



THE 18TH BUILT ENVIRONMENT CONFERENCE

CONSTRUCTION 5.0: TOWARDS A COLLABORATIVE AND PEOPLE CENTRED

15-16 July 2024
Nelson Mandela University, Gqeberha, South Africa

Book of Abstracts



International Council
for Research and Innovation
in Building and Construction

BUILT ENVIRONMENT CONFERENCE – 2024

18th Built Environment Conference – Construction 5.0: Towards A Collaborative and People-Centered Industry

15-16 July 2024

Nelson Mandela University, Gqeberha, South Africa

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12 July 2024

PREFACE

The Association of Schools of Construction of Southern Africa (ASOCSA) Built Environment conference series in its 18th year of existence continues to be one of the major cutting-edge built environment conferences on the African continent. Since its inception in 2006, the blind peer reviewed conference proceedings have been referred to by both private and public sector policy and decision makers. The series produces a post-conference edition of the Journal of Construction, which is on the list of journals approved by the South African Department of Higher Education and Training (DHET) for subsidy. The conference series continues to be endorsed by the International Council for Research and Innovation in Building and Construction (CIB), one of the largest global built environment research organizations and recognized by the Australian Institute of Building (AIB). The conference provides an interactive international forum and networking opportunities among researchers, academics, administrators and practitioners, representing institutions of higher learning, government agencies, contracting organisations, consulting enterprises, financial institutions, and other construction-related organisations.

The 18th Built Environment Conference is an in-person event. Delivering a world-class conference is not novel for ASOCSA. The conference proceedings will be published by ASOCSA within a reasonable time after the conference once all audits and verifications have been completed. The authors of a selection of the best ten to twelve conference papers will be invited to rework their papers into book chapters that will be published in a Scopus, Compendex and Web of Science indexed edited book post-conference and titled, Construction 5.0: Towards A Collaborative and People-Centered Industry. This book will be published within 12-18 months after the papers in their correct format have been submitted. Papers will also be invited to be reworked for submission to the Journal of Construction.

OBJECTIVES

The 18th Built Environment Conference with its theme of Construction 5.0: Towards A Collaborative and People-Centered Industry has a range of interesting and cutting-edge peer-reviewed research papers addressing topical issues that affect the built environment not only in South Africa but in the regions beyond. Notwithstanding the ever-increasing challenging global economic environment with shrinking sponsorship budgets, the conference continues in the tradition of previous conferences in the series and provided an international forum with clear industry development and sustainability focus. This focus provides the opportunity for researchers and practitioners from developed and developing nations to deliberate topical current issues that impact the Built Environment.

The broad objectives of the conference are:

- To provide a forum for multi-disciplinary interaction between academics and industry practitioners.
- To disseminate innovative and cutting-edge practices that respond to the conference theme and outcomes, namely Construction 5.0: Towards A Collaborative and People-Centered Industry
- To provide a world class leading internationally recognized, accredited and SCOPUS-indexed conference for the built environment; and
- To contribute to the existing built environment body of knowledge (BEBOK) and practice.

The conference organizers bring together in a single forum, a group of researchers and academics from the wide range of built environment disciplines that include engineers, architects, quantity surveyors, construction, and project managers. 'Delegates' and participants are drawn not only from South African institutions of higher education, government agencies, and other construction-related organizations but also from across the African continent and the United States.

CONFERENCE THEME AND OUTCOMES

CONSTRUCTION 5.0: TOWARDS A COLLABORATIVE AND PEOPLE-CENTERED INDUSTRY

In recent times the Industrial Revolution 4.0 also known as IR4.0 has spawned huge, unprecedented and unparalleled investment, effort and energy into the rapid development and implementation of highly innovative technologies on a global scale that include, for example, simulation, automation, Artificial Intelligence (AI), Machine Learning (ML), the Internet of Things (IoT) and robotics. Unfortunately this focus has either ignored or side-lined the human element.

On the other hand, Construction 5.0 (C5.0) which represents the next stage in [global construction advancement](#) presents an exciting vision for the future of construction characterized by high efficiency, health and safety, sustainability, and a human-centric focus, where technology complements human skills rather than replacing them.

C5.0 will involve up-skilling and re-skilling of the construction workforce to work with new technologies, incorporate the human element into all construction processes, improve working conditions, and foster a culture of creativity and innovation. To be successful, C5.0 must be tailored to the demands of the workers and the industry.

There is little doubt that the construction industry has experienced exponential change and development in recent years. The 18th Built Environment Conference will examine the selected cutting-edge concepts to determine their state of the art in the construction sector both in practice and academic research. This conference therefore seeks final responses to questions related to current conversations, debates, and empirical research on:

The conference includes papers that address, inter alia,

- Current trends and developments
- Policies
- Legislation and regulations
- Practices
- Case studies.

The internationally peer reviewed, and edited conference proceedings that contains the full papers is aimed at contributing significantly to the body of knowledge relative to the science and practice of construction not only in South Africa but everywhere where the products of construction are produced even in these new challenging times of fear and uncertainty.

Prof Theo C. Haupt
Conference Academic Chair (2024)
Durban, South Africa
July 12, 2024

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ACKNOWLEDGEMENTS

The organizing committee of the 18th Built Environment conference, held at Nelson Mandela University, Gqeberha South Africa, is grateful to the Council of the Association of Schools of Construction of Southern Africa and member universities and individuals for supporting this conference through their valued contributions. Special thanks are also extended to our conference partners for supporting the conference. Without the support received, this conference and the further development and growth of the Association of Schools of Construction of Southern Africa (ASOCSA) with respect to its mission in the region would not be possible. Additionally, this support demonstrates the commitment to the further development of the body of knowledge relative to the science and practice of construction. This commitment is deeply valued and acknowledged. Additionally, this support demonstrates the commitment to the further development of the body of knowledge relative to the science and practice of construction. This commitment is deeply valued and acknowledged.

Further thanks are extended to Dr. Progress Chigangacha (Nelson Mandela University), Dr. Mohlomi Raliile (Nelson Mandela University) and Mr Ashvin Manga (Nelson Mandela University) who worked tirelessly especially in the co-ordination of paper reviews. The organizing committee also wishes to acknowledge the selfless contributions of the Scientific and Technical Committee and panel of reviewers who ensured that each paper was rigorously refereed for inclusion in the conference proceedings and possible selection for inclusion in the published SCOPUS-indexed post-conference publication of the highest standard that satisfies the criteria for subsidy by the South African Department of Higher Education and Training (DHET).

The excellent support of our webmaster, Tamar Ellis in setting up and supporting the conference website and technical support during the conference itself is appreciated. The sterling contributions of Ferial Lombardo in the co-ordination and organization of the conference are acknowledged.

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PEER REVIEW PROCESS

To maintain and ensure the highest quality in the conference proceedings and comply with the requirements for subsidy of the South African Department of Higher Education and Training (DHET), a rigorous two-stage system of peer review by no less than two acknowledged experts in the field has been followed. In terms of this process, each abstract received was twice blind reviewed in terms of:

- Relevance to overall conference theme and objectives;
- Relevance to selected sub-theme;
- Originality of material;
- Academic rigour;
- Contribution to knowledge; and
- Research methodology.

Authors whose abstracts were accepted after a blind peer review process was completed were provided with anonymous reviewers' comments and requested to submit their full papers noting and addressing these comments. Evidence was required relative to the actions taken by authors regarding the comments received. These resubmitted papers were twice blind reviewed again in terms of:

- Relevance to overall conference theme and objectives;
- Relevance to selected sub-theme;
- Originality of material;
- Academic rigour;

- Contribution to knowledge;
- Research methodology and robustness of analysis of findings;
- Empirical research findings; and
- Critical current literature review.

Paper Outcomes		
Accepted papers	38	65.5%
Rejected/withdrawn	20	34.5%
Total Papers	58	100%

Authors whose papers were accepted after the second review were provided with additional anonymous reviewers' comments and requested to submit their revised full papers. These final papers were only included in both the conference presentation schedule and the conference proceedings after evidence was provided that all comments were appropriately responded to, having been multiple peer-reviewed for publication. At no stage was any member of the Scientific and Technical Committee or the editor of the proceedings involved in the review process relative to their own authored or co-authored papers. The role of the editors was to ensure that the final papers incorporated the reviewers' comments and arrange the papers into the final sequence based on the conference presentation schedule as captured on the conference proceedings and Table of Contents. Of the 58 papers originally received, only 38 papers were finally accepted for presentation at the conference and inclusion in the conference proceedings, representing an acceptance rate of 65.5%. To be eligible for inclusion these papers were required to receive one of three recommendations from at least two reviewers, namely:

- Accepted for publication or
- Provisional acceptance provided minor changes / corrections are made or
- To re-submit for publication provided author/s reconsider/s the areas of concern

Accepted Papers Allocation					
No.	Name of Institutions	No. of Author	Co-Authors	Total No. Authors	% By Institution
1	Nelson Mandela University (RSA)	9	17	26	26%
2	University of Wyoming (USA)	3	7	10	10%
3	University of Pretoria (RSA)	2	2	4	4%
4	Mangosuthu University of Technology (RSA)	1	0	1	1%
5	University of Johannesburg (RSA)	11	22	33	33%
6	Walter Sisulu Uni (RSA)	0	1	1	1%
7	Ladoke Akintola University of Technology Ogbomoso (Nigeria)	0	1	1	1%
8	University of South Africa (RSA)	1	0	1	1%
9	University of the Free State (RSA)	2	2	4	4%
10	Durban University of Technology (RSA)	2	4	6	6%
11	The Federal University of Technology, Akure (Nigeria)	0	1	1	1%
12	Auburn University (Nigeria)	1	0	1	1%
13	Kwame Nkrumah University of Science and Technology (Ghana)	0	1	1	1%
14	Cape Peninsula University of Technology (RSA)	1	2	3	3%
15	Central University of Technology (RSA)	1	1	2	2%
16	University of the Witwatersrand WITS (RSA)	1	0	1	1%
17	University of Kwa-Zulu Natal (RSA)	2	1	3	3%
Total		38	61	99	100%

Regards,

Theo C. Haupt
Conference Academic Chair 2024
Nelson Mandela University and University of Wyoming

TAX BENEFIT

ASOCSA is a registered Public Benefit Organization as defined in Section 30 of the Income Tax Act and a registered Section 21 Company as defined in the Companies Act. Therefore, all donations made to ASOCSA will be fully deductible for income tax purposes and a section 18A certificate, for proof of deductibility will be issued to the donor upon receipt of the donation. The deductible donation is limited to 10% of the donors' taxable income before providing for Section 18A and Section 18 deductions.



History

ASOCSA is not the first attempt to form a body that addresses, inter alia, matters of construction education and training. In the days of the Building Industries Federation South Africa and the National Development Fund there were regular annual meetings of the Heads of Departments that offered construction-related programs. Recognizing the two-tiered higher education sector in South Africa, there were separate meetings for universities and the former technikons. In the more recent past, the Chartered Institute of Building - Africa initially convened annual educators' forums that did not quite fulfill the same function as the previous forums. However, during 2005 the very first meeting of University Heads of Departments drawn from all higher education institutions in South Africa met for the very first time since the re-landscaping of the sector in the same venue to discuss matters affecting construction, and particularly construction education in the country. This meeting was repeated in 2006 where the need was expressed for the establishment of a formal forum / association of universities to engage in discussion / debate / collaboration / promotion of matters of mutual interest and so ASOCSA was born.

Broad Aims

ASOCSA aims to be the professional association for the development and advancement of construction education in Southern Africa, where the sharing of ideas and knowledge inspires, guides and promotes excellence in curriculums, teaching, research and service. To achieve this aim ASOCSA is partnering with the construction industry to find ways to effectively represent the interests of both construction academic and industry practitioners. ASOCSA will offer a variety of programs and services designed to help its members serve their customers more effectively and succeed in an increasingly challenging environment of construction information management and technology. To this end ASOCSA provides a forum for the debate and discussion of issues of mutual interest to all industry stakeholders. For example, one of the tasks of ASOCSA will be supporting the development of curriculums that address the needs of the construction sector in the Southern African region. ASOCSA convenes an annual conference that is one of only two construction-related conferences previously accredited by the Department of Higher Education and Training (DHET) where construction academics and practitioners can interact relative to practical experience and the findings of relevant research. This conference series is endorsed and underwritten by the International Council for Research and Innovation in Building and Construction (CIB) as well as several major industry stakeholders.

The Journal of Construction which is accredited by the Department of Higher Education presently published electronically four times per year is the official journal of ASOCSA and in the past more than 5,000 complimentary copies were distributed to all industry stakeholders in the Southern African region. The production and distribution of practice notes and technical papers is a further endeavor to grow the partnership between academia and industry.

With respect to the Southern African region, ASOCSA is committed to the following:

Vision

To drive innovative construction related higher education

Mission Statement

To promote, facilitate, develop, and monitor the relevance and quality of construction related curricula, research, and graduates in conjunction with higher education institutions, industry and government.

Strategic objectives

The objectives of the Association are:

- to promote and facilitate the development of curricula for construction related programmes
- to assist with the accreditation of construction related programmes
- to hold an annual conference that acts as a forum for multi-disciplinary interaction between academics and practitioners

- to publish an accredited research-based journal and contribute to the built environment body of knowledge (BEBOK)
- to disseminate information dealing with construction education and related matters
- to develop and maintain closer links with industry and government
- to represent the collective views of its members
- to liaise with other organisations and persons to promote the interests of its members
- to promote and support relevant postgraduate research
- to provide bursaries to postgraduate students in accordance with set criteria

ASOCSA continues to seek opportunities to promote both academic and industry employment opportunities. Finally, ASOCSA intends to play a significant and supportive role in the accreditation of construction-related academic programs.

Heads Forum meetings

ASOCSA believes that meetings of the Heads of School and Departments of Construction in Southern Africa is a vital component of its functions and holds both formal and informal discussions with Heads during each conference. The annual Construction Education Summit series commenced in 2021 (CES21) and was planned from 2023 to become a formal platform for engagement with all construction higher education stakeholders.

International Affiliation

ASOCSA has commenced discussions about closer collaboration with similar institutions such as the Associated Schools of Construction (ASC) in the United States, the Royal Institute of Chartered Surveyors (RICS), the Chartered Institute of Building (CIOB), Australian Institute of Building (AIB) and Council of the Heads of the Built Environment (CHOBE) in the United Kingdom. ASOCSA has entered a Memorandum of Understanding with the International Council for Research and Innovation in Building and Construction (CIB).

In summary, benefits of membership of ASOCSA which are self-evident include participation in meetings of the Heads and the CES series throughout the region, access to the Journal of Construction with reduced paper processing fees, reduced rates at all ASOCSA, MBA and CIB events, involvement at regional level with industry-academia forums, interaction and networking opportunities relative to, for example, collaborative research, curriculum development, external moderation of courses, and external examination.

ASSOCIATION OF SCHOOLS OF CONSTRUCTION OF SOUTHERN AFRICA

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Associate Editor:	Mr Ferdinand Fester, Durban University of Technology

For more information on ASOCSA and its activities visit www.asocsa.org

Dear Author

PEER REVIEW PROCESS CONFIRMATION: 18TH BUILT ENVIRONMENT CONFERENCE: NELSON MANDELA UNIVERSITY, GQEBERHA, SOUTH AFRICA, 2024

This serves to confirm that the following blind peer review process was strictly followed relative to this conference.

To ensure the highest quality in the conference proceedings and comply with the requirements for subsidy of the South African Department of Higher Education and Training (DHET), a rigorous two-stage system of peer review by no less than two acknowledged experts in the field has been followed. In terms of this process, each abstract received was twice blind reviewed in terms of:

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Sincerely,



Dr. Progress Chigangacha (Conference Co-Chair)

Dr. Mohlomi Raliile (Conference Co-Chair)

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Assessing Timber Construction in South Africa: Perceived Quality, Barriers and Solutions

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ABSTRACT AND KEYWORDS

Purpose of this paper

This paper investigates the perceptions, barriers, and drivers influencing the adoption of timber in the construction industry in South Africa.

Design/methodology/approach

An online survey was conducted targeting stakeholders in the construction industry. The survey comprised closed and open-ended questions designed to gather insights on stakeholders' perceptions of timber compared to conventional materials, the barriers to adopting timber, and recommendations for increased adoption.

Findings

The review revealed a range of barriers, including negative perceptions, cost concerns, and cultural preferences for traditional building methods. Solutions proposed include education, investment in the timber construction sector and pilot timber projects.

Research Limitations/Implications

The findings are based on respondents' opinions and should be seen as subjective. They are not representative of the entire industry. Future research could explore the extent of the diffusion of timber construction in South Africa and the extent to which the factors highlighted in this study contribute to the diffusion of timber construction.

What is the original/value of the paper

This study provides valuable insights into the perceptions and challenges surrounding timber construction in South Africa, offering practical recommendations for industry stakeholders.

Keywords: Construction industry, Timber construction, South Africa.

A Case Study on Collaborative Instruction Platforms: Exploring Multi-Campus Interconnected Teaching with Industry Engagement, Technology Integration, and its Impact on Aligned Learning Outcomes

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ABSTRACT

Purpose of this paper

This study was necessitated by research findings that demonstrate how higher education learning, which serves as a pivotal transition to the industry for many individuals, consistently encounters challenges in meeting the diverse demands posed by real-world experiences. As a result, a significant number of construction-related students lack first-hand experience and the essential soft skills required for industry practice. Consequently, there is a need for a partnership between industry and academia to train students for improved learning outcomes.

Design/methodology/approach

In the study, three instructors of record and six industry practitioners participated in a co-teaching exploratory experiment, utilizing video conferencing tools such as Zoom Meeting and Meeting Owl Pro. The study assessed student learning outcomes (SLOs) through both Direct and Indirect Assessment.

Findings

The results of the study revealed that students from all participating school levels (university, community college, and high school) achieved the established student learning outcomes. Additionally, responses gathered from conducted surveys indicated a successful synergy between the instructors of record and industry practitioners, with high ratings for the utilized technology.

What is original/value of paper.

It is imperative to continue and enhance the co-teaching platform involving the industry (referred to as "Teaching with Industry") through the aforementioned online technology, while aligning with the expected student learning outcomes. This will serve to further elevate the competencies of young graduates.

Keywords: Teaching with Industry (TWI), Meeting Owl Pro, Collaborative Instruction Platforms, Aligned Learning Outcomes, Industry Practitioners

Evaluation of Building Information Modelling Tools as a Communication Strategy among Stakeholders in the Construction Industry

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ABSTRACT AND KEYWORDS

Purpose of this paper

Communication is a bedrock of successful construction operations; It serves as the engine room in which all activities hang on for productive execution. Therefore, this study seeks to evaluate building information modelling tools as a communication strategy among stakeholders in the construction industry.

Design/methodology/approach

Structured questionnaires were distributed to construction professionals in Lagos, Nigeria who are involved in construction activities through systematic random sampling techniques to collect data on the building information modelling usage as a communication channel for construction operations. Data collected through the questionnaire were computed through descriptive analysis. Using a statistical data equation, a valid mean item score was determined in the study, and each item was ranked while standard deviations and Cronbach's alpha were established.

Findings

The study findings showed that Autodesk Revit, ArchiCAD, 3DsMax Design, Digital Project and Navisworks Manager were the leading BIM tools as communication channels among stakeholders in the construction operations. These tools are used to improve collaboration, effective communication and make apt decision at every phase of construction works.

Research limitations/implications

The research is limited to construction professionals in Lagos state within the Nigerian construction industry. Further research could be conducted among professionals and other stakeholders in other state of the federation to BIM tools prominently used by professionals in other state of the federation.

Practical implications

The study recommends that construction professionals to make use of BIM tools at all stages of construction operations from clear representation of project objectives, enabling concise execution of the project.

What is original/value of paper.

The study contributes to the body of knowledge by giving the construction stakeholders an understanding of relevant BIM tools that can be used at various stages of construction works, highlighting its importance as a communication strategy in construction operations.

Keywords: Communication, Construction, Construction Stakeholders, Strategy, Tools.

Innovative and Intervention Strategies to Tackle Challenges Associated with Water Infrastructure Management By Public Sector

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ABSTRACT AND KEYWORDS

Purpose of this paper

The purpose of this study was to assess eThekweni Municipality's innovative and intervention strategies towards tackling the challenges associated with its water resource infrastructure.

Design/methodology/approach

This study adopted a qualitative research method utilising unstructured in-depth interview based on a case study of eThekweni Municipality's water resources-related entities. Based on the objective of the study, an in-depth interview approach was used in order to elicit vital information from the HoDs within eThekweni Municipality's water resource infrastructure entities (such as Water and Sanitation). This approach was appropriate as it is an attempt to in-depthly understand some of strategies employed by municipality tackling the challenges associated with its water resource infrastructure.

Findings

The study findings revealed that there is only one intervention strategy that has been partially employed by the municipality is a PPP-desalination project, which aimed to relieve the pressure of water supply. The municipality has not implemented any substantial and innovative strategies to adequately address potential and existing challenges associated with its water resource infrastructure such as climate changes and its negative impacts.

Research limitations/implications (if applicable)

The future research should consider quantitative research approach as well as expert judgement and view on subject matter.

Practical implications (if applicable)

Based on study findings, there is a lack adequate innovation strategies by the municipality have far reaching economic, social and environmental implications if the the government cannot proactively and effectively resolve some of challenges associated with its water resource infrastructure.

What is original/value of paper.

The study has highlighted some of the issues of relating inadequate readiness of municipality to effectively tackle critical challenges associated with water resource infrastructure and its management. Thus, the study has contributed to body of knowledge within the subject matter of water resource infrastructure.

Keywords: Challenges of water resource management, eThekwinin municipality, Infrastructure, Strategies.

Bridging Construction 4.0 and 5.0: Strategic Attributes for Transforming South African Undergraduate Built Environment Programs through Activity Theory

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Abstract

Purpose:

This paper examines Construction 4.0 (C4.0) attributes within South African Construction Built Environment (CBE) undergraduate programs, aiming to bridge these attributes to the emergent Construction 5.0 (C5.0) framework, which advocates a collaborative and people-centred industry.

Design/methodology/approach

Employing an Explanatory Sequential mixed-method approach underpinned by Activity Theory, this study combines quantitative data analysed through descriptive statistics with qualitative insights from focus group discussions to map the integration of C4.0 attributes in educational pedagogy.

Findings

The research uncovers that while C4.0 competencies are heavily emphasised within the curricula, there is a crucial intersection with C5.0 ideals, where soft skills such as problem-solving and critical thinking are vital for nurturing a collaborative and adaptive workforce. The qualitative analysis indicates a need for educational programs to evolve, highlighting the role of generic graduate attributes in fostering a human-centric approach to technological education. The findings advocate for a curriculum that equally emphasises technical skills and the development of soft skills that align with C5.0 principles, preparing students for technological efficiency, leadership and collaborative roles in the construction industry.

Practical implications

This paper contributes to the ongoing discourse on educational adaptation in the face of industry evolution, providing a framework for integrating C4.0 technical skills with C5.0's people-centred approach.

Keywords: Construction 4.0, Construction 5.0, Graduate Attributes, Activity Theory, South African Construction Education.

A REVIEW OF CIRCULAR ECONOMY PRACTICES ON CONSTRUCTION PROJECTS

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ABSTRACT

Purpose of this paper

This study aims to evaluate existing construction circular economy strategies to identify enhancement opportunities. This paper outlines practical improvements that can drive more sustainable and efficient practices across construction projects.

Design/methodology/approach

The study employed a systematic literature review (SLR) to rigorously analyse the corpus related to circular economy practices in the construction industry. This review methodically compiles and synthesises findings to identify best practices and gaps in practice, facilitating targeted recommendations for improvement.

Findings

The results show that while many construction projects adopt recycling and reuse strategies, there is a significant lack of integration in the earlier design phases, where most decisions impacting circularity are made. The study also highlights a critical gap in adopting green procurement policies and using sustainable materials across the industry. The findings underscore the need for better data collection and technology use, such as Building Information Modeling (BIM), to optimise resource management and waste reduction. Additionally, the study points out the limited stakeholder engagement in planning and executing circular economy practices, suggesting that greater collaboration across all project phases could substantially improve outcomes. These insights indicate that while the construction industry has begun to embrace circular economy principles, there are considerable opportunities for using practices to achieve greater sustainability and efficiency.

Research limitations/implications

The study faces limitations primarily due to the reliance on published literature and secondary data, which may not fully capture the latest industry innovations or unpublished grey literature.

Practical implications

The study encourages stakeholders to foster greater collaboration and adopt green procurement policies, enhancing sustainability and efficiency across construction projects.

Value of paper

The study adds significant value by systematically identifying key improvements in circular economy practices that should inspire more sustainable construction projects. Its findings provide a foundation for policymakers and practitioners to implement practical changes, enhancing environmental stewardship and operational efficiency in the construction sector.

KEYWORDS: Circular Economy, Construction Industry, Sustainable Practices, Resource Efficiency

Assessing The Impact of Frugal Innovation In The Construction Industry

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ABSTRACT AND KEYWORDS

Purpose of this paper

The concept of frugal innovation can be used to help promote sustainable development, tackling global issues such as social and environmental needs. Sustainability, cost-effectiveness, and waste reduction are needed in the construction industry. This scoping review assesses how frugal innovation can be utilised in the construction industry to realise benefits. Frugal innovations within different industries were evaluated, and lessons learned were considered in the context of the construction industry.

Design/methodology/approach

The methodology used was a scoping review to group themes and systematically analyse the available literature.

Findings

Through the study of literature and case studies from different industries, the review mapped out the benefits of including frugal innovation in the construction industry. The results show that implementing frugal innovation in construction is possible, and environmental, economic, and social benefits can be sustainably met. The frugal innovation approaches identified included using timber as a construction resource, designing reuse, and prefabricated buildings.

Research limitations/implications (if applicable)

All frugal innovation approaches listed in this paper were tested in different industries. Only the use of these approaches in the construction industry will provide a true reflection of the benefits experienced.

What is original/value of paper. The frugal approaches serve as a starting point for enlisting frugal innovation in the construction industry with an emphasis on the sustainability of construction moving forward.

Statement of contribution to the conference theme. Including frugal innovations in different industries has led to resource savings and economic, social, and environmental sustainability benefits. While traditional construction methods leave excessive waste and greenhouse gas emissions in their wake, incorporating frugal innovation approaches is worth considering as it can be one of the solutions in the ongoing need to develop/construct sustainably.

Keywords: Frugal Innovation; Construction Industry; Sustainability; Industries; Sustainable development; South Africa

Construction 5.0: Innovations, Trends, and Implications for the Future

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ABSTRACT & KEYWORDS

Purpose of this paper

The purpose of this paper is to explore the transformative advancements and emerging trends in the construction industry, often referred to as Construction 5.0. This study aims to provide a comprehensive overview of the technologies, methodologies, and paradigms reshaping the sector. It seeks to highlight how these innovations are enhancing efficiency, safety, sustainability, and productivity, while also discussing their broader implications for industry stakeholders, policymakers, and society at large.

Design/methodology/approach

The methodology focused on utilizing bibliometric analysis to systematically review and analyze the existing literature on Construction 5.0. The primary objectives were to identify key themes, trends, influential authors, institutions, and countries, as well as to uncover research gaps and future directions. This study explored literature on construction 5.0 through examining 49 articles published between 2019 and 2024 from the Scopus database. VOSviewer version 1.6.20 was used to develop a co-occurrence network based on the bibliographic data obtained.

Findings

The findings highlight the growing body of research dedicated to technological innovations, such as robotics and IoT, indicating a robust interest and investment in understanding and leveraging these technologies. The trends identified suggest a continued trajectory towards more automated, data-driven, and sustainable construction practices.

Research limitations/implications

Scarcity of longitudinal data on the long-term impacts of Construction 5.0 technologies, making it challenging to assess their effectiveness.

Original/value of paper

This paper offers comprehensive insight by providing a detailed analysis of the key innovations and trends defining Construction 5.0.

Key words: Construction 5.0, Industrial Revolution 5.0, Construction 4.0, Technology, Smart Construction

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Adopting Construction 5.0 For Operational Excellence of Construction SMEs

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ABSTRACT

Purpose of this paper

This study aims to explore how Construction SMEs could adopt Construction 5.0 (C5.0) technologies and practices.

Design/methodology/approach

A systematic literature review (SLR) was conducted to examine the available scholarly literature from Scopus and Web of Science databases. From the databases, 24 studies were screened for further detailed review.

Findings

A thematic content analysis was conducted to explore 23 themes from the screened studies, analysed using ATLAS.ti23. Accordingly, the different drivers/enablers, facilitators, and barriers/constraints to the adoption of C5.0 in construction SMEs were identified through this study.

Research limitations/implications

The study was limited to articles indexed in Scopus and Web of Science databases, potentially overlooking relevant insights from other sources.

Practical implications

This study's findings provide actionable insights for construction SMEs, policymakers, and industry leaders to strategically adopt C5.0 technologies and practices to enhance operational excellence in the construction industry

Keywords: Adoption, C5.0, Construction SMEs, Operational excellence, SLR

Mentorship as a mechanism to enhance emerging contractor development

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ABSTRACT

The purpose of this paper

The objective of this research was to study mentorship as a mechanism to enhance the development of the emerging contractor by determining the benefits of mentoring for emerging contractors establishing the value of mentoring in assisting within the broader context of economic development.

Design/methodology/approach

The research employed a case study method. The data used for this research was mainly qualitative and was based on case studies.

Findings

The findings of this research project reveal how mentoring can offer much-needed support and guidance for emerging contractors (mentees) and provide valuable financial and management skills. Further findings will also reveal the potential of mentoring to assist the mentee in gaining confidence and enable professional development of the emerging contractor and sustainable business growth.

Research Limitations/ implications (if any)

The study is limited to emerging contractors who are participating in development programmes initiated by the DPWI. The study is confined to the Gauteng region.

Practical implications (if any)

For years emerging contractors in the construction industry have been experiencing limited growth or failure due to a lack of professional support and mentorship. This research project will investigate the concept of mentoring to enhance emerging contractor development to ensure their sustainability.

What is original/value of paper?

The importance of this research is to explore mechanisms such as mentorship that aim to ensure the sustainable business development of emerging contractors within the construction industry, thereby contributing towards the overall economic growth of the country.

Keywords: construction industry, emerging contractor, infrastructure, mentor, skills development, socio-economic.

Infrastructure in Human Settlements in South Africa

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ABSTRACT AND KEYWORDS

Purpose of this paper

The purpose of this paper is to present research that develops and tests human settlement infrastructure policy statements as input for a new White Paper on Human Settlements in South Africa.

Design/methodology/approach

The study develops infrastructure policy statements for human settlements. These are tested through an online survey of human settlement stakeholders. Data gathered through the survey are analysed to provide findings for the study and recommendations for human settlement policy development.

Findings

The findings indicate that addressing infrastructure in human settlements in South Africa is a high priority. It shows that there is strong support for alternative delivery and operational models, increased involvement of the private sector and communities, innovative financing and the use of sustainable technologies and systems, in the development and operation of infrastructure in human settlements.

What is original/value of paper.

The study is original as it explores new approaches to addressing infrastructure backlogs in human settlements in South Africa. It contributes new thinking on how the private sector and communities can be involved, alternative delivery models developed, and how sustainable technologies may be applied in addressing these backlogs.

Construction 5.0: A Policy Approach to Future Workforce Adaptability in the South African Construction Industry

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Abstract

Purpose

Megatrends like technological shifts are causing disruptions to work, the workplace, and the workforce. Compared to other megatrends, technological shift provides a new digital platform and technologies that make the future workforce even more diverse regarding skill composition, demographics, location and time of work, and employment relations. This has led to companies virtually balancing between the archaic full-time and gig workforce models while creating new workforce issues. This study aims to review existing policies in South Africa that could be used to address the workforce issues posed by 4IR in the South African construction industry.

Design/methodology/approach.

The methodology adopted for this study involves a review of existing secondary data sources such as journals, articles, etc.

Findings

The findings reveal that various existing policies, such as the Employment Equity Act, the Skill Development Act, and the Skill Development Levies Act, can be adapted to manage future workforce issues in the South African construction industry. Additionally, tailor-made regulations could be enacted to address specific workforce issues caused by technological changes. Regulatory interactions for addressing the future workforce issues in the South African construction industry can be guided by the principles of coherence or carving out Coordination.

Research Limitation

This study is based solely on secondary data sources; future research could be carried out based on primary data sources to strengthen this study further.

Practical Implication

This study will help the construction industry in South Africa effectively manage its future workforce of diverse employment relations from a policy approach.

Original/Value of the paper

This study provides a novel regulatory approach to solving a diverse workforce issue in the South African construction industry

Keywords

IR4.0, Construction 4.0, Regulation, Policy, Future Workforce, Construction industry.

Opportunities for Achieving Optimal Sustainable Performance of Water Infrastructure in Gauteng Province, South Africa

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ABSTRACT AND KEYWORDS

Purpose of this paper

Developing countries, like South Africa, confront myriad challenges within their water sectors, spurring a rising demand for innovative solutions to enhance sustainable performance. This study examines opportunities for optimizing water infrastructure performance.

Design/methodology/approach

The study employs a quantitative method, administering questionnaires to water infrastructure stakeholders in Gauteng Province, South Africa, followed by a descriptive data analysis. Utilising a quantitative method, a survey captured responses from 31% of participants, with descriptive analysis applied.

Findings

Data analysis revealed that adopting a digital asset management system and leveraging emerging technologies from the Fourth Industrial Revolution (4IR), such as the Internet of Things (IoT), hold substantial potential for optimizing water infrastructure performance.

Research limitations/implications

The study identifies opportunities to enhance the optimal performance of water infrastructure in Gauteng Province, South Africa. However, the scope of the study was limited to water infrastructure asset management within Gauteng Province.

Practical implications

This study makes a significant contribution to the improvement of water infrastructure management by highlighting the significant opportunities for enhancing water infrastructure performance in Gauteng Province through the adoption of digital asset management systems and Fourth Industrial Revolution (4IR) technologies like the Internet of Things (IoT).

What is the original/value of paper?

To achieve Sustainable Development Goals (SDGs) 6 and 9 as highlighted by the United Nations (UN), the study emphasises that prioritising the adoption of digital asset management and 4IR technologies such as (IoT) in water infrastructure asset management is crucial. This approach addresses the unique challenges the water sectors face in developing nations and identifies opportunities for attaining sustainable water infrastructure management.

Keywords: Water, Infrastructure, Performance, Sustainability, South Africa

Towards Collaborative and Sustainable Construction 5.0: Benefits of Integrating People-centred Principles in Construction

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ABSTRACT

Purpose:

Focusing on integrating people-centred principles into Construction 5.0 aims to enhance collaboration and sustainability within the construction industry, ultimately improving overall project outcomes and stakeholder satisfaction.

Design:

The study through bibliometric analysis embedded in the Scopus database, coupled with the use of keywords such as "collaborative," AND "sustainability," AND "construction," AND "principles", and the use of VOSviewer to generate occurrence maps, 49 papers were exported.

Findings:

The findings underscored the importance of stakeholders integrating people-centred principles into decision-making processes, design methodologies, and project management strategies within the construction industry. Also, it showed the correlation between the integration of people-centred principles and improved project performance, including enhanced communication, increased worker satisfaction, and reduced environmental impact.

Value:

It contributes to the construction industry by emphasising the importance of prioritising human-centric approaches in project planning and execution, thereby fostering a more sustainable and socially responsible built environment.

Practical implication:

Adopting people-centred principles in Construction 5.0 can lead to more efficient project delivery, improved stakeholder relations, and greater resilience to external challenges such as economic downturns or resource scarcity.

Research Limitation:

It included the generalisability of findings across diverse construction contexts and the inherent subjectivity in assessing human-centric approaches' impact.

KEYWORDS: Construction 5.0, Digital construction, Industry 5.0, Smart construction, Sustainable construction

Strategies To Improve Material Management on Construction Site

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ABSTRACT

Purpose of this paper

Construction material management is a new approach in the construction industry that has not been properly managed. Construction managers and contractors are currently more concerned with cost control than with material management on site. However, it is considered that the cost of materials accounts for a significant percentage of the total cost of construction projects. As a result, crucial material management should be implemented on-site. The aim of this study is to investigate the methods that contractors might employ to ensure the effective use of material management on construction sites.

Design/methodology/approach

This study was carried out using focused group discussion and a thorough literature search to analyse approaches for ensuring successful material management on building sites

Findings

According to the research findings, lean construction concept, building information modelling, intelligence material tracking systems and internet of things are considered to be the essential improvement strategies for effective materials management on construction sites. A good materials management procedures increase overall material handling, resulting in greater efficiency and effectiveness on the construction sites.

Research limitations/implications (if applicable)

If research is reported on in the paper this section must be completed and should include suggestions for future research and any identified limitations in the research process.

What is original/value of paper.

This study will contribute to the field of built environment by emphasizing the effective use of materials on construction sites. Stakeholders in construction industry will be provided with information regarding the causes of the inefficiencies in the management of materials so that suitable decisions in the handling of material on site and materials procurement decisions can be made.

Keywords: Construction sites; Practices, Management systems, Building Materials

Costing refurbishment projects: approach and challenges of quantity surveyors

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ABSTRACT AND KEYWORDS

Purpose of this paper

This research aims to identify challenges for estimating refurbishment works and strategies that quantity surveyors can adopt to produce accurate estimates.

Design/methodology/approach

The study adopted a qualitative research approach using the interview as a data collection instrument. The in-depth interview was conducted with 8 Quantity Surveyors with experience in cost refurbishment projects. Data received from the interview were analyzed thematically.

Findings

The study found that quantity surveyors face challenges such as detailed drawings/item specs, limited access to the site of the building, and determining contingency allowance, among other costs for refurbishment projects. To improve the cost of such projects, they employ strategies such as requesting drawings for measuring, conducting conditional site and physical assessment, formulating the scope of work, and making allowance for items that may cause cost overruns during construction.

Research limitations/implications

The study adopted a qualitative approach; thus, a small sample was used, limiting the generalization of the findings. However, they do provide relevant insights into challenges that Quantity Surveyors encounter when costing refurbishment projects

Value of paper.

The study will provide professionals and potential clients about the challenges and factors that cause inaccurate estimates, which will help them make informed decisions when refurbishing buildings.

Keywords: Refurbishment, maintenance, Costing, Challenges, projects

Addressing the construction skills shortage in South Africa: An exploratory study

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ABSTRACT AND KEYWORDS

Purpose of this paper

The South African construction industry currently faces a significant shortage of skilled labor and craftspersons. To understand the underlying causes of this scarcity and the contributing factors, it is essential to examine the social and economic conditions that have led to this shortage and evaluate the effectiveness of measures aimed at addressing it. This paper aims to explore strategies to mitigate the skills shortfall to promote the sustainable growth of the construction sector.

Design/methodology/approach.

This study uses a quantitative approach. A small purposive sample of 15 participants was surveyed to gather data for this exploratory phase of a larger study.

Findings

The preliminary findings of this study reflect a strong consensus on the importance of a multifaceted approach to closing the skills gap in South Africa. By focusing on education, mentorship, industry partnerships, and curriculum upgrades, stakeholders can develop a comprehensive strategy to enhance skill development and create a more capable workforce.

What is original/value of paper?

South Africa is currently experiencing a shortage of skilled artisans across many sectors but more specifically the construction industry. This paper seeks to determine the status of construction crafts training in comparison to the training that existed in the past. It also investigates why training provisions has changed since then. This paper suggests how the shortage of artisans can be mitigated within the context of the South Africa education landscape.

Keywords: Craftspersons, skilled artisans, shortage, construction industry.

The Role of Digital Technologies in Promoting Sustainable and Human-Centric Waste Management Practices: A Review of Current Practices and Future Directions

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ABSTRACT

Purpose of this paper

The purpose of this literature review study is to look at the role of digital technology in supporting sustainable and human-centered waste management practices within the context of Construction 5.0 (C5.0). A diverse range of available waste management methods may need to be clarified or more complex to use, particularly with the sustainable development goal.

Design/methodology/approach

This paper uses secondary data to cross-examine existing practices and proposes a conceptual model for resource efficiency, reduce waste, and promote environmental sustainability. The data synthesis and analysis were carried out systematically using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework.

Findings

The findings from the systematic review revealed that contractors adopt awareness, waste management-related policy, legislation and regulation, and adoption of Building Information Modelling (BIM) to monitor waste. Furthermore, educating the workforce to effectively manage waste on construction sites and optimizing construction resources are important in achieving sustainable waste management practices.

Research limitations/implications (if applicable)

This study focuses on reviewing existing literature on construction waste management practices. Newly developing technologies not included in the study may present additional opportunities and difficulties that need to be investigated.

Practical implications (if applicable)

The outcomes of this study will help academics improve their understanding of key management practices for decreasing on-site construction waste through sustainable and human-centered waste management practices within the context of Construction 5.0 (C5.0).

What is original/value of paper.

This paper provides the contributors to successful contractors' waste management approaches in South Africa through the enhancement of technology to achieve sustainable and human-centered waste management practices.

Keywords: Construction 5.0, Construction waste, Sustainable development, technologies.

An Investigation into Stakeholder Collaboration for Increased Building-Integrated Photovoltaics Adoption Within The South African Construction Industry

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ABSTRACT AND KEYWORDS

Purpose of this paper

BIPV systems amalgamate PV modules and the building envelope by replacing conventional building materials. There is resistance to BIPV adoption in South Africa, and the purpose of this paper is to identify key stakeholders for BIPV adoption in the construction industry and how these stakeholders can collaborate to increase its adoption in South Africa.

Design/methodology/approach

This study uses a literature review methodology and conducts a narrative review. The initial literature search identified 246 potential articles on the database which matched the key search terms. After exclusions were made the final selection for thorough assessment and analysis for this study consisted of 48 published articles.

Findings

The key stakeholders that need to collaborate in order for increased BIPV adoption are government; built environment and renewable energy specialists; financial institutions and investors; academia, learning institutions and researchers; as well as inter-governmental bodies.

What is original/value of paper?

The focus of this paper is on identifying the key stakeholders that have the potential to collaborate and make the adoption of BIPV technology more prevalent within the South African construction industry. This paper links to construction 5.0 as it focuses on interdisciplinary collaboration among different stakeholders for improved BIPV adoption. Additionally, construction 5.0 focuses on SDGs and this paper can help in the realisation of the goal of affordable and clean energy.

Key words: Building-Integrated Photovoltaics, Sustainable Construction, Green building, Collaboration, Sustainable Development Goals

Enhancing Collaborative Learning Across Institutions through Videoconferencing: A Pedagogical Perspective

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ABSTRACT

Purpose of this paper

This paper explores the pedagogical implications of connecting three distinct educational institution levels (university, community college, high school) via videoconferencing technology, focusing on the collaborative learning opportunities and challenges such an environment presents. As digital technologies continue to evolve, videoconferencing has emerged as a pivotal tool in facilitating synchronous learning experiences, allowing participants from geographically dispersed locations to engage in real-time interactions. This study examines how instructors can leverage these technologies to foster an inclusive, interactive, and engaging learning environment that transcends traditional classroom boundaries.

Design/methodology/approach

Employing a mixed-methods approach, the study combines quantitative data from student performance metrics with qualitative insights from surveys of students, instructors, and industry practitioners. The research setting involves three institutions connected via videoconferencing, each with its own instructor of record, over a semester-long collaborative project.

Findings

Findings reveal positive impacts on student learning outcomes and successful technology integration, underscoring the pivotal role of videoconferencing in transcending traditional classroom boundaries. Furthermore, the study identifies key challenges, such as technological reliability and fostering a sense of community, offering strategies to mitigate these issues.

What is original/value of paper. This research contributes valuable insights into leveraging technology for collaborative learning, aiming to inform pedagogical practices and technology adoption in education.

Keywords: Videoconferencing in Education, Collaborative Learning, Cross-Institutional Collaboration, Pedagogical Strategies, Student Engagement and Outcomes

Quantifying the Influence of Subsurface Fractures on Infrastructure Stability: Integrating Electrical Resistivity and Magnetic Survey Techniques in Construction Projects

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ABSTRACT AND KEYWORDS

Purpose of this paper:

This study aims to assess the impact of fractures on road and building infrastructure, by employing geophysical methods, specifically Electrical Resistivity (ER) surveying and Ground Magnetic Survey.

Design/methodology/approach:

The objectives were achieved by conducting geophysical surveys using ER surveying and Ground Magnetic Survey techniques to evaluate subsurface conditions. The approach involved analyzing dipole-dipole pseudosections and magnetic profiles along traverses to identify lateral and vertical variations in resistivity and magnetic values.

Findings:

The study revealed prominent fractures beneath the study area, contributing to road failures and building distress. Analysis of geophysical data confirmed the presence of subsurface fractures and delineated distinct subsurface layers, including topsoil, weathered layer, and basement bedrock.

Research limitations/implications:

Limitations include the need for further research to explore the full extent of subsurface fractures and their impact on infrastructure stability. Future studies could focus on refining geophysical techniques to enhance accuracy in detecting and characterizing fractures.

Original/value of paper:

This interdisciplinary approach, combining geophysical techniques with engineering principles, offers valuable insights into subsurface conditions, facilitating informed decisions in infrastructure development and management. The study contributes to the body of knowledge by highlighting the importance of assessing subsurface fractures in civil engineering projects.

Leveraging blockchain smart contracts to mitigate construction payment delays: A bibliometric analysis

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Abstract.

Purpose: This study aims to conduct a bibliometric review on existing literature on the use of blockchain smart contracts to mitigate payments delays in the construction sector. By analyzing and synthesizing the findings of previous studies, the study aims to identify current trends in research related to smart contract and payment delays, to map out the most cited authors, countries publication output on the subject matter and identify top cited journal or conference articles.

Methodology: The study employed a bibliometrics technique, forty-nine papers published between 2010 to 2023 from the Scopus database were extracted and data was analysed using Vos viewer.

Findings: Research output that specifically deals with smart contracts and payment delays in the construction industry is gaining its momentum, most publications are from developed countries. A research output representation gap has been identified in the subject area for developing countries since construction delays are a global phenomenon.

Research limitations: The use of only Scopus as the sole database may have limited the findings. The inclusion of other databases like Dimensions, Web of Science, and Google Scholar could have potentially yielded different results. Also, some countries are appearing as contributing countries while they were only collaborating with contributing countries.

Keywords: Construction delays, smart contracts, blockchain, payments

Retrospective Insights and Future Directions for Innovation and Sustainability in the Construction Industry

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Abstract

Purpose of this paper

Despite numerous studies examining the challenges and potential interventions associated with sustainability, it remains a significant issue. This paper aims to identify the sustainability challenges, barriers to innovative practices, and sustainable solutions in the global construction industry through a comprehensive scientometric analysis and in-depth literature review. By doing so, this research endeavours to chart a path forward for overcoming these obstacles and integrating sustainable practices within the industry.

Design/approach

Data was collected from the Scopus database for the scientometric analysis, which was performed using VOSviewer software. Bibliographic mapping was conducted according to co-authorship, co-occurrence, and citation, and the results were analysed to uncover significant themes in sustainability challenges, barriers to innovative practice, and pioneering solutions in the construction industry.

Findings

The study identified critical themes related to sustainability challenges and barriers to innovative practice in the construction industry. It also highlighted pioneering solutions. The findings provide an overview of pathways to sustainability and innovation in the construction industry.

Value of paper

The research offers valuable insights into acknowledging, integrating, and achieving sustainability and innovation in the construction industry. By providing a comprehensive analysis of current trends, the paper outlines clear pathways for professionals in the field to continuously pursue sustainability goals.

Keywords: construction industry, challenges, practice barriers, sustainable/innovative solutions.

Health and Safety Practices in the Fourth Industrial Revolution: Opportunities and Challenges to the Construction Workers

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ABSTRACT AND KEYWORDS

Purpose of this paper: Various strategies have been adopted to enhance construction health and safety management to keep pace with global innovative practices in the fourth industrial revolution. Unfortunately, understanding the opportunities and challenges of safety practices among construction site workers in this era constitutes a knowledge gap in the construction sector. This paper reviewed health and safety practices in the fourth industrial revolution to understand its opportunities and challenges among site workers in the construction sector.

Design/methodology/approach: The paper adopted a thematic literature review. The review synthesises findings related to the evolution of safety practices and digital transformation opportunities for safety practices in the fourth industrial revolution for the construction sector.

Findings: According to the study, the fourth industrial revolution technologies in the construction industry provide opportunities to enhance H&S planning, monitoring, controlling, and training relevant stakeholders. However, technological skill gaps, difficulties of human-robotic interaction, lack of decision support tools, legal regulations and worker safety, and ageing workforce resistance to change are part of the challenges that created knowledge gaps among construction site workers.

Practical implications: The study suggests that promoting understanding of the ergonomic design of workplaces, awareness of digital measures integration, availability of technology training capacity, and human-robotic interaction will improve knowledge of H&S practices among construction site workers during the fourth industrial revolution.

Originality of paper: The study gives insight into a new discussion on the subject and guides the body of knowledge as they unravel safety enhancement awareness among construction site workers. It also forms additional literature for future studies on the 4IR technologies and construction site workers' health and safety practices in the construction industry.

Keywords: Construction Workers, Fourth Industrial Revolution, Health, Safety, 4IR Technologies.

Collaborative co-instruction practice: Active versus Passive learning

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Abstract

Purpose

This paper explores the benefits of active versus passive learning within the context of collaborative co-instruction practice in the USA of the Construction Safety module offered by an ACCE accredited construction management program.

Research design

This paper reports on the collaborative co-instruction practice as a single case study during which real life observations were made and analysed. Observations during the class sessions were compared against the findings of relevant passive and active learning studies. The comparison was used to formulate recommendations for implementation in the next iteration of the course.

Findings

The observations confirm that the student learning experience in the collaborative co-instruction course can be improved from them being passive learning by adopting some of the recommendations for introducing active learning strategies into the classroom.

Contribution

The paper contributes to improving student experiences and learning outcomes using the collaborative multi-institutional co-instruction module to the benefit of the industry, construction education, instructors and students.

Keywords: passive learning, active learning,

Construction 5.0: Towards a human-centric Approach for addressing the poor welfare of construction workers in South Africa

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ABSTRACT AND KEYWORDS

Purpose of this paper: Construction worksites are often characterised by noise and air pollutants, adverse weather, and physically demanding tasks, usually leading to ergonomic-related injuries and fatalities among workers. Consequently, the Construction 4.0 framework introduced emerging technologies aimed at optimising productivity and enhancing workers' health and safety; however, it is observed that it overfocuses on digitalisation at the expense of human needs and interests. Hence, this study, through a systematic literature review, assesses the impact of Construction 5.0's human-centric approach on the welfare of construction workers in South Africa.

Design/methodology/approach: Employing an extant review, this study meticulously examined peer-reviewed research utilising prominent online databases such as Google Scholar, ResearchGate, and Science Direct. Articles published between 2014 and 2024 were retrieved for further screening. This research, guided by specific keywords relating to the topic, yielded a comprehensive selection of articles. Inclusion criteria focused on recent articles addressing Construction 5.0's human-centric approach, specifically with construction worksites. The data extraction process focused on identifying the impact of ergonomics on poor worker welfare in the construction industry.

Findings: A critical content analysis of empirical and non-empirical studies revealed that poor welfare conditions, such as inadequate ergonomics and workplace safety measures, can harm construction workers' well-being. However, integrating emerging technologies (Building Information Modeling, wearables, mixed reality, robotics and automation, and the Internet of Things) and human-centricity offer promising solutions to improve worker welfare and optimise construction processes.

Research limitations: This study is limited to a comprehensive review of published articles between 2014 and 2024 focusing on construction workers in the South African construction industry. Future research could focus on other countries and accommodate different members of the construction human resource.

Practical implication: The study established the human-centric approach that guides the adoption of emerging technologies for improved safety measures and enhanced working conditions on construction worksites. This will help guide policymakers, relevant regulatory bodies, trade unions, and construction industry professionals to exploit the benefits of digitalisation to address the needs and well-being of workers on construction worksites.

Original of paper: The study assesses the impact of Construction 5.0's human-centric approach on addressing the poor welfare of construction workers by promoting worker welfare, enhancing productivity and driving innovation within the construction industry by integrating human-centricity and emerging technologies which can guide various stakeholders involved in the construction industry.

Keywords: Construction 5.0, human-centric, ergonomics, construction workers, poor welfare

Factors contributing to efficiency losses in small construction companies in the Eastern Cape

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ABSTRACT AND KEYWORDS

Purpose of this paper

This research paper aims to examine the factors contributing to efficiency losses within small construction companies in the Eastern Cape.

Design/methodology/approach

The data was collected through a questionnaire that was sent to small construction companies in the Eastern Cape and analyzed using inferential statistics analysis.

Findings

The significant factors that contribute to efficiency losses for small construction companies in the Eastern Cape include a lack of adequate cost and accounting practices and systems, encountering multiple delays, starting of work on short notice, and lag in adopting beneficial management strategies.

Research limitations/implications

Recruiting participants was a challenge, however, the achieved response rate was sufficient for statistical analysis. The success of small construction companies is very important as they are large contributors to the country's economic and social growth therefore an awareness and use of strategies provided in this study could help with improving efficiency and bring about a new era in construction; although due to a low response rate, these results may only apply to small construction companies in the Eastern Cape.

What is original/value of paper. This paper contributes to knowledge on efficiency losses in small construction companies in the Eastern Cape.

Statement of contribution to the conference theme. It is argued that if executed properly and proficiently, the construction sector will benefit from higher margins and better organizational productivity because of enhanced resource allocation, cost savings, and great time effectiveness and management; as well as higher profitability and efficiency.

Keywords: Efficiency, performance, Eastern Cape Province, Small construction companies.

Risk Factors for Building Information Modelling (BIM) Implementation in The Construction Industry

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ABSTRACT

Purpose of the paper

Building Information Modelling is important for construction as it is implemented throughout the building's lifecycle, starting from the planning stages until the demolition. However, its implementation faces challenges due to various risk factors. This study comprehensively identified the risk factors associated with BIM implementation. Moreover, it is necessary to employ risk mitigation strategies to overcome potential obstacles and mitigate the associated risk factors. Doing so will improve the overall implementation of BIM in the construction industry. This study aimed to identify these risk factors to facilitate successful BIM adoption in the South African construction industry.

Methodology

A literature review was conducted using an interpretivist epistemology approach mixed with meta-analysis. Relevant BIM risk factor studies were retrieved from databases like Science Direct, Research Gate, Emerald, and Google Scholar. A total of 42 publications were analyzed.

Results

The review identified various risk factors associated with BIM implementation, these includes but not limited to the following Inadequate experience with BIM project practice, High initial cost and Potential for incorrect designs due to BIM.

Value of the Study

This study offers valuable insights for stakeholders involved in BIM implementation in the South African construction industry and beyond. By identifying and understanding these risk factors, construction firms, policymakers, and educators can develop strategies to mitigate risks and create a more supportive environment for BIM adoption. Additionally, this research provides a foundation for further studies exploring BIM risk factors in specific regional contexts or focusing on the development of risk mitigation strategies.

KEYWORDS: Digitisation, risk mitigation, risk identification, BIM implementation

Drivers for the Effective Implementation of Service Delivery in the South African Public Sector – a Delphi study

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Abstract

Purpose of this paper

In South Africa, the improvement of public service delivery is a critical priority. A democratic society thrives on efficient, equitable, and accountable public services. Despite ongoing efforts, the challenges of public service delivery in 2021 mirrored those of previous years, including capacity issues, skill shortages, and ineffective policy implementation by public servants. This study aims to identify key drivers for the effective implementation of public service delivery and assess their impact on the South African public sector.

Design/approach

The first stage involved a comprehensive literature review to pinpoint three key drivers: the public sector, government policies and frameworks, including the Framework for Infrastructure Delivery and Procurement Management (FIDPM) and project management tools and techniques. This review identified a total of 19 factors and 192 sub-factors. The second stage employed an iterative Delphi study to validate the factors identified in the literature review. A panel of 16 experts participated, with 14 experts completing three rounds of the study. Consensus was achieved after the third round on 160 sub-factors under 19 factors, which were grouped into the three key drivers.

Findings

The results of the Delphi process confirmed the importance and impact of the identified key drivers. The public sector, government policies and frameworks (including the FIDPM), and project management tools and techniques emerged as crucial for effective public service delivery in South Africa.

Value of paper

This study highlights the significant drivers for improving public service delivery in South Africa. By focusing on these key areas, policymakers and practitioners can enhance the efficiency, equity, and accountability of public services.

Keywords: consensus, Delphi, impact, importance, public sector, service delivery

The Barriers of Sustainable Housing Development: A Bibliometric Review

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ABSTRACT AND KEYWORDS

Purpose of this paper

Establishing sustainable housing development is crucial for tackling current environmental concerns and safeguarding the welfare of future generations. Nevertheless, numerous barriers hinder the progress of sustainable housing initiatives on a global scale. Understanding these barriers is essential for policymakers, developers, and scholars to effectively address them and advocate for sustainable housing practices. This bibliometric review seeks to thoroughly examine the current body of research on obstacles to the development of sustainable housing, ascertain prevalent patterns and tendencies, and offer valuable suggestions for future studies and initiatives.

Design/methodology/approach

Utilizing Scopus, we conducted a bibliometric analysis gathering literature from 2019 to 2023 using keywords such as Barriers, Sustainable, and Housing. This search yielded 53 relevant documents meeting the specified criteria. Subsequently, VOSviewer was employed as a tool for data analysis.

Findings

The results highlighted a significant gap in research from developing countries, emphasizing the need for greater attention to this area. One prominent finding of the study is that the affordability of sustainable housing poses a substantial barrier to its widespread adoption and implementation.

Research limitations/implications

This study adds to the current understanding of sustainable housing development, providing valuable insights to guide decision-making in shaping and executing improved policies and strategies to make sustainable housing more affordable and accessible to all.

Practical implications

Sustainable housing is a global concern, impacting both developed and developing nations respectively. Both developed and developing countries experience challenges in terms of sustainable housing development. The study highlights the necessity for further research to delve into sustainable housing development within developing countries.

What is original/value of the paper.

The paper highlights the challenge of affordability in the widespread adoption of sustainable housing. Addressing affordability not only tackles environmental issues but also advances social equality and inclusive economic growth, ultimately fostering healthier and more sustainable living environments for everyone.

Keywords: Housing, Development, Systematic Literature Review, Sustainable, Barriers, Sustainability, Housing

Bridging the Gap: A Holistic Approach to AEC Education through BIM and Collaborative Pedagogy

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ABSTRACT

Purpose of this paper

This paper aims to investigate the current state of Architectural, Engineering, and Construction (AEC) education and propose a holistic model that integrates Building Information Modelling (BIM) and collaborative pedagogy to prepare students for industry.

Methodology

Employing a mixed-method research technique, this study utilises action research methodologies to compare the traditional siloed educational method with an interdisciplinary BIM model. An observational strategy is used with primary data generated from a comparison study.

Findings

The study reveals that integrating BIM and collaborative pedagogies offers significant advantages over traditional teaching methods. Students engaged in the BIM model demonstrated superior critical thinking, communication, and problem-solving skills, indicating the efficacy of BIM as a transformative tool in AEC education.

Practical implications

The findings suggest the need for curriculum reform to incorporate modules on collaborative architectural design, particularly for construction management and quantity surveying students. Embracing innovation and collaboration can empower the next generation of AEC professionals to succeed in an increasingly digital world.

Value of paper

This paper contributes to the ongoing discourse on the role of information technology, such as BIM, in AEC collaborative education by highlighting the inadequacies of traditional teaching methods and proposing a BIM-integrated pedagogical model.

Contribution to the conference theme

This paper aligns with the conference theme by addressing the evolving landscape of AEC education in the digital age. Advocating for integrating BIM and collaborative pedagogy underscores the importance of adapting educational approaches to meet the demands of Industry 4.0 and preparing students for industry.

Keywords: BIM, Collaborative learning, Design, Industry 4.0, Information Technology

Improving Built Environment Education: Analysing User Comfort in VR Learning with Oculus Quest 2

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ABSTRACT AND KEYWORDS

Purpose of this paper

This study examines the role of user comfort in the adoption of Virtual Reality (VR) in higher education, focusing on built environment students using Oculus Quest 2. It explores VR's potential to enhance learning through immersive experiences, emphasising user comfort.

Design/methodology/approach

A quantitative survey was conducted involving 31 built environment students who used Oculus Quest 2 in a VR learning session. The survey assessed physical, cognitive, and emotional comfort, along with perceptions of VR's immersiveness and realism.

Findings

Most students reported low physical discomfort and high cognitive and emotional comfort with Oculus Quest 2. Positive feedback on VR's immersiveness and realism suggests significant potential to improve education.

Research limitations/implications (if applicable)

The study's small sample size and focus on built environment students may limit the generalizability of its findings. Further research with diverse disciplines and larger groups is needed.

Practical implications (if applicable)

The findings indicate VR's readiness for broader educational use, though financial barriers related to the cost of high-quality VR headsets remain a challenge.

What is original/value of paper.

This paper contributes to the understanding of VR's potential in higher education by highlighting the critical role of user comfort in the acceptance and sustained use of VR technologies. Its findings advocate for the inclusion of VR as a standard educational tool, provided that financial barriers can be overcome.

Keywords: Virtual Reality, Construction Management, Education

Challenges Affecting the Adoption of Sustainable Energy-efficient Building in the Nigerian Construction Industry

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ABSTRACT

Purpose

Global advocacy for sustainable energy-efficient buildings is growing, yet adoption in Nigeria faces significant challenges. This study aimed to identify and analyze the key challenges impeding the adoption of sustainable energy-efficient buildings in Nigeria's construction industry.

Design/methodology/approach

Focusing on Lagos State, this study conducted a comprehensive literature review to identify the 15 key challenges. A quantitative approach was employed, using a web-based questionnaire distributed to built environment professionals in Lagos State. The survey yielded 158 valid responses, which were analyzed using descriptive statistical analysis and Principal Component Analysis (PCA).

Findings

The descriptive analysis indicated that the high cost of constructing sustainable energy-efficient buildings, poor maintenance and management culture, and inadequate government enforcement were the most significant challenges. PCA categorizes challenges into four components: knowledge and legal, organizational, technological, and cost-related challenges.

Original/value.

This study provides a detailed understanding of the barriers to adopting sustainable energy-efficient buildings in Nigeria. These findings provide valuable insights for built environment professionals in developing strategies that promote the implementation of sustainable practices. By highlighting these challenges, this study aims to raise awareness, encourage sustainable practices, and advocate for stronger law enforcement to expedite the adoption of sustainable building construction and retrofitting in Nigeria.

KEYWORD: Buildings, Energy Management, Energy Efficiency, Retrofitting, Sustainable Practices

Universal Access and Design in Public Sector Buildings: Efforts and Challenges for Retrofitting

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ABSTRACT AND KEYWORDS

Purpose of this paper

This study investigated the efforts and challenges for retrofitting public sector buildings to accommodate persons living with disabilities (PWDs) in compliance with the SABS minimum norms and standards for the use of public buildings. The study further examined the implementation of the universal design and access (UDA) in public sector buildings in accordance with the requirement of the White Paper on the Rights of PWD directives under section 6.1.1.2: Access to the Built Environment.

Design/methodology/approach

In this qualitative cross-sectional study, data were collected by means of interviews from three lead agents (government departments). An interview schedule containing sixteen open-ended questions was distributed prior to the meetings with the relevant lead agents responsible for implementing the programmes promoting the empowerment of PWD in the built environment (BE). The meetings were recorded, and the data were analysed verbatim. Themes were extracted and coded for further analysis.

Findings

From the findings, there seemed to be a disjointed approach when dealing with the issues around universal design and access in South Africa. Each government department understands its individual role with no coordinated national strategy to work together and to ensure harmonisation of UDA issues across departments. Further, it was evident from the discussions that while improvements have been seen among women and youth, disabled persons are still experiencing similar challenges as before.

Practical implications

The study revealed that the issues of disability and other vulnerable groups must not be treated as a collective; rather, they should be addressed as a targeted initiative, bearing in mind the differences and challenges between these groups. It would also be advisable to have a targeted ministry dealing with the issues of disabilities.

Keywords: Persons with Disabilities, Public Sector Buildings, Retrofitting, Universal Design and Access

Post-Occupancy Evaluation of a Green-Rated Educational Building Leveraging AI and Multimetric IoT

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ABSTRACT

Purpose of this paper

This research aimed to evaluate the effectiveness of the Atmocube, indoor environmental quality (IEQ) monitor, as a technology capable of providing facility managers with precise, data-driven insights. These insights not only promote healthier educational spaces but also contribute to more energy-efficient management practices.

Design/methodology/approach

The quantitative case study methodology was employed to assess the effectiveness of IEQ monitoring in enhancing the indoor environment quality of lecture rooms, with Nelson Mandela University's Business School serving as the case study building.

Findings

The Atmocube pinpointed critical areas for environmental quality enhancement. It was discovered that lighting systems remained on in unoccupied spaces more than 50% of the time, suggesting substantial opportunities for energy conservation. Additionally, air quality assessments occasionally revealed elevated CO₂ levels, highlighting the necessity for enhanced ventilation.

Research limitations/implications (if applicable)

This study is confined to a single educational institution and reflects conditions unique to that site. Nonetheless, the findings suggest a trend that may be applicable to comparable settings. Further research is recommended to explore how different levels of facility/operations involvement might affect the outcomes and to verify these trends in a variety of educational settings.

Practical implications

The insights derived from this study can equip facility managers with actionable strategies to enhance energy efficiency and environmental health within educational spaces. Implementing these strategies could lead to significant cost savings and heightened occupant comfort, ultimately fostering a more sustainable and pleasant learning environment for higher education institutes.

What is original/value of paper?

The concept of using real-time environmental monitoring like Atmocube to enhance facility management in educational settings is innovative in its application, even if the technology itself isn't new. Integrating such technology for continuous data analysis helps operational improvements, which is a growing field of interest and application. This study is particularly valuable as it focuses on a rated building (The Green Star South Africa rating), emphasizing the importance of post-occupancy data to evaluate whether the building's use aligns with its intended energy-efficient designs.

Keywords: Indoor Environment Quality Management; IoT; Artificial Intelligence

Workforce prioritisation in the construction 5.0 era

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ABSTRACT AND KEYWORDS

Purpose

This paper explores the shift towards a human-centric approach in Construction 5.0, addressing the previous neglect of workforce welfare in Construction 4.0. It emphasizes the integration of technological progress with the welfare, health, safety, and rights of construction workers through legislation and regulations.

Design/Methodology/Approach

Using a qualitative approach, the research reviews existing literature, case studies, and theoretical frameworks related to human-centric design and ethical technology integration. The analysis includes legislative documents and regulatory policies to assess their impact on workforce welfare and safety.

Findings

The study finds that Construction 5.0 effectively integrates technological advancements with human welfare, highlighting the necessity of robust legislation to protect workers' rights and promote safety. Ethical guidelines are crucial to ensure that technological progress serves the common good, fostering a sustainable construction industry.

Research Limitations/Implications

The research is limited by its reliance on existing literature, necessitating future empirical studies across diverse regions. Further exploration of specific technological tools and their direct impact on the workforce is needed.

Practical Implications

The findings suggest that policymakers must develop comprehensive regulations to safeguard workers' welfare. Construction companies should adopt human-centric operations, integrating technologies that enhance human capabilities and implementing training programs for effective technology use.

Keywords

Construction 5.0, Ethics, Health and Safety, Wellbeing, Workforce

The impact of digital technologies on property valuation practice in Gqeberha, South Africa

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ABSTRACT AND KEYWORDS

Purpose of this paper

Construction 5.0 has digital technologies that can be in property valuation is a critical intervention to reduce the problem of valuation inaccuracies. Despite this, limited research has been conducted to ascertain the application levels of digital technologies and their potential benefits in addressing valuation inaccuracies in the sector. Therefore, this study aims to investigate the impact of digital technologies on property valuation practice in Gqeberha, South Africa.

Design/methodology/approach

Structured online questionnaires were used to collect data from real estate professionals selected from property valuation firms, estate agents, banks, and home insurance companies in Gqeberha, South Africa. The collected data was analysed with descriptive statistics, such as mean scores (MSs) and frequencies.

Findings

The results suggest that the use of digital technologies, in Construction 5.0, in the property valuation sector of South Africa is relatively limited. Technologies notably applied to valuation practice include Google Maps/Earth, smartphones, automated valuation models, cloud software, and high-end computers. The main benefits of digital technologies in property valuation encompass the mitigation of human error and inaccuracies, reducing paperwork, and time-saving capabilities.

Research limitations/implications.

The small sample may affect the generalisation of the findings to other regions in South Africa and elsewhere.

Practical implications

The results highlighted the need to create an enabling framework to support adopting these technologies from Construction 5.0 to improve performance. Integrating digital technologies into the real estate curriculum is important to impart knowledge and skills to the graduates.

What is the original/value of paper? The study's results can inform the necessary interventions required to enhance the adoption of Construction 5.0 digital technologies in property valuation practice in South Africa and elsewhere.

Keywords: Digital Technology, Valuation, Valuation Practice, Residential Valuation.

Strategies for Post Concession Sustainability of BOT Hostel Facilities in Public Tertiary Institutions in Nigeria

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ABSTRACT AND KEYWORDS

Purpose of this paper

The study examines the strategies to ensure the sustainability of hostel facilities that were procured using build-operate-transfer (BOT) model in selected public universities in Southwestern Nigeria.

Design/methodology/approach

The study was based on primary data obtained through structured questionnaires. University environment was used as a controlled environment for maximum rate of return of responses such that a total number of 56 questionnaires administered to the targeted population were all retrieved and found suitable for the analysis. The study employed a Likert scale to ensure flexible questions and gather comprehensive understandings. The data obtained were subjected to statistical analysis including mean score (MS), standard deviation (SD) and agreement test.

Findings

Top rated criteria for measuring BOT hostel sustainability include material standard compliance at construction stage (with mean score, MS = 4.50) and cost efficiency maximization (MS = 4.46). The overall results point to the fact that strict adherence to material standards ensures the construction and maintenance of hostels meet the required quality and safety standards, and the significance of optimizing operational costs ensures economical high-quality services.

Research limitations

The scope of the study could be extended to other infrastructure categories. Additional sample size would also help to improve a better generalization of the findings.

Originality/ value of paper

The study provides valuable contribution to the existing literature on sustainability practices in the context of public-private partnership (PPP) procurement model.

Keywords: Build-operate-transfer, concessionaire, hostel, Public-Private-Partnership, sustainability