

47th Australasian Universities Building Education Association Conference

Book of Abstracts

24 - 27 November 2024

Building for a Sustainable Future:
Innovations, Challenges, and Collaboration

Editors:

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VU City Tower
370 Little Lonsdale St, Melbourne VIC 3000

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Book of Abstracts of the 47th Australasian Universities Building Education Association (AUBEA) Conference 2024

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Edited by Professor Zora Vrcelj, Associate Professor Malindu Sandanayake and Dr Yanni Bouras from Built Environment and Engineering, College of Sports Health and Engineering, Victoria University, Melbourne, Australia.

Acknowledgement of country

Victoria University (VU) acknowledges the Elders, families and forebearers of the Boonwurrung, Woiwurrung (Wurundjeri) and Wathaurung (Wadawurrung) who are the custodians of University land and have been for many centuries.

We acknowledge that the land on which we stand is the place of age-old ceremonies of celebration, initiation and renewal, and that the Kulin people's living culture had, and has, a unique role in the life of this region. VU supports the aim of Reconciliation Australia to build better relationships between the wider Australian community and Aboriginal and Torres Strait Islander peoples for the benefit of all Australians.



Artist: Paola Balla, Moondani Balluk, 2017

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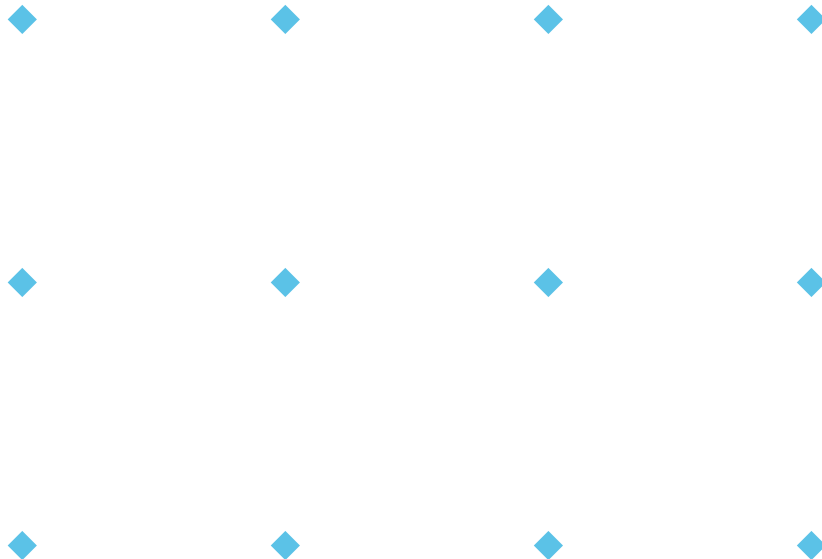
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Welcome Message from the Conference Chair

Welcome to AUBEA2024!

It is an absolute pleasure to welcome you to Melbourne and the 47th AUBEA conference, hosted by Victoria University at our City Tower campus. This year's conference is truly an international gathering, with delegates joining us from across the globe, bringing together diverse perspectives and expertise that enrich our field.

AUBEA2024 focuses on the theme “Building for a Sustainable Future: Innovations, Challenges, and Collaboration.” Over the next few days, we'll explore critical areas that shape the future of the built environment, including circular economy practices, digital innovation in construction, advancements in sustainable construction and leadership and gender equity. Our program also highlights Victoria University's unique educational model and its approach to innovative, industry-integrated learning.

Melbourne, renowned for its architectural diversity and cultural vibrancy, offers an ideal backdrop for these discussions. In addition to our sessions, we have organised technical tours that showcase groundbreaking projects, from the West Gate Tunnel to our own Structural Fire Testing Facility.

I would like to express my heartfelt gratitude to everyone who has contributed to making AUBEA2024 possible: Victoria University, AUBEA Council, our sponsors, our conference co-chairs, organising committee, keynote presenters, panel members, speakers, and each of you as attendees. Your commitment to advancing building education and practice is what drives the success of our conference and shapes the future of our industry.

