productivity	0	0	0	0	2	2	2	6
Safety risk analysis and risk management	0	0	0	0	0	1	0	1
Site safety and mgt. eg. Equipment & facilities	0	0	0	0	1	4	4	9
Stakeholder involvement in H&S	0	0	0	0	0	0	2	2
Total					**4**	**13**	**32**	**49**

However, it is evident that the research focus is on creating awareness on the status quo of site safety (nine studies, the highest in number), accidents including the causes, safety performance, and regulation and standard, all ranking second with six studies each (Table 4). Most of the safety performance and site safety studies mainly reiterate 'common knowledge', with little or no contribution to knowledge. The table also shows that in the past decade, site safety was the main focus, but studies on regulation and standards increased. Most of the studies on accidents were in the past five years (Table 4). Okorie and Aigbavboa (2016: 507) state that 'Much has been researched on the causes of construction site accidents in Nigeria'.

In controlling risk, the hierarchy of control should be applied; it helps in eliminating risks, for example, by designing out hazards (HSE, n.d). Where this is not possible, there can be substitution where hazardous activities or materials are replaced by the less hazardous ones (ibid). This will then lead to engineering control, the third on the hierarchy, then Administrative control such as H&S training, and Personal Protective Equipment, the last control (HSE, n.d). The concept here is that the higher the control on the hierarchy, the more effective it is in risk control. As Table 4 shows, the CH&S research in Nigeria is not focussed at the top of the hierarchy such as designing out hazards, building information modelling and H&S, and advanced technology. Other areas overlooked are not limited to achieving the goal of zero incidents, subcontracting and safety management, and safety benchmarking.

The implications of this include that the knowledge on these areas in the context of Nigeria is lacking hence little or nothing to inform context-based measures; research is also lagging behind. Authors such as Kheni (2008) and Umeokafor (2017) strongly argue that without understanding the social, political, economic, and cultural contexts of developing countries, H&S issues therein will remain challenging. In other words, the solution lies in understanding and factoring in these contexts. If this is the case, then Table 4 that shows two studies on the contexts of Nigeria in terms of H&S and the gap in terms of hierarchy of control, imply that the research direction of Nigerian CH&S academics may not be aligned to address the problems in the society, consistent with the findings of Zou et al. (2011) noted elsewhere.

Drawing on Zou et al. (2011), the methodologies are presented in Table 5 covering quantitative, qualitative, mixed, review or conceptual papers. This has been purposefully simplified by comparing the methodologies and not using positivist, interpretivst, etc. views for the benefits of novice research (Umeokafor and Windapo 2017). Table 6 shows more than 49 research methods because in mixed methods, more than one method is adopted.

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Table 5: Methodologies in CH&S research from 1983–2018

Methodology	Frequency
Mixed methods	13
Others, Lab experiment	1
Qualitative	3
Quantitative	30
Review or conceptual paper	2
Total	**49**

Table 5 shows that quantitative strategies are dominant; Table 6, which shows that quantitative methods are also dominant, supports this. However, while both Tables show that Qualitative Methods and Strategies (QMS) are underrepresented, Table 6 shows an increase in the adoption of qualitative methods. Authors (e.g. AlSehaimi et al., 2013, and Ejohwomu and Oshodi, 2014) found that quantitative methods and strategies are dominant in construction research while qualitative strategies are underrepresented. Of course, there are implications for this. For example, AlSehaimi et al. (2013) found that the recommendations of studies examined in developing countries do not match the research findings because the quantitative methods adopted therein identify and describe the current state of affairs and the knowledge produced. This is where qualitative methods should have been adopted.

H&S issues are context-based and QMS have the potentials of addressing issues therein (Kheni, 2008) because they ensure 'close collaboration with industry partners, ... solving practical problems and generating new knowledge in the form of systems, models, or frameworks' (AlSehaimi et al., 2013: 411). QMSs help gain the in-depth understanding of social phenomena including H&S problems, which survey and questionnaires are unable to do. QMSs take into account the nature of the research subject in explaining its behaviour and enables interaction with the subject in their language (Kheni, 2008). Also, the 'subjects' perceptions of the world around them, the meanings, understandings and opinions about the world are of significance and can be the subject of investigation' (Kheni, 2008: 91). Admitted that quantitative methods and strategies can also address H&S issues, the adopted research methods and strategies should be fit for purpose and not based on convenience or bias against qualitative methods (Umeokafor and Windapo, 2017).

Table 6: Research methods in CH&S research from 1983–2018

Methods	1983–88	1989–93	1994–98	1999–03	2004–08	2009–13	2014–18	Total
Content analysis	0	0	0	0	0	2	4	6
Group interviews	0	0	0	0	0	0	1	1
Lab experiment	0	0	0	0	0	1	0	1
Questionnaires	0	0	0	0	5	13	21	39
Semi-structured interviews (individual)	0	0	0	0	0	1	11	12
Structured interview	0	0	0	0	0	3	0	3
Structured observation	0	0	0	0	0	3	2	5
Unstructured Observation	0	0	0	0	0	0	1	1

Umeokafor and Windapo (2017) report that the bias against qualitative research is explained by the science and engineering backgrounds of many academics in the built environment, the level of skills it requires and the culture and norm of quantitative research. Evidence shows

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that the implications of this bias include that some research questions are unaddressed or poorly addressed and some recommendations impractical (Umeokafor and Windapo, 2017).

CONCLUSIONS AND RECOMMENDATIONS

The study examined CH&S research in Nigeria, identified and analysed the current trend, dissemination and implications towards ensuring the right alignment of CH&S research in addressing problems in the industry. It shows a significantly growing interest in CH&S research but indicates that it is not aligned with addressing CH&S problems. Contextualised CH&S strategies or measures are lacking. While publications on the awareness of safety performance, site safety and accidents are high and many just reiterate what is already known, design for safety, building information modelling and safety, and advanced technology that would eliminate or substitute the hazards at the preconstruction stage remain unexamined. By implication, the research lacks currency. While QMSs would provide vital information and knowledge in CH&S, they remain underrepresented. There is the need for a shift in current research attitude and focus towards well informed and grounded research that will increase the contributions of research in problem-solving and socioeconomic development. For example, while not overlooking other topics in Table 4, research areas on more effective risk control measures such as eliminating and/or substituting the hazards at the preconstruction stage should also be considered. Adopted research methods and strategies should be fit for purpose and not based on convenience or bias against QMSs. Academics should consider publishing in high-ranking journals with the understanding that research quality contributes to university rating and their CVs. In being a guide for the future direction of CH&S research, the study advances the understanding of underexplored areas in CHS research which academics, especially the novices, students and policymakers should consider in research and H&S strategies and policies development. While the inclusion of journal indexes such as Social Science Citation Index may have produced a different result, the difference is likely to be little, if any. As the study is limited to desktop study, further research, perhaps through interviews, can seek to understand the direction of CH&S research in Nigeria.

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