BUILT ENVIRONMENT CONFERENCE – 2021

15th Built Environment Conference - Construction in 5D: Deconstruction, Digitalization, Distruption, Disaster, Development
27 – 28 September, 2021
Durban, South Africa

EDITORS

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PUBLISHED BY

Association of Schools of Construction of Southern Africa,
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September 2021
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The Association of Schools of Construction of Southern Africa (ASOCSA) Built Environment conference series in its 16th 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 also 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 15th Built Environment Conference had again been severely impacted by the effects of the COVID-19 pandemic as had been the rest of the academic world across the globe with conferences either having to be cancelled or converted to virtual events. However, true to its vision and commitment to continue being a premier African built environment conference, ASOCSA and the organizers persevered under difficult and challenging circumstances to present the current version in the long-standing Built Environment series as a virtual conference to prevent the spread of COVID-19 infections. Delivering a second world-class virtual conference was no longer novel for ASOCSA and with very few technical glitches and snags. Further, all protocols were again observed by the small team of organizers who were together physically for the duration of the conference to ensure a hands-on quality conference without any compromise on standards. The post-conference proceedings will be published by Springer in the Book Series "Lecture Notes in Civil Engineering", indexed in Scopus, Compendex and Web of Science and titled, Construction in 5D: Deconstruction, Digitalization, Distruption, Disaster, Development: Part 1.

OBJECTIVES

The 15th Built Environment Conference with its theme of "Construction in 5D: Deconstruction, Digitalization, Distruption, Disaster, Development" had a range of interesting and cutting edge peer-reviewed research papers addressing highly topical current issues that will most definitely 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 continued in the tradition of previous conferences in the series and provided in a virtual international forum a clear industry innovation and development for the future focus. This focus provides the opportunity for researchers and practitioners from developed and developing nations to deliberate pressing and burning issues that impact the Built Environment and will potentially change the way it responds to rapid growth in technological advancement.

The broad objectives of the conference were:

- 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 in 5D: Deconstruction, Digitalization, Distruption, Disaster, Development: Part 1;
- 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 brought together despite major challenges and threats of non-participation in a single virtual 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. Virtual ‘delegates’ and participants were drawn not only from South African institutions of higher education, government agencies, and other construction-related organizations but also from across the African continent, Europe, United States of America, Australia and the United Kingdom. The range of the topics presented by a diverse group of hand-picked keynote speakers who shared their expertise made the conference a more than memorable event and experience.
CONFERENCE THEME AND OUTCOMES

CONSTRUCTION IN 5D: DECONSTRUCTION, DIGITALIZATION, DISTRUPTION, DISASTER, DEVELOPMENT

There is little doubt that the construction industry has experienced exponential change and development in recent years. The 15th Built Environment Conference examined five of these cutting-edge concepts to determine their state of the art in the construction sector both in practice and academic research. This conference therefore sought responses to questions related to current conversations, debates, and empirical research on:

Deconstruction - the dismantling or ‘unbuilding’ of buildings to maximise reusing and preserving the demolished fragments and involves taking a building apart piece by piece, essentially reversing the order of its construction.

Digitalization - the conversion and transformation of construction business processes to use digital technologies and embrace the ability of digital technology to collect data, establish trends and make better business decisions.

Disruption – displacement of well-established construction technologies, techniques or products to disruptively affect the normal operation or function of the construction industry while potentially creating a new industry or market. Artificial intelligence, virtual/ augmented reality, internet of things, blockchain technology, and e-commerce are some of the disruptive technologies that are significantly influencing the future of the construction industry.

Disaster - an occurrence that disrupts the normal conditions of existence and operation causing a level of suffering and challenge that exceeds the capacity of adjustment of the affected community and the construction industry.

Development – in the context of construction refers to an industry that possesses the vision, leadership and capacity to bring about a positive transformation of itself within a condensed period of time.

The virtual conference included papers that address, inter alia,

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

These internationally peer reviewed and edited proceedings were 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 (2021)
Durban, South Africa
September, 2021
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Published by Association of Schools of Construction of Southern Africa, 77 Herbert Penny Road, Penhill Estate, 7100, South Africa

ACKNOWLEDGEMENTS

The organizing committee of the 15th Built Environment conference, held in Durban, South Africa as a virtual conference, is grateful to the Council of the Association of Schools of Construction of Southern Africa and membership universities and individuals for supporting this conference through their valued contributions. 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.

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 published SCOPUS-indexed post-conference proceedings of the highest standard that satisfies the criteria for subsidy by the South African Department of Higher Education and Training (DHET). The contributions of the ASOCSA Organizing Committee as listed below are appreciated.

The excellent support of our webmaster, Edwin Peacock 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.

CONFERENCE COMMITTEES

ORGANISING COMMITTEE

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Dr Mariam Akinlolu, Mangosuthu University of Technology, Conference Chair
Dr Zakheeya Armoed, Durban University of Technology, Conference Co-Chair
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PEER REVIEW PROCESS

In order 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.
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 53 abstracts originally received, only 39 papers were finally accepted for presentation at the conference and inclusion in these proceedings, representing an acceptance rate of 73.5%. 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

Regards,

Theo Haupt
Conference Chair 2021
Mangosuthu University

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 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 role in the accreditation of construction-related academic programs.

Heads Forum meetings

ASOCSA believes that meetings of the Heads Forum comprising of Heads of School and Departments of Construction is a vital component of its functions and holds Heads meetings during each conference.

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 into 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 Forum throughout the region, access to the Journal of Construction, 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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University of the Free State

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

PEER REVIEW PROCESS CONFIRMATION: 15TH BUILT ENVIRONMENT CONFERENCE: DURBAN, SOUTH AFRICA 2021

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

In order 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:

- 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 the blind review process was completed, were provided with anonymous reviewers' comments and requested to submit their full papers addressing these comments. Evidence was required relative to the action 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.

Authors whose papers were accepted after this second review were provided with additional anonymous reviewers' comments and requested to submit their revised full papers. These final papers were only included into both the conference presentation schedule and the conference proceedings after evidence was provided that all comments were appropriately responded to. 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 53 abstracts originally received, only 39 papers were finally accepted for presentation at the conference and inclusion in these proceedings, representing an acceptance rate of 73.5%. 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
- Re-submit for publication provided author/s reconsider/s the areas of concern

The final accepted papers which had undergone a three-stage review process (abstract, full paper and final paper) will be included in the conference proceedings and published in the IOP Conference Series: Materials Science and Engineering.

Sincerely,

Mariam Akinlolu
The Adoption Of 3D Printing As A Construction Methodology In South Africa: What Are The Barriers?

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Abstract. 3D Printing is the production of 3-dimensional objects using an additive process. It has revolutionized industries such as manufacturing, aerospace, medicine and now commonly construction. This technology has been successfully implemented in the construction industries of countries such as China, United Arab Emirates and Russia. It has improved productivity on site, produced sustainable buildings and lowered costs of production. However, there is limited use of the 3D construction methodology in South Africa. Therefore, this research examines whether there are barriers to implementing 3D printing technology within the South African construction industry. The research employs a qualitative research approach that involves interviews of 12 construction industry professionals in South Africa. The data obtained from interviews and secondary data sources were analyzed using thematic analysis. The findings revealed that critical barriers to the implementation of 3D printing within the construction industry were Regulations, the dominant labour-intensive production process and the traditional methods of procurement used in construction project delivery in South Africa. Based on these findings, the study concluded that 3D printing technology would make the project production process more efficient and effective from a cost, performance, and quality perspective; however, the South African construction industry is currently not conducive to the implementation of an innovative solution in construction such as 3D printing. Further research should be conducted on how 3D printing could be implemented in the current state of the construction industry

Keywords: 3D Printing, Conservative, Construction methodology, Labour-intensive production process, Procurement, Regulations
Influencing Building and Infrastructure Poor Performance to Inadequate Maintenance Budget and Funding.

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Abstract. This research aimed to establish the financial resource requirements for the maintenance management of public high school buildings and infrastructure. Quantitative methodology was employed in this research. The uThungulu District of KZN in South Africa was the selected geographical scope of this research. Thirty public high schools in the district were purposely selected for the study. The research finding was that resource constraints continue to pose a challenge to public high schools’ maintenance departments. The research revealed that most (37.5%) of the respondents perceive that the method used for determining maintenance costs was to use the previous year’s budget and add a percentage amount and concluded that effective estimation techniques should be employed to satisfy the financial requirements of ten (10) to fifteen (15) percent of the annual budget for maintenance activities of the institutions.

Keywords: Maintenance Funding and Budget, functional requirements, buildings and infrastructure.
Factors Influencing Successful Completion of Property Development Projects in Gqeberha, South Africa

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Abstract. Property development plays a major role in the Gross Domestic Product (GDP) of global economies worldwide and, changes in the supply and demand values of property impacts on the performance of the property market. Therefore, property development and real estate can be considered as one of the largest suppliers of employment. However, most property development entrepreneurs lack the project management skills that are necessary for managing projects successfully. The aim of this study, therefore, was to investigate the factors influencing the successful completion of property development projects in Gqeberha, South Africa. This study intends to assist project managers/stakeholders with measures to identify and mitigate the effects of factors influencing the successful completion of property development projects. Moreover, this study also wishes to contribute the South African Property Development Body of Knowledge. In this study, the related literature was reviewed and the empirical study was conducted using a quantitative statistical approach. Research questionnaires were distributed to 100 individuals who were randomly selected due to their availability and willingness to participate in the study. A descriptive survey was conducted among professionals in the property industry that consisted of project managers and property development practitioners as well as clients and contractors respectively. The sample population was limited to the Built Environment Professionals registered with the South African Council for Project and Construction Management Professions (SACPCMP) and the Association of South African Quantity Surveyors (ASAQS) as well as Stakeholders in the property development industry in Gqeberha. The findings suggested that the variables researched in this study (namely technological, environmental regulation as well as project management factors) have a significant influence on how property development projects are run by property managers. Therefore, this may cause delays and/or disruptions that have an influence on how successful the property development project gets completed.

Keywords: Project Management; Property Development; Project Property Developer; Body of Knowledge
Factors Influencing the Adoption of Disruptive Construction Procurement Models in State Universities.

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Abstract.
Construction procurement models determine how projects are executed. For a long period, the design-bid-build model dominated government institutions and departments. However, the model proved inefficient in most situations within Zimbabwean state universities, resulting in the emergence of disruptive models such as design-bid, direct labor, labor only, and Public Private Partnerships (PPPs). Even so, as disruptive models gain traction, there is a scarcity of literature which identifies the factors that influenced their adoption. For that reason, this study explored the factors that influenced the selection of disruptive models in state universities. Premised on the interpretivism paradigm, the study employed a multi-case study approach. A purposive sample of five state universities was drawn constituting a total of 15 key informants. These informants were interviewed via online platform. The study findings show that most state universities had fully migrated to disruptive models. Furthermore, client expectations, financial, technological, social, and legal factors were influential in the selection of disruptive construction procurement models. It means that, in addition to the project quadruple parameters (cost, time, scope, and quality), state universities considered external factors. The study recommends that the government continue to support the state universities whereas on the other hand, the lagging universities are urged to explore adopting innovative disruptive models.

Keywords: Disruptive, Construction Procurement Model, Projects, State Universities, Design-Bid-Build.
Investigating the Effects of Gentrification in the Creation of Socially Sustainable Urban Precincts: A Case Study of Bo-Kaap, Cape Town, South Africa

K. Michell and J. Le Roux

Abstract. African cities are characterised by a variety of challenges in terms of urban degradation. In South African cities the research surrounding gentrification is limited. Therefore the significance of looking at the way gentrification is handled by the various role players of gentrification is imperative in ensuring social sustainability and more importantly social cohesion. This paper documents the findings of a social constructivist single case study that investigated the effects of gentrification on the social sustainability of the Bo-Kaap precinct in Cape Town. The collected data were analysed using thematic analysis and NVivo 12 software package. The Bo-Kaap precinct is unique because of its status as a heritage protected overlay zone. The residents of Bo-Kaap have a strong social character in the place and a deep attachment to the community. It emerged from the data that there is lack of commonality of understanding between the role players acting within the precinct, which disables any form of effective holistic participation in the regeneration of the area. The cause of this either comes down to an ignorance that separates these role players and a lack of effective communication streams enabling parties to understand different perceptions of development. Stakeholders are influenced by both the fear residents have for displacement, loss of identity and development, and the economic mindset of developers and government. The paper concludes that in mitigating the negative impacts of gentrification on historically marginalised communities, role players need both a level of understanding and a clear direction on how to manage this transition.

Keywords: Gentrification, Bo-Kaap, Social Sustainability.
Critical Review of the Impacts of Successful BIM Technology Application on Construction Projects

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Abstract. Building Information Modelling technology (BIM-t) continues to gain more attention. Its adoption creates a platform that allows the built environment professionals to have a common database for project information sharing. While there is an increased perception/impression that the implementation of BIM-t on construction projects positively influences the construction project delivery, the critical analysis of such impacts is still missing. This paper, therefore, conducts a critical review of the impacts of BIM-t application on construction projects delivery and provides reports on research gaps and possible future research directions. This paper employed a systematic examination of related literature on the subject of BIM-t between the years 2008 to 2021. The search includes published journal articles, thesis, books, documents, and conference proceedings. Different databases including; ResearchGate, Taylor and Francis, ScienceDirect, Springer, and Google scholar were explored. The findings indicate seventeen (17) positive impacts gathered from 41 reviewed publications. The listed positive impacts were grouped under the different construction phases. The implications of the findings were discussed and future research directions were suggested.

Keywords: BIM-t application, BIM impact, Built environment, construction project phases.

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Abstract. The Construction of small and medium size enterprises (CoSMEs) are the backbone of the UK economy, Covid-19 have affected many of this sectors. This has not only affected the construction industry negatively, but has caused many health and safety concerns on construction sites, resulting in increased unemployment, cash flow problems, and insolvencies. The research analyses the implications of coronavirus COVID-19 for UK Construction small and medium size enterprises (CoSMEs) in terms of their resilience using secondary data and information from articles and public data. Findings from the research reveal that small and medium size construction firms in the UK were adversely affected by the pandemic with many going into liquidation. The impact of government interventional measures varied across the various subsectors, overall, the measures were deemed inadequate and implemented rather late to stop many CoSMEs from insolvency. Additionally, most CoSMEs that operate largely on self-employed basis could not immediately take advantage of these measures. Mostly, it was the large construction firms that took advantage of government schemes and survived. The government concentrated on the huge and indivisible capital projects which offered a soft landing for many big construction firms, benefitting the upper end CoSMEs. The research concludes that understanding the effects of external shocks on CoSMEs will help in formulating robust strategies and policies that will enhance their resilience, and by extension, the UK economy given the pivotal role the construction industry plays in the UK economy.

Keywords: Covid-19, Construction SMEs, Government, Measures, Strategy, Construction resilience, Unemployment.
A Study on Knowledge, Attitudes and Commitment of Managers Within Construction Firms Towards the Recent Construction Health and Safety Legislation Changes

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Abstract. This study seeks to evaluate the knowledge, attitudes and commitment of managers within construction firms towards the recent construction H&S legislation changes. This study further aims to identify the differences in responses between management personnel and construction workers within construction firms. An empirical research approach was adopted using a quantitative method of data collection and data were analysed using IBM Statistical Package for Social Sciences (SPSS) version 25. Furthermore, descriptive statistics was used to analyse data and data were interpreted using inferential statistics. Cronbach’s Alpha reliability test was conducted to determine the internal consistency of the constructs. Furthermore, independent t-test was conducted to determine the statistical significance of the means between the groups of respondents. The findings from management and construction workers within construction firm revealed that although there was a small correlation between management commitment and knowledge of H&S legislation, there was no statistical significance between the two constructs. Also, management was not fully committed in applying all the aspects of the construction regulations to improve construction workers wellbeing. The findings revealed that there is a need for more knowledge of H&S legislation and management commitment. The paper proposes measures for managers to engender full compliance and to apply all aspects of the construction regulations such as to; improve knowledge; improve working conditions, consider the health and wellbeing of workers and treat health and safety as a value and not just a priority.

Keywords: Health and Safety, Legislation, Workers Wellbeing, Management Commitment.
Challenges to project delivery in the dynamic Human Settlement Environment in South Africa

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Abstract. Governments worldwide are continually battling to address the housing backlog. In South Africa the backlog stems from previous discriminatory regimes and increasing urbanization. The housing backlog in South Africa has increased significantly and most especially in Cape Town. Housing is seen as a measure to transform and unify the segregated population. Project Leaders (PLs) are saddled with the responsibility of housing delivery and managing diverse stakeholders. Although project management is the driving force behind housing delivery, the project process is not free from dynamics. These housing projects constantly attract social and political attention, resulting in the PL repetitively contending with the inherited social and political dynamics of the Human Settlement Environment (HSE). The numerous challenges facing the PL created by the dynamism and ensuing complexity is unknown. Therefore, this research examines the challenges faced by PLs in the HSE and whether PLs exercise a capacity to transform, maintain, and lead the project organization creatively. A qualitative research approach with inductive-philosophical reasoning that employs interviews for data collection was chosen for the study. A sample of 19 PLs working in the public sector of human settlements in Cape Town was purposefully selected to participate in the study. The collected data were analyzed using thematic analysis to identify appropriate themes. The results identified six challenges: Social, Political, Organizational, Legislative challenges, Multi-stakeholder, and Skills faced by PLs. Following these themes, two key issues showed that social and political influence were the dominant factors affecting the implementation of housing projects. The research found that PLs do not have the authority in housing delivery. This limits the PL’s ability to transform, maintain and lead the project organization creatively.

Keywords: Cape Town, Housing, Human Settlement Environment, Project Delivery, Project Leader, Transformation
Application of Artificial Intelligence for Construction Workers' Wellbeing in South Africa

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Abstract. Globally, the construction industry is known for its complexity, where a multi-array of interdependent activities all take place at the same time. Construction job sites are increasingly dangerous with historically low levels of innovations and adaptation to change. Construction workers are required to perform repetitive manual tasks involving heavy lifting, bending, twisting, reaching overhead or away from the body and working under generally unfavorable conditions. Construction companies have a moral and legal responsibility to ensure working environments for their workers that do not present a threat to their health, safety and general wellbeing. The purpose of this study is to explore how the application of disruptive AI technologies could improve construction workers' wellbeing and safety on the job site. This paper reviewed previous studies on the application of AI on construction workers' wellbeing such as, for example, Weak AI, Strong AI, Machine Learning, Deep Learning and Big Data. Furthermore, keywords such as, for example, Construction, Workers, Health and Safety, Artificial Intelligence and Wellbeing were used to search online databases. The findings of this study indicated that the integration of AI on construction job sites may be used to prevent negative and health and safety prejudicial occurrences from happening by monitoring and tracking the workforce and their construction activities using, for example, applications (apps), wearables or emotional wellbeing tools. Moreover, the complex industry could benefit from machine learning to bank an unlimited amount of data for better overall health and safety performance. Based on the findings, the benefits of AI technologies imbued with machine learning, have a far-reaching impact than the negatives as traditional health and safety systems continue to fail to eliminate construction accidents. Therefore, the adoption of AI could help improve construction workers wellbeing.

Keywords: Artificial Intelligence, Construction Workers, Health and Safety, Machine Learning, Wellbeing.
Artificial Intelligence (AI) in Sustainable Construction Management: A Scientometric Review

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Abstract. The possibilities and potentials of Artificial Intelligence (AI) in enhancing the effectiveness of sustainable construction management is gaining momentum in research. While this area is in need of further studies, it is imperative to identify the trends, research clusters, emerging thematic areas and future directions of AI in sustainable construction management. Using scientometric analysis, this study examines AI in sustainable construction management research published primarily in the Scopus database from 2011 to 2021. A critical study was used to define the research trends in AI sustainable construction management research, while a scientometric analysis critically visualised the research status quo. From analysis China, the United States of America and the United Kingdom are the top contributing countries. The top co-occurring keyword is “Artificial Intelligence”. Four research themes were identified with the combination of cluster analysis and critical review: “GA Decision Support System (GA-DSS)”, “High-Performance Building Design and Decision-Making”, “Intelligent Concrete Prediction” and “Geographic Information Model.” This analysis examines current research and identifies emerging trends in this field.

Keywords: Artificial Intelligence, Construction Management, Sustainable Scientometric, VOSviewer.
Utilisation of Remote Monitoring Systems in Construction project Management

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Abstract. Traditional project monitoring systems are increasingly linked with high financial losses, project delays and poor project performance. Emerging digital technologies such as remote monitoring systems offer immense potential in resolving these challenges. This study identifies the challenges faced in managing multiple projects in the construction industry and how adopting remote monitoring systems can mitigate the challenges presented by these. Case study approach was adopted to contrast practical usage of remote monitoring and on-site monitoring systems. By using similar projects, with the same organisation and client, a comparative analysis between traditional on-site monitoring and remote monitoring systems on project efficiency, resource optimization and project outcome revealed that remote monitored multiple construction projects had better project performance on its goals and objectives compared to traditional monitored systems. Given the urgent need for improved productivity in the built sector, it is therefore imperative that remote monitoring systems adoption is adopted at national and organizational levels in the built environment. Furthermore, its need is imperative for further studies and research with regards to scaling its use for both big construction conglomerates and small and medium-sized construction firms.

Keywords: Remote monitoring system, construction multiple projects, resource optimisation, traditional monitoring system.
Construction Organisation’s Planing and Implementation: The Case Between Conceptualization and Implementation Teams

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Abstract. The economic growth required to put nations in the path to prosperity has further necessitated the Construction sector to improve its productivity and performance which is largely dependent on contractor performance. However project failure linked to poor performance of construction firms has further highlighted the effectiveness of the tendering process in selecting capable contractors. Therefore tender decisions are key to the success of a project from the conception to the completion of the project. The disconnect between decisions made during tendering and the execution of the project also is further challenging to the success of the project and overall productivity of the constructions sector. It is vital that the teams are aligned, as this will lead to project success and ultimately, organizational success. This research paper focuses on literature and research interviews conducted within South African construction organizations to establish the gap or cause of the disconnect between the two teams. The analysed research interviews present findings that indicate the results of the disconnect which are due to a lack of systems or procedures and siloed processes and structures within the organizations interviewed. The researcher recommends that further investigations need to be carried out to develop a solution that would standardize, systemize, integrate, and cross-skill the handover process between the estimators and project teams.

Keywords: Construction organisation, Construction Planning, Tendering
Adaptive Co-design for Self-Help Housing in Durban

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Abstract. In Africa, informal settlements are home to more than half the urban population. Because of their spontaneous and unplanned nature, such neighbourhoods represent one of the most complex challenges worldwide as they are characterised by a lack of basic services and infrastructure, poorly performing building materials, without any building plans approved and often on illegally accessed and hazardous land. As a result, informal settlements are more vulnerable to natural disasters (such as storms, flash floods). Nevertheless, they show a unique resilience (social resilience) and natural capacity to cope with these catastrophic events. It can be argued that vulnerability and resilience can coexist in these settlements. This research has two key objectives: mapping and characterizing vulnerability to natural hazards in spontaneous settlements and co-designing adaptive solutions for self-help housing upgrading in such neighbourhoods. By combining drone imagery with collaborative mapping, the authors suggest a new approach to enhance community resilience and co-produce practical strategies for disaster management in South African informal settlements. Participatory action research methods are followed to co-produce knowledge with local residents, in a case study in the Durban Metropolitan area. The ultimate goal of this study is to build capacity in local communities seeking to improve their quality of life and assist local authorities in enhancing their intervention towards more resilient futures. Findings show the importance of a meaningful participation of the local dwellers to co-design solutions tailored to the local context and community’s priorities, which lead to adaptive interventions.

Keywords: Informal settlements, self-help housing, resilience, collaborative mapping, co-design
Learning Online During a Pandemic: Student Perspectives

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Abstract. This study explores student experiences of online learning during the global COVID 19 pandemic. The paper assesses whether the outcomes of constructivist inquiry-based learning can still be achieved online. A qualitative research approach was used to survey online learning experiences of students. A total of 27 registered Construction Studies university students conveniently sampled across all levels of study completed a questionnaire with close ended questions. The data collection was computed and analysed using SPSS version 27. Mean values, standard deviations and reliability values were computed. Results of the survey indicated that most students spent more time doing work during online learning. Students indicated that they were able to think more critically and discuss concepts and collaborate with other students. There was a handful of students that were more stressed, socially inactive and lacked outdoor activity due to online learning. The sample is drawn from a single university in South Africa and findings cannot be generalized across all student populations.

Keywords: Constructivist, COVID-19, Inquiry based learning, Online learning.
Risk Assessment in Construction Businesses

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Abstract. The South African construction industry is growing, where new contracting businesses are rapidly emerging. However, statistics show that some of these emerging businesses seem to fail on a more rapid rate. Studies have shown that adequate risk management has a huge impact on sustaining and increasing both productivity and profitability in construction businesses. The rise of the 4th industrial revolution has brought about automated technology and, it is moving the industry forward, simplifying tasks and changing the construction industry as a way of assessing and managing risk. This study aimed to determine the effects of risk and the effective ways of conducting risk assessment in construction businesses. This exercise may help to establish efficiency in construction business functional areas in order to maximise productivity. The study further highlights on the importance of using BIM (AI) as a tool to assess risks in improving construction business efficiency. Quantitative methodology is used to conduct the study where questionnaires were administered to receive field data from respondents. The study is analysed based on the perspective of the various construction contractors in small and medium sized construction businesses in Port Elizabeth, Republic of South Africa. The purpose is to create an understanding on why most of the construction businesses fail in their operations and establish whether the solution could be the effective implementation of BIM as risk assessment tool.

Keywords: Business, Construction, Management and Risk.
Lean Thinking As An Approach For Improving Client Communication During The Design Process

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Abstract. Lean thinking is perceived as a successful strategy for saving time and cost, while improving at the same time the position in the market. Lean thinking is about eliminating waste and increasing the quality. When applied correctly, lean thinking is a well understood and well examined platform upon which to build firm practices. In the architectural profession miscommunication has a lot of consequences including time and cost overruns, conflict and ultimately project failure. The aim of this research was to investigate the role of lean thinking in improving the communication between the client and the architect during the design process. To achieve the aim of this research, an indepth firstly, a literature review was used to build a comprehensive background about the research topic including the design process, causes and impacts of poor communication during the design process, and lean thinking. Secondly, an analysis of case studies was used to investigate the role of lean thinking in enhancing the client communication during the design process. It was found that comprehending, understanding and incorporating lean thinking principles in the design stages can assist in reducing the causes of poor communication between the architect and the client.

Keywords: Lean thinking, communication, design process, architecture design.
Integrated Project Delivery (IPD): An Innovative Approach for Achieving Sustainability in Construction Projects

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Abstract. In spite of the positive impact construction can have on the economy and society in general, the industry is being blamed for the negative impact it has on the environment. This problem can be attributed to traditional procurement approaches adopted in construction industry and the inability to handle the different challenges regarding waste generation and pollution of the environment. This paper focused on the role of construction procurement as a method to achieving sustainability. This paper aims to investigate the role of integrated project delivery (IPD) in achieving sustainability in construction projects. In order to achieve this, the research method consisted of an in-depth literature review and case studies. Firstly, the literature review was used to identify and categorise the principles of integrated project delivery and their importance in achieving sustainability in construction. Secondly, two case studies were analysed to investigate the benefits of the using of integrated project delivery in construction projects. It was found that the usage of the integrated project delivery results in meeting the goals of sustainability. The two case studies examined showed that IPD had a positive outcome in regards to economic, social and environmental aspects because it reduced the cost and time of the construction of the project, as well as having a positive effect on the community.

Keywords: Sustainability, Traditional procurement, Integrated Project Delivery (IPD), Construction industry.
Client Roles in Influencing Project Delivery Outcomes

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Abstract. Construction clients are the originators of projects who are central to the construction process and play a crucial role in influencing project delivery outcomes. Consequently, it behoves all role players to support the client and deliver specific client requirements. The construction industry is fraught with several challenges during project delivery and it is a common occurrence that critical project objectives are not usually achieved. It is therefore, in the client’s interest and control to ensure that the various challenges, foreseen or unforeseen, which could result in waste, conflict, excessive costs and delays do not occur or are well managed to minimize their impact. This paper examines the role of the client and the client’s team structure in influencing project delivery outcomes, which was explored quantitatively. Data was collected through the use of semi-structured questionnaires. Study samples were selected through purposive convenience sampling. The study demonstrated a link between client roles and their influence on project delivery outcomes. Between public and private clients, the latter was considered by the majority of respondents as being more involved in their projects and significantly performed their roles, hence the high success rate of private projects.

Keywords: Clients, Client Roles, Construction Industry, Project/s, Procurement
The Effect of Disruptive Technologies on Facilities Management: A Case Study of the Industrial Sector

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Abstract. Disruptive technology is rooted in the fourth industrial revolution. Technological innovation and advancements have benefited a multitude of global industries. However, the benefits from disruptive technology are yet to be realised in the real estate industry. As such, the emergence of the global e-commerce industry positions the industrial sector ideally for technological adoption, specifically within the distributive warehousing and logistics sub-markets. Facilities management (FM) itself is further ideally placed within this framework to necessitate this change given its services and operational functions. This paper documents the findings of an investigation into the effect of disruptive technologies on FM within the context of the industrial sector. The findings show that the impact of disruptive technology can be disaggregated into two stances, namely: the cautious stance where little impact is occurring; and the open stance where significant impact is occurring. The nature of the different stakeholders gives rise to a variety of perspectives on the implementation of technology. Property-owning companies were more inclined to choose labour as a solution over technology as in South Africa labour proves to be a cheaper alternative than the capital required to incorporate and maintain technology. The paper concludes that although the industrial sector is experiencing the implementation of disruptive technologies the industry is still lagging behind the developed world. Not much will change in this regard as long as labour costs are cheaper than technological installations, or property owners are forced to adopt technology in order to remain competitive.

Keywords: Facilities Management, Disruptive Technology, Industrial Sector.
Sustainable Approach To The Replacement Of Water Mains: Environmental, Social And Economic Considerations

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Abstract. Water mains in many areas of London and some parts of the Thames Valley are still thus the oldest and in need of replacement. The mains have been susceptible to corrosion, leaks and subsequent breakage, causing water wastage, continuous maintenance cost, social and environmental impact because of disruptions to water supply to local communities, road congestion and damage to the road infrastructure. The aim of this study is to examine the factors, which determines the methods adopted for the replacement of water mains and the economic, environmental, and social considerations that underpins the decision-making process. The research method adopted is a mixture of quantitative and qualitative approaches using surveys and interviews. These trenchless techniques are preferred due to lower cost, speed and productivity. Directional drilling was selected due to its cost, speed and productivity but also because it is the most customer driven method to ensure a constant supply of water. There is a need for a sustainable procurement approach incorporating social and environmental factors which affects productivity such as ground conditions, unknown utilities, the impact of water disruption on residents/schools and delays due to obtaining road access permits. Involvement of Local authorities in the design and accessibility discussion can help speed up the process and increase productivity.

Keywords: Water mains; Replacement methods; Environmental; Social and Economic factors; Sustainability.
Critical Success Elements for Central Government Real Estate Asset Management in South Africa - A Literature Survey

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Abstract. The need to manage public real estate assets effectively and efficiently is increasing globally. The widespread appreciation for assets management is due to ongoing government reforms and budget cuts that compel government departments to raise revenue and cut spending. The National Department of Public Works and Infrastructure (NDPWI) in South Africa owns diverse and capital-intensive assets which require systematic management practices, including following local and global trends. A comprehensive literature review covering Public Real Estate Asset Management in South Africa (PREAM), public sector reforms, Asset Life Cycle Management (ALCM), current and future public asset management trends was carried out. The review aimed to identify the elements necessary for a successful PREAM. By presenting this review, it is also intended to establish the extent to which the discovered elements could improve the usefulness of state buildings at the lowest possible cost. The results show that asset management information systems, ALCM, regular asset needs analysis, and performance management are essential elements for effective and efficient PREAM. Rapidly changing information technology, globalisation, increased focus on performance management, rising service delivery standards and changing socio-economic circumstances among the current trends driving PREAM changes. The study further found that through adherence to legislation and application of asset management best practices, the central government could enhance asset management effectiveness and efficiency and ultimately improve service delivery quality.

Keywords: Asset management, Central Government, National Department of Public works and Infrastructure, Public Real estate Asset Management.
Stakeholder Participation Trends in the South African Green Building Industry: 2016 to 2018 Perspectives

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Abstract. The participation of stakeholders involved in the construction of buildings is crucial to the successful implementation of green building practice in South Africa. This paper investigated stakeholders' participation trends in the new South African office buildings for 2016 to 2018 with an As-built or Design rating. The study expanded on a 2016 study covering the period 2009 to 2016. The study described participation trends and the market share of major stakeholders. Seven stakeholder disciplines were analysed: owners, architects, quantity surveyors, green consultants, main contractors, and structural and electrical engineers. Data was made available by the Green Building Council of South Africa. A total of 156 new office buildings received a green building certification between 2009 and 2018. The extent of participation between firms of the different disciplines varied significantly: Owners (75), architects (63), quantity surveyors (55), green consultants (27), main contractors (34), structural engineers (42) and electrical engineers (48). The market share of the top three firms also differed significantly: Owners (19.9%), architects (29.3%), quantity surveyors (26.4%), green consultants (57.7%), main contractors (50.3%), structural engineers (41.4%) and electrical engineers (31.9%). The study indicated an acceptance of green building as a practice by different stakeholders, which was validated by a growing stakeholder participation trend and by the number of projects firms had undertaken.

Keywords: Green buildings, Participation Trends, Market Share, Stakeholders, South Africa.
The Effective Implementation of the Framework for Infrastructure Delivery and Procurement Management

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Abstract. The South African government since 1994 has implemented numerous unsuccessful policies and frameworks to address the ever-present challenges in providing adequate and satisfactory service delivery to citizens. The Framework for Infrastructure Delivery and Procurement Management (FIDPM) was developed in 2019 to ensure a systematic and structured approach for infrastructure procurement and delivery management for the successful delivery of construction projects. This study investigated government’s ability to apply infrastructure delivery management tools through the implementation of the FIDPM towards improving public sector service delivery from the construction project manager’s perspective. This quantitative study utilised online questionnaires. The questionnaire was distributed to 1,185 professionally registered construction project managers with the South African Council for Project and Construction Management Profession (SACPCMP) through a stratified random sampling approach. Four hundred and ten responded representing 34.59% response rate and the data was analysed using IBM SPSS v27. Key policies and frameworks developed by the South African government for addressing service delivery and its challenges since its democracy in 1994 have not been successful in their implementation. Government still struggles with the implementation of the current policy, namely the FIDPM. Government is not effectively managing public procurement and needs to train, develop, and build capacity to achieve service delivery targets through robust policy implementation. Project managers through their knowledge, awareness, and application of the infrastructure delivery management system (IDMS) and FIDPM are in a key position to assist government improve policy implementation towards improving service delivery. The study was limited to only construction project managers registered with the South African Council for Project and Construction Management Professions (SACPCMP) located in the most active provinces in terms of public service delivery and policy implementation, KwaZulu-Natal, Gauteng, and the Western Cape in South Africa.

Keywords: Construction project managers, FIDPM, policies and frameworks, public service delivery
Abstract. Candidate quantity surveyors face many challenges on their road to professional registration. A candidate quantity surveyor is one who has completed a tertiary qualification in a quantity surveying programme from an accredited institution but does not yet have the required work experience to work on their own. They have to work under the supervision of a Professional Quantity Surveyor until they have acquired enough experience of between 3-5 years to register as a professional quantity surveyor. The aim of this paper was to identify the challenges the candidates in South Africa face during these 3-5 years and possible solutions to these challenges to help candidates be better prepared in the future. This was a quantitative study in which 52 random participants were emailed a link to the Google form questionnaire. Forty valid responses were received. The findings of the questionnaires revealed that the main challenges candidates faced were the transitioning from university into the world of work, filling out the logbooks, lack of mentorship and inadequate technological and software skills. The solutions provided to overcome these challenges were to increase mentorship to guide the candidates, encourage candidates to learn new technologies and software and that they should be willing to adapt to changes in the working environment. It was also found that involving the candidate from inception to close out gave them a better understanding of their job and the industry.

Keywords: candidate quantity surveyor, professional registration, routes to registration

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Abstract. Assets maintenance management in accordance with the maintenance management policy systems remains a challenge not only nationally but globally. The research revealed that institutions are not complying with the practice of maintenance management policy systems. This is the gap the research aim to establish an improved maintenance management system for public high school buildings and other infrastructure based on standard practice as stipulated in the Department policy document. Literature shown that building and other infrastructure asset deterioration owned to inadequate maintenance. Quantitative methodology was employed in this research. The research included a study of relevant literature and the distribution of questionnaires to the target sample to gather the required data that seek to establish an improved maintenance management policy system for public high schools based on standard practice. The uThungulu District of KZN in South Africa was the selected geographical scope of this research. Thirty public high schools in the district were purposely selected for the study. The reasons include the proximity of the schools relative to where the researcher currently resides; resource constraints regarding the ability to fund transport costs to the various schools. The questions that were related to maintenance management policy systems, functional requirements of public high school buildings and other infrastructure were correlated with the data that were generated from the maintenance management stakeholders at the various institutions. The research revealed that most of the institutions do not comply with the existing National Education Infrastructure Management System and Provincial Maintenance Policy System and concluded that the majority (82.4%) of the respondents strongly agreed that maintenance conducted in accordance with policy documents enhances the functioning of the assets that satisfies users’ needs and expectations.

Keywords: Maintenance management policy systems, functional requirements, buildings and infrastructure, maintenance.
Accessing The Value Of Water Infrastructure Delivery And Management In South Africa

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Abstract. This study aims primarily to identify potential causes of the bottlenecks in the public sector that affect delivery and formulate evidence-based interventions to improve delivery and management of infrastructure projects. An initial literature review was carried out on infrastructural development and delivery in South Africa, with the aim to formulate evidence-based interventions to improve delivery within the sector. The Infrastructure Delivery Management model will be developed to map out best practice delivery processes. These will become the backbone on which improvement initiatives that will be developed within participating stakeholders. The model will in turn support a range of methodologies, including the risk system, and a knowledge management framework. It will also look at key challenges facing departments with the ability to ensure knowledge and skills transfer at various sectors. The research is limited because the findings were based on existing literatures. This study adopted an indirect approach for infrastructure management by focussing on the challenges faced and approaches adopted to overcome these challenges. This may narrow the consideration of some of the viewpoint thereby limiting the richness of experience available to this research. The study will contribute to current understanding of essential capabilities, challenges faced and also approaches adopted on improving infrastructure management in South Africa.

Keywords: Infrastructure, assets management, delivery, management framework, challenges
A Bibliometric Analysis of Sustainable Construction Practices - Implication on Construction Productivity

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Abstract. Damages being done to the ecosystem have continued to foster the clamor for sustainable development practices across sectors, including the construction industry. The construction industry’s operations account for about 33% of greenhouse gas (GHG) emissions on the earth, thereby making sustainable construction practices (SCPs) central to the global sustainable development goals. A bibliometric analysis was conducted to map the existing literature in SCPs research field. The analysis was utilized to ascertain the growth trajectory of publications in SCPs research domain, most productive and influential authors, collaboration among authors, geographical distribution of publications, and ultimately the emerging knowledge areas (EKAs) in the research field. The EKAs include: lean construction, procurement, energy, recycling, construction ecology, lifecycle costing, construction waste, and sustainable design. These knowledge areas have varying degree of implication on construction productivity. However, some of the knowledge areas, which include lean construction, energy, construction ecology, and sustainable designs have more notable implications on construction productivity. Documents published in the Scopus database were considered for analysis due to the wider coverage of the database. Besides, the study is limited to journal articles published from 2002-2021. Construction stakeholders can adopt the research findings to develop a framework that promotes SCPs and contributes to improving construction productivity. The reported knowledge areas provide directions for future research, whereas, factors with more notable implications on construction productivity should be investigated more extensively to determine their extent of implication.

Keywords: Bibliometric analysis, construction, literature review, productivity, sustainable construction practices.
Digitalization of the South African Construction Industry: A Potential for Further Future Research

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Abstract. This paper reviewed recent researches on digitalization of the South African construction industry in comparison with countries like United Kingdom and Korea among others with a view to identify the potential of subsequent research that will further enhance the digitalization level of the South African construction industry. It was pursued via a review of existing and recent literature retrieved from various search engines such as GoogleScholar® within the years 2017-2020 which is assumed to be the years of active research activities in digitalization in South African Construction industry based on Deloitte South Africa-White Paper Report. The research accessed the various researches conducted and the result proposed five broad research directions among which are: broad trends in digitalization of the construction industry; perceptions and methods used by the scholars; government guidelines; digital technologies; and apprehension around security. It is on the premises of this direction that this paper suggests that subsequent research should be challenged in this direction as it was observed as an obvious study/research gap.

Keywords: Digitalization, construction, construction industries, South Africa.
Gendered Health and Safety Hazards in Construction Work

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Abstract. Gender disparities exist in the workplace, which sometimes influences occupational health and safety practices. Through a comprehensive literature review, this study examines differences in occupational exposures between men and women, to highlight how gendered work conditions influence the health and safety of women in construction trades. The study also highlights (i) current labor issues about women’s occupational health and safety in the construction industry, (ii) research gaps relating to women’s workplace health and safety. Recommendations are made concerning how to address health and safety concerns of women involved in construction activities.

Keywords: Construction, Gender Differences, Health and Safety, Occupational Hazards
Circular Economy: A Sustainable Approach to Waste Management in the City of Johannesburg

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Abstract. Circular Economy (CE) is a fresh approach to a systematic waste management strategy. It establishes principles which align with a net-zero waste agenda, promoting a sustainable environment, society, and economy. Furthermore, the concept aims to reduce carbon emissions by using waste as a resource. Johannesburg (JHB) is facing social and economic problems, which need effective waste management techniques. Current waste management methods implemented by the public sector are not sufficient in combating waste accumulated daily. As part of a comprehensive research into how systematic waste management strategies are implemented in other countries, a qualitative study was conducted. Pikitup was used as a case study and empirical data from the interviews of experienced practitioners was used. An inductive approach provided explanations of the continuous interplay between theory, business proposals and real-life examples. To bridge the current research gap, benchmarking currently implemented methods in the JHB city to those of leading countries in CE allows for enhanced developments in terms of efficiency and sustainable living. The results further suggested that waste production is a serious problem that not only the country is dealing with but the entire world. Therefore, many barriers should be overcome, concerning the introduction of environmental policies, effective investments, and social inclusion. JHB city should ensure that CE is adaptable and flexible to the standards set out by government and private sector waste management service provider; guaranteeing the technical capacities to implement CE. The model should accommodate activities like the informal sector but boost the principles of sustainable development.

Keywords: Circular economy, Pikitup, Sustainability, Technology-know-how, Waste management
Critical Factors Influencing Energy Use Behaviour Of Building Occupants: A Literature Review

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Abstract: The wasteful and inefficient energy consumption behaviour of energy users has caused negative effects on the environment and the economy at large. It has also been found to lead to an increase in various environmental effects like ozone layer depletion, scarcity in electricity supply, increase in energy bills, global warming, climate change. Consequently, the factors influencing this energy use behaviour becomes a crucial area of study which needs urgent attention. This paper, therefore, discusses the critical factors influencing the energy use behaviour of occupants in buildings. The methodology involves a thorough review and analysis of selected published journals. The search included journal articles, books, and conference proceedings on the factors influencing energy use behaviour of building occupants from different databases including Science Direct, Google Scholar, Research gate, Web of Science. Five (5) critical factors influencing occupants’ energy use behaviour were identified from the 71 reviewed literature. These factors are; awareness factors, personal factors, socio-demographic factors, management factors and motivational factors. The challenges faced by the environment and the ecosystem call for urgent attention to the factors that influence occupants’ energy use behaviour. This paper provides an understanding of the critical factors that can influence occupants’ energy use behaviour in buildings. The understanding of these critical factors will not only assist policymaking but will also provide knowledge of their prevalence in ascertaining their severity or benign nature.

Keywords: Energy, Energy Consumption, Energy Use Behaviour, Energy Conservation, Energy Efficiency
Comparative Analysis Between The Tender Estimate And The Actual Completion Cost Of High Voltage Fluid Filled Cable Decommissioning

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Abstract. This research investigates the relationship between a tender-stage cost estimate and the actual cost incurred to complete decommissioning of aging high voltage power cables connected to the transmission network. Such work is essential to preserve health and safety (H&S) of on-going power generation activities. The research adopts a mixed postpositivist and interpretivist epistemological lens to analyse longitudinal cost data accrued via a case study of an underground cable decommissioning project. Quantitative cost data and qualitative feedback from project stakeholders was analysed using summary statistical analysis and content analysis. The data from the comparative analysis then informed the basis of an interview with industry professionals and practitioners with a view to identifying the key drivers of change between tender estimate and actual cost. The interview content was analysed, and key themes were extracted. Findings from the case study suggest that the niche nature of fluid-filled cable decommissioning, combined with the diminishing number of experienced practitioners in the field, contributed to the variances seen within the cost data. The interviews conducted indicate that the three key drivers for cost variance between tender and actual cost are: lack of decision around methodology at tender stage, changes in method of delivery and changes to programme and planned durations. The data suggests that many of the variances could have been foreseen and considered within risk allowances or contingencies. This research is the first published work in this area. The content provides rare insight into the electricity transmission sector and specifically the decommissioning of high voltage fluid filled cables and the cost variances that occur between the estimated and actual costs incurred.

Keywords: Actual Cost, Cable Decommissioning, Cost Uncertainty, Fluid Filled Cable, Transmission Voltage.
A Review Of Barriers To The Adoption Of Smart Building Concepts (SBCs) In Developing Countries

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Abstract. The smart building concept is becoming more popular in construction in recent times. This is because the world is embracing digitization in response to the advent of new technologies. The call for high building performance and sustainable development has brought about the adoption of smart building concepts in the construction industry. The Smart Building Concept adoption has not been without hindrances occasioned by several constraints undermining the efforts that aid its adoption. This paper intends to review systematically extant literature on barriers undermining the adoption of SBCs, considering papers published in peer-reviewed journals and conferences. The study reviewed 33 relevant articles concerning barriers to the adoption of SBCs, and barrier frequency was employed to select the most reported ones. The study revealed the most reported barriers undermining the adoption of SBCs as the high cost of initial construction, vague objectives, lack of guidelines to manage SBC, lack of government incentive and policy, lack of knowledge on the smart building by contractors and professionals, and resistance to change from the use of traditional technologies among others. For SBCs to thrive in developing countries, there is a need to mitigate the identified barriers to their adoption.

Keywords: Smart building Concepts, Sustainable construction, Smart building barriers, Smart building technologies, and sustainable development
Understanding The Functionality And Mechanical Properties Of Steel Fibre Reinforced Concrete In Stemming Building Collapses In Nigeria

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Abstract. In Nigeria, building collapses is a common occurrence, and several factors have been advanced to explain the incidents, amongst these is the lack of understanding of the functionality and mechanical properties of steel fibre reinforced concrete. Such understandings can assist in stemming building collapses and attendant economic and social effects, particularly the health and safety of construction workers and occupants. This is achieved by understanding the functionality and mechanical properties of steel fibre reinforced concrete. As a way of demonstration, an efficient way to achieve this is to use thin short discrete steel fibres, this will allow, a multi-directional reinforcement, the process modifying and improving properties of the concrete, especially its ductility. Critical to this, is the understanding of the preference and selection of materials to make appropriate mixes for efficient result of steel fibre reinforced concrete. In other words, failure to pay attention to selection and use of materials will produce weak concrete structure and precipitating unwarranted disasters.

This study investigates the effects of length and aspect ratio of steel fibres when mixed with different sizes of coarse aggregate on the workability and subsequently, on the mechanical properties of the material. Variables selected for the study were fibre lengths of 50 mm and 60 mm, aspect ratio of 45, 50 and 60, fibre dosages of 25 kg/m³, 40 kg/m³, 50 kg/m³ and 60 kg/m³ and maximum aggregate sizes of 10 mm and 20 mm. Mix proportions for the investigation were kept constant throughout the study. Slump test was performed on fresh concrete while compressive strength was measured using 100 mm cubes and flexural performance assessed through 150 mm x 150 mm x 600 mm prism. The experimental results confirm that the combination of geometry and maximum aggregate size in the mix has an important influence on the workability of fresh steel fibre reinforced concrete. Consequently, the obtained results confirm that there is relationship between the mechanical properties of hardened concrete and the workability of fresh concrete. The concrete with poor workability reveals inadequate orientation and distribution of fibres, leading to poor actions of fibres within the mix and hence, affecting the mechanical properties of tested concrete materials. It is hoped that construction practitioners in Nigeria, and by extension, Africa, will evaluate their practices considering this study.

Keywords: Steel fibres, fibre geometry, aggregate size, workability, compressive strength, flexural properties.
Construction Sustainability: Empirical Evidence On Sme Development And Delivery Challenges Of Road Infrastructure In South Africa

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Abstract. This paper presents findings on small and medium enterprises (SMEs) development and delivery challenges of road infrastructure in the Limpopo province of South Africa. The analysis of qualitative data gathered through in-depth interviews with contractors, architects and project/construction managers in all five cases resulted in the emergence of variety of factors influencing delivery challenges of road infrastructure in construction SMEs. Primary data were collected through a number of depth interviews with construction SMEs experts and project managers. Secondary data were collected through construction SME organisations’ documents written procedures, transformation and technological issues. The main findings of this study showed there was a huge delivery challenges related to road infrastructure in the construction industry, i.e. poor construction design, lack of technical and engineering abilities, inadequate management involvement and support, unclear targets to sustainability in building construction, lack of technological skills, improper training of the team members and inadequate use of information and communication technologies. A good understanding of the SMEs development for improving service delivery of road construction projects as well as the challenges faced by project manager in the construction industry in South Africa have been identified and discussed in detail. The study has contributed hugely to understanding the importance of construction SMEs for improving economic growth and delivering efficient road infrastructure in developing countries. The findings reinforce the conclusion that a significant relationship exists between construction sustainability and road infrastructure design. This result can also be used as a guideline to successfully handle SME construction projects in South African local governments as well as in other countries, especially in the emerging economies in Africa and the rest of the world.

Keywords: Small and medium enterprises, construction sustainability, challenges, road infrastructure
The Hand-Arm Vibration Syndrome: Current and Future Trends of a Neurological Disorder in Construction Workers

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Abstract. Hand-arm vibration is vibration that is transmitted into the hands and arms of construction workers that are using mechanical hand-held power tools or processes while carrying out construction work activities. During an attack the fingers might feel ‘numb’ and a sensation of ‘pins-and-needles’ may also be experienced. This paper provides a bibliometric review of existing studies to explore the evolution and research trends on Hand-arm Vibration Syndrome among construction workers. A total of 204 relevant publications obtained from the Scopus database were examined. Co-occurrence networks of keywords based on bibliographic data were developed using VOSviewer. Based on the trend of research topics, the study provides significant implications and insights into the research status and future research trends, which is crucial to help construction health and safety stakeholders develop targeted interventions.

Keywords: Construction Workers, HAVS, Musculoskeletal disorder, Neurosensory, VosViewer.
The Challenges with Developing and Applying Knowledge, Skills and Competences (KSC) in the Nigerian Engineering and Construction Industry (NECI)

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Abstract. In Nigeria, the construction industry contributes over 3% of the annual gross domestic product and is the fourth highest employer of labour in Nigeria. Despite its contributions and the huge potential of the Nigerian Engineering and construction industry (NECI), inadequate attention is given to its significance in driving the Nigerian economy. Knowledge, skills, and competences are the main critical success factor of the construction industry. Several challenges are responsible for sloth of the NECI. This study explored these challenges evident in developing and applying knowledge, skills, and competences (KSC) in management of the NECI. The NECI employs an extremely diverse range of workers from extensive and various backgrounds, who are deployed to be managed and supervised. Ineffective management caused by lack of updated KSC, has been identified in academic literatures as a major setback in the NECI. This study identified and extensively discussed these challenges through a review of literature and data from the NECI. The data, on which this study was based, was sourced from 155 completed and usable survey questionnaires and 30 semi-structured interviews with registered engineering and construction professionals in Nigeria. Participants were drawn from membership database of the Nigerian Society of Engineers, practicing in both private and public sectors.