Thank you for being part of this important event. I encourage you to make the most of every session, panel, and conversation, as we work together toward a more sustainable and resilient future.

Warm regards,

Professor Zora Vrcelj
Conference Chair, AUBEA2024



Welcome Message from the President of AUBEA

On behalf of the Australian Universities Building Education Association (AUBEA), it is my pleasure to welcome you to the AUBEA 2024 Conference. This year's event, hosted by Victoria University, takes place at a pivotal time in our field. Building education, now more than ever, plays a critical role in addressing the global challenges we face. From climate change to the demands of a digitalisation, our industry is being reshaped in ways that call for renewed collaboration, innovation, and sustainable practices.

The theme for this year, "Building for a Sustainable Future: Innovations, Challenges, and Collaboration", speaks to the core of what AUBEA stands for. We recognise that tackling these challenges requires integrating diverse perspectives, bridging academia and industry, and fostering a commitment to research that drives impact. Over the next few days, we will explore insights from leading experts, exchange pioneering ideas, and engage in meaningful discussions that will inform the future of building education and practice.

AUBEA2024 would not be possible without the hard work of the organising committee, the support of our sponsors, and the engagement of each participant. I would like to extend my sincere gratitude to everyone who has contributed to making this event a success. Special thanks to Victoria University for hosting and to the many individuals who have worked tirelessly to bring us all together. I also wish to specifically thank Professor Zora Vrcelj, Conference Chair, and conference co-chairs A/Professor Malindu Sandanayake and Dr Yanni Bouras and the conference committees including the international scientific committee for their immense dedication and contributions.

As we gather here, I encourage each of you to take full advantage of the opportunities to connect, share, and inspire. Together, we are shaping the future of building education, and I am confident that the knowledge and partnerships fostered at AUBEA2024 will continue to make a positive impact long after the conference concludes.

Thank you for being a part of AUBEA2024.
Let's make it an unforgettable experience!

Warm regards,

Professor Srinath Perera
President, Australian Universities
Building Education Association (AUBEA)



AUBEA2024 Conference

Keynote Speakers



Stephen Sammartino

*November 25, 9:45am - 10:45am
Level 25, VU City Tower*

Futurist Steve Sammartino is a tour de force in the field of technology. His energy and humour on stage have made him sought-after speaker around the globe. An expert in AI's profound implications for business and society, Steve has been immersed in Computational Intelligence systems from the tender age of 10.

Steve goes beyond theory and brings lessons from his own tech ventures. His latest Macro3D, a ground-breaking AI and robotics company – which 3D prints houses. Since co-founding the company he has managed to 3D print a house, and is now embarking on building the world's first home built entirely by AI. An accomplished author, Steve has written three best-selling books on the subject of technology and its future. As a testament to his compelling insights, he has given a TED talk and is the host of the popular national Technology and Business TV show on Channel 9, "The Rebound" – now in its 4th Season.

Steve's takes the complex and makes it simple, and human. This sentiment is captured in his viral videos, which boast over 100 million views - his drivable Lego Car being a prime example. As a respected media commentator, his views are widely sought after, making him an authoritative voice in the tech industry. Steve Sammartino doesn't just predict the future of technology, he's literally building it, and his speeches are an unmissable opportunity to get a glimpse into that future.



Jorge Chapa

*November 25, 11am - 11:50am
Level 25, VU City Tower*

As its Chief Impact Officer, Jorge ensures the Green Building Council of Australia (GBCA) strategic priorities, partnerships, products and services, including Green Star, accelerate the transformation of Australia's built environment – delivering healthier, more resilient, and positive places for people and nature.

He chairs WorldGBC's Global Commitment for Net Zero Carbon Buildings Taskforce and WorldGBC's ESG working group. He is a member of Climate Bond Initiative's Low Carbon Buildings Technical Working Group,GRESB's Real Estate Standards Committee, Carbon Risk Real Estate Monitor's Global Industry Committee, and part of Science Based Target Initiatives Buildings Technical Expert Group. He is also a Board Director at GreenFleet.



Clare Shiell

*November 26, 9am - 10am
Level 25, VU City Tower*

Clare Shiell is the Executive Director, Portfolio Delivery at Plenary, a leading independent long-term investor, developer and manager of public infrastructure, specialising in public-private partnerships and precinct development. Clare's strategic oversight of a diverse portfolio of projects, including the \$1.5 billion New Footscray Hospital Project, which is being delivered in partnership with the Victorian government and Western Health.

With over 24 years of experience spanning both public and private sectors, Clare is a leader delivering some of Victoria's most successful large-scale PPPs across sectors such as Justice, Health, and commercial infrastructure. Managing complex teams, navigating risks, and overcoming challenges to achieve outstanding project outcomes have been defining features of her career. Clare will share her insights into cultivating transformational leadership and driving meaningful change within the demanding landscape of infrastructure development.

AUBEA2024 Conference Plenary Panel Sessions

Plenary Panel Session 1

Circular Economy Research Network Australia Pacific (CERN APac): Building Skills for a Circular Economy

November 25, 12:45pm - 1:45pm

This panel will explore the critical intersections between the built environment, skills development, and education within the framework of the circular economy. As Australia transitions toward a circular economy to support its net-zero targets, the built environment plays a key role through strategies such as reusing structures and implementing efficient building practices. However, challenges remain in terms of market barriers, unclear roles, and procurement issues.

To address these challenges, there is a growing need for a workforce skilled in innovative products, materials, and recovery techniques. This session will discuss how advancing education and skills can directly impact circular economy practices in the built environment. Panelists will highlight the pivotal role that engineers, architects, and other professionals can play in driving sustainable outcomes through this integrated approach. Join us as we explore how enhancing skills and education can propel both the built environment and circular economy practices forward.

Panelists

Professor Usha Iyer-Raniga (Facilitator), Gavin Cotterill, Rob Turk, Dr Mayuri Wijaysundara, Duy Le, Ani Chakraborty GAICD

Plenary Panel Session 2

Performance- based legislation: facilitating innovation or negotiated compliance?

November 25, 3:40pm - 5:00pm

Proponents of performance-based legislation argued that it encourages innovation by allowing designers greater flexibility to meet minimum health, amenity and safety standards. By adopting a performance-based approach designers can utilize new technologies and methods tailored to specific projects rather than adhering strictly to prescriptive codes, which may be outdated or overly restrictive. Theoretically, this approach has the ability to adopt cutting-edge solutions, ultimately leading to higher quality and more sustainable buildings.

However, critics contend that the flexibility inherent in performance-based codes could lead to a tendency towards negotiated compliance, where designers may seek to develop performance solutions through negotiation to cut corners and reduce costs. This session will discuss whether the existing regulatory frameworks ensure accountability and prevent such practices.

The discussion will focus on whether the current built environment curriculum provided by the university sector in the use of performance-based legislation is adequate to meet these challenges. Specifically, is sufficient content related to the need to develop a culture of responsibility among industry stakeholders to avoid the pitfalls of negotiated compliance when using performance-based legislation provided?

Panelists

Dr. Darryl O'Brien (Panel Facilitator), Stephen Kip, Bronwyn Weir, Tass Georgas, Steven Baxas

Plenary Panel Session 3

Innovation in Built Environment Education: The VU Block Model®

November 26, 10am - 11am

This panel session introduces attendees to Victoria University's innovative VU Block Model® of teaching, with a specific focus on its application in Built Environment programs. The VU Block Model®, a revolutionary approach to course delivery, has transformed the learning experience for students and educators alike. Our diverse panel of experts will explore how this model enhances education related to the Built Environment, aligning with the conference theme of "Building for a Sustainable Future."

The session will highlight the strengths and opportunities presented by this delivery model, including:

- Intensive, focused learning periods
- Enhanced student engagement and success rates
- Improved alignment with industry practices and expectations
- Flexibility in incorporating emerging trends and technologies

Through the questions posed to this expert panel and related discussions, attendees will gain a comprehensive understanding of how the VU Block Model® has enhanced education related to the Built Environment. The panel will also address challenges encountered and solutions developed, providing valuable insights for educators and practitioners.

Panelists

Dr Joshua Johnson (Panel Chair), Professor Andrew Smallridge, Associate Professor Loretta Konjarski, Dr Mengbi Li, Dr Hing-Wah Chau, Ms Lauren Unger.

AUBEA2024 Conference Program Overview

Day 0	Sunday 24 November 2024
5:30pm – 6pm	Arrival and Early Registration <i>Foyer, VU City Tower</i>

6pm – 7:30pm	Welcome Reception <i>VU City Tower</i>
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Day 1	Monday 25 November 2024
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8am – 9am	Registration <i>Level 25, VU City Tower</i>
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9am – 9:45am	Welcome and Opening Ceremony <i>Level 25, VU City Tower</i>
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9:45am – 10:45am	Keynote Address 1: Stephen Sammartino Futurist & Keynote Speaker <i>Level 25, VU City Tower</i>
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10:45am – 11am	Tea & Coffee Break <i>Level 25, VU City Tower</i>
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11am – 11:50am	Keynote Address 2 Sponsored by Transurban: Jorge Chapa Green Building Council of Australia <i>Level 25, VU City Tower</i>
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11:50am – 12pm	Australian Institute of Quantity Surveying (AIQS) <i>Level 25, VU City Tower</i>
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12pm – 12:45pm	Lunch <i>Level 10, VU City Tower</i>
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12:45pm – 1:45pm	Plenary Panel Session 1: Circular Economy Research Network Asia-Pacific (CERN APac): Building Skills for a Circular Economy <i>Level 25, VU City Tower</i>
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1:50pm – 3:20pm	Parallel Session 1 <i>Level 11 and 12, VU City Tower</i>
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1:50pm – 3:20pm	AUBEA Council Meeting <i>Room: Level 03 Rm 0307</i>
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3:20pm – 3:40pm	Tea & coffee break <i>Level 10, VU City Tower</i>
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3:40pm – 5pm	Plenary Panel Session 2: Performance-based legislation: facilitating innovation or negotiated compliance? <i>Level 25, VU City Tower</i>
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3:20pm – 5:10pm	Online Session <i>Zoom link</i>
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6:30pm – 9pm	Conference Dinner <i>Zinc at Federation Square, Cnr Princes Walk &, Russell St Ext, VIC 3000</i>
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Day 2	Tuesday 26 November 2024
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08:30 – ongoing	Registration <i>Level 25, VU City Tower</i>
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9am – 10am	Keynote Address 3: Clare Shiell Plenary Group <i>Level 25, VU City Tower</i>
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10am – 11am	Plenary Panel Session 3: Innovation in Built Environment Education: The VU Block Model* <i>Level 25, VU City Tower</i>
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11am – 11:15am	Tea & Coffee Break <i>Level 10, VU City Tower</i>
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11:15am – 12:15pm	Parallel Session 02 <i>Level 11 and 12, VU City Tower</i>
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12:15pm – 1pm	Lunch <i>Level 10, VU City Tower</i>
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1pm – 2:30pm	Parallel Session 03 <i>Level 11 and 12, VU City Tower</i>
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1:45pm – 2:30pm	Workshop: Applications of Generative AI in Construction Project Management <i>Level 1114, VU City Tower</i>
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2:30pm – 2:45pm	Tea & coffee break <i>Level 10, VU City Tower</i>
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2:45pm – 4:15pm	Parallel Session 04 <i>Level 11 and 12, VU City Tower</i>
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4:15pm – 5pm	Closing Ceremony <i>Venue: Level 25, VU City Tower</i>
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Day 3	Wednesday 27 November 2024
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8:15am – 3pm	Technical Bus Tour*: West Gate Tunnel Project and Victoria University Structural Fire Testing Lab with Buffet Lunch <i>Meeting location: VU City Tower</i>
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9am – 12pm	Technical Walking Tour: Walking tour, Melbourne CBD award-winning buildings <i>Meeting location: Ground Floor Lobby, 55 Collins St</i>
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*To register please visit the conference website

Sustainable Building Practices



ID 09: Evaluating the Coherence of Victoria's Local Jobs First Policy: Insights from Strategic, Performance and Process Management Perspectives

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Abstract:

Should governments prefer local manufacturers when acquiring goods and services? If yes, what conditions necessitate preference for local manufacturers and how can policymakers design and measure the impact and coherence of these market intervention policies? This paper aims to qualitatively examine the policy coherence of the Local Jobs First (LJF) Policy backed by the Local Jobs First Act 2003. Three objectives have been specified: (1) To critically examine the benefits of the LJF Policy, (2) To uncover the costs of the LJF Policy and (3) To explore the coherence of the LJF Policy. This qualitative research adopted a single-state case study, covering Victoria. Twenty-five documents mostly published by the Victorian government were thoroughly analysed. The document analysis covered twenty years to provide a comprehensive understanding. The findings indicate that, over the last decade, the Victorian Government invested \$164 billion in capital projects under the LJF Policy, providing access to public contracts for small and medium-sized enterprises (SMEs) and raising the awareness of head contractors on local industry capability. However, the coherence analysis revealed that most of the objectives were partially coherent because the data reported by the Victorian Government did not show precise policy impacts. Also, the costs incurred by the Victorian Government in implementing the LJF Policy and firms' compliance costs were not stated. Therefore, it is recommended that the Victorian Government reports more detailed data on benefits and related costs to improve policy coherence analysis.

Keywords:

Local Jobs First Act 2003, Local Jobs First Policy, Policy Coherence, Procurement, Victoria

ID 10: Quantifying the Energy Impact of Resilient Ventilation on Existing Office Buildings

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Abstract

The ever-increasing risk of climate change and the impact of recent global pandemics have resulted in a significant drive by industry to develop and construct resilient office buildings. In addition to the pandemic, Australia has experienced some of the worst bushfire incidents in its history. This has pushed industry to focus on the operation of building ventilation systems. Researchers have conducted significant research on how pathogens are transported and distributed through ventilation systems and how to mitigate or neutralise pathogens in buildings. Most literary works tended to be more concerned with residential construction or new facilities than with existing office buildings. In general, the agreed response was an increase in outside air via the ventilation system. In contrast to the pandemic response, the reaction to bushfires was to reduce the amount of outside air introduced to a building via ventilation. The results of the literature associated with pandemics and bush fires also suggest increased filtration as a solution. However, the proposed solutions result in an energy penalty. This study investigated the design requirements of mechanical ventilation systems in an existing office building constructed before the pandemic. This study examined the adaptability of a mechanical ventilation system to the requirements of a resilient building. Furthermore, a comprehensive analysis quantified the peak energy consumption attributable to enhanced ventilation and system components.

Keywords:

Buildings, Energy, Resilience, Sustainability, Ventilation

ID 13: System dynamics (SD) application in carbon trading research in the construction industry: a systematic review

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Abstract:

Carbon trading has been identified as an effective and economical mechanism in reducing carbon emissions. There is a notable scarcity of comprehensive reviews on system dynamics (SD) modelling application within carbon trading research in construction. The purpose of this study is to undertake a systematic literature review of system dynamics application in carbon trading in the construction industry. Scopus and Web of Science were the databases adopted. Relevant keywords aided by Boolean search operators were used. Of 67 articles retrieved, a two-stage filtering was undertaken. The final number of articles adopted for analysis was 42. Content analysis was used to extract and synthesize the findings. From the findings, the most significant applications of SD in carbon trading in construction include carbon trading price forecasting, efficiency of emissions trading scheme, impact of carbon quota allocation, and simulation of carbon emission reduction in the construction industry. This study is significant and through this review paper, practitioners can easily be more familiar with system dynamic modelling techniques. This will motivate them to better understand their application in carbon trading research in the construction industry.

Keywords:

Carbon trading, system dynamics, construction industry, systematic review, climate change

ID 14: Smart and advanced manufacturing technologies and artificial intelligence for sustainability enhancement of prefabricated construction: A scientometric analysis

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Abstract:

Prefabricated construction (PFC) involves a factory-based controlled manufacturing environment that creates significant opportunities to enhance sustainability compared to conventional construction. The current review explores the potential of smart and advanced manufacturing technologies and artificial intelligence (AI) to elevate the sustainability performance of PFC. The current applications, trends, and future directions are identified using a systematic methodology and data analysis through a scientometric study. The conceptual structure revealed that “computer vision”, “industry 5.0”, “machine learning (ML)”, “3d concrete printing”, “artificial intelligence”, “blockchain”, and “digital twin” are emerging themes in recent years. The subsequent critical discussion identified the role of construction 4.0 technology domains such as AI, Internet of Things, digital twin, 3D printing and robotic fabrication in elevating the sustainability of PFC methods. However, the outcomes indicate that the PFC industry still has significant barriers to overcome in integrating and adopting these emerging technologies to reach desired sustainability benchmark performances. Thus, the study highlights the importance of formulating strategies for the elevated diffusion of these technologies into prefabrication by the close and imminent involvement of key life cycle stakeholders.

Keywords:

Artificial intelligence, Prefabricated construction, Smart and advanced manufacturing, Sustainability, Construction 4.0

ID 16: BIM for Safety Management: Current Implementation and Challenge in Indonesian Construction Industry

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Abstract:

Construction sites are notorious for high levels of hazards, often attributed to human error. To reduce these risks, there is an urgent need for tools to complement current efforts. However, addressing various hazards requires a systematic approach where an integrated system of technologies is expected to enhance hazard prevention. In Indonesia, since the Government mandated BIM use for state-owned projects in 2018, its utilisation has rapidly expanded. However, the current regulation for construction safety management systems in Indonesia does not address BIM adoption. Consequently, there is an expectation to explore potential integrations between BIM and safety management to optimise safety effectiveness during construction. This research aims to identify BIM and technologies used for construction safety management. The implementation and challenges faced by the Indonesian construction industry will be explored from the contractors' point of view. To achieve this objective, a systematic literature review was conducted by examining papers to understand the current state of the art of research in this area. Questionnaires-based interviews with practitioners were conducted to collect data. The result indicates that 70.18% of respondents already implementing BIM for Safety Management. Among them, the most common use is for safety visualisation, while early warning systems are less commonly applied. However, most of the current implementation of the technology remains concentrated on building projects with less focus on another type of infrastructure. In addition, key challenges identified include a shortage of skilled personnel, additional costs of technology implementation, and complex integration between BIM and safety data.

Keywords:

BIM, Digital Technology, Indonesia, Safety Management

ID 20: Analysing Construction Stakeholder Perceptions in Indonesia: Analytic Hierarchy Process Approach for Quality, Cost, and Carbon Emission Assessment

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Abstract:

Degradation of natural ecosystems and climate change are of the utmost importance. There have been initiatives initiated in numerous nations across the globe to reduce the effects of climate change. One industry that contributes significantly to carbon emissions and can amplify the consequences of climate change is construction. Stakeholders in the construction sector in Indonesia tend to be relatively unconcerned with long-term climate change mitigation. Therefore, this research is performed to investigate the construction industry stakeholder's perceptions in order to create a decision-making system which incorporating not only cost and quality of construction but also carbon emissions. The research is conducted by adopting Analytic Hierarchy Process (AHP) and involving respondents from the private and public sectors which includes contractors, consultants, and owners. The results show that construction stakeholders in Indonesia prioritize quality by 63.33%, followed by cost by 26.05%, and carbon emissions rank last at 10.62%. The Indonesian construction industry has not yet perceived carbon emissions as a significant concern. Therefore, the government should implement measures and policies that promote greater awareness among construction stakeholders regarding carbon emissions such as offering incentives as a movement towards sustainability.

Keywords:

Analytic hierarchy process, construction stakeholder, perception analysis, decision making

ID 25: Critical Success Factors for Synergistic Development of Circularity and Resilience in Energy Infrastructures

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Abstract:

Energy infrastructure projects consume extensive resources and are vulnerable to natural and human-induced hazards. The enhancement of their circularity and resilience is essential for sustainable development in the post-pandemic era. Although the two concepts are closely interconnected at both the conceptual and practical levels, research focusing on the synergistic relationship between circularity and resilience is still in its nascent stages. This study contributes to the body of knowledge by systematically reviewing the target literature to accurately identify the critical success factors (CSFs) for the synergistic development of circularity and resilience in energy infrastructure. By identifying the CSFs for circularity and resilience, this study aims to provide guidance and reference for governments and construction companies to enhance circularity and resilience in the early stages of the project. The research outcome reveals that 'capacity of project teams and training support', 'early planning', 'preventive and corrective maintenance', 'availability of materials', 'policy support', and 'data and technology' are shared CSFs for achieving circularity-resilience co-development.

Keywords:

Circularity, Resilience, Energy Infrastructure, Success Factors

ID 31: Tales of the Unexpected - the Embodied Carbon of Building Services Systems in Housing

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Abstract:

New Zealand has committed to net zero carbon emissions by 2050. A historical focus on operational carbon reduction means that as this reduces, the embodied carbon becomes a more significant factor. The Ministry of Building Innovation and Employment (MBIE) methodology for whole-of-life embodied carbon states that building services are optional. Research into this area of building services is in its infancy, with uncertainty about the real contribution to the embodied carbon footprint. Internationally, manufacturers are increasingly publishing the embodied carbon of individual pieces of services equipment, but the cost of producing a full Environmental Product Declaration (EPD) can be a barrier. This paper outlines some of the challenges of documenting the embodied carbon of complete residential building services systems. In a case study, a single-storey house is used to estimate the contribution from Electrical, Plumbing Drainage, and HVAC services across specific life cycle stages. It found that a possible illusion of precision is underpinned by pragmatic decisions in calculating fundamental data, the use of inconsistent Functional and Declared Units, and gaps in high quality data. The contribution of services varies between 5% and 21% of the total building whole of life embodied carbon, depending upon the Functional Units, LCA scope and the embodied carbon in the base building. This range underlines the importance of an agreed detailed methodology of assessment. Additionally, calculating and reporting protocols could be developed that use existing Building Code mechanisms of Verification Methods and Approved Solutions that will be particularly useful for designers and other practitioners.

Keywords:

Buildings services, embodied carbon, environmental product declaration

ID 32: Stakeholders' Behaviour Towards Achieving Net Zero Carbon Building - A Review

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Abstract:

With a heightened focus on the concept and development of net zero carbon building (NZCB) towards achieving the global carbon reduction target set for 2030 and 2050, the development of NZCB has been relatively slow. However, stakeholders are the main drivers in achieving NZCB. The effective involvement and partnership of the stakeholders are indispensable towards achieving NZCB. Nevertheless, these stakeholders present different stakeholders' behaviours that could influence the development of NZCB. Competitive threat behaviours of stakeholders will slow down the development of NZCB. The cooperative potential behaviour of a stakeholder will expedite the development of NZCB. It is imperative to identify the cooperative potential behaviours of these stakeholders that would enhance the achievement of NZCB. This study adopts a systematic literature review to explore the stakeholder cooperative potential behaviours that could positively influence the development of NZCB from 27 articles. Results obtained from this study revealed 15 cooperative potential behaviours among four groups of stakeholders (policymakers, professionals, researchers, and public bodies). The findings of this study will broaden the knowledge of key stakeholders on the appropriate behavioural factors that could promote NZCB development. In addition, the findings of this study will present significant insights to policymakers in formulating workable strategies for motivating stakeholders towards achieving NZCB. Furthermore, the findings of this study could serve as foundational knowledge for further empirical study on a comprehensive understanding of stakeholders' behaviours towards achieving NZCB.

Keywords:

Net zero carbon building, Stakeholders, Stakeholder involvement and partnership, Stakeholder competitive threat behaviours, Stakeholder cooperative potential behaviour

ID 33: Strategies for the Adoption of Green Finance in Green Building: The Case of Ghana

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Abstract:

Green building (GB) faces challenges such as high initial capital costs and inadequate investment, which can be addressed through green finance (GF). The existing literature lacks a theoretical framework on the interrelationships between the strategies necessary to promote GF-in-GB. To address this gap, this study adopts a two-step fuzzy Delphi survey to identify the critical strategies and their interrelationships to establish cause-effect parameters that may help in the effective adoption and implementation of GF-in-GB. Based on the opinions of 12 experts with GF-in-GB experience, the fuzzy Delphi method and fuzzy decision-making trial and evaluation laboratory were utilized to identify and analyze 20 strategies for GF-in-GB identified from the literature. The strategies were grouped into two categories: cause and effect strategies. The findings emphasize the top two causal strategies as “increased government participation as “leader by example” and “PPPs to facilitate GF from the private sector.” These causal strategies drive the entire GF-in-GB system and impact effect group strategies. Since the effect group can be easily influenced by the cause group, managers, stakeholders, policymakers and decision-makers must pay more attention to causal strategies when implementing GF-in-GB strategies. Such knowledge will help managers define the strategies needing greater attention within the sector compared to the less important ones. The study’s contributions may shape the theoretical framework used by stakeholders to analyze financing sources for green projects, ultimately enhancing the sustainability performance of both GF institutions and GB firms. The findings are, therefore, critical to promoting sustainable investments and development.

Keywords:

Fuzzy Delphi method, Fuzzy DEMATEL, Green building, Green finance, Strategies

ID 34: A Conceptual Framework for Lean Integrated Life Cycle Risk Management for Sri Lankan Large Contractors

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Abstract:

In addressing the challenges faced by Sri Lankan Large Contractors (SLLCs), it is imperative to introduce an innovative risk management approach spanning the entire project lifecycle (Kamalanathan et.al., 2014). Current practices in the Sri Lankan construction industry show a deficiency in effectively managing macro-level risks and stakeholders, primarily due to an overreliance on hard-skill management and traditional project management methods, prioritizing efficiency over efficacy which ill-affects the process and portfolio success (Czekster, et.al. 2023). To mitigate these challenges, this study proposes the implementation of Lean Integrated Life Cycle Risk Management (LILCRM) within SLLCs. The study establishes a conceptual framework based on a traditional literature review, outlines the shortcomings of traditional risk management, and suggests integrating lean principles with life cycle risk management to optimize project outcomes. By employing a qualitative approach with a positivist perspective, the framework of the study identifies specific challenges and barriers across each project stage and offers strategies and remedies for cohesive project delivery. This study not only contributes significantly to the understanding of LILCRM within the context of SLLCs but also has the potential to influence risk management practices in developing countries worldwide. It lays the groundwork for further refinement and validation of LILCRM tailored for LMCs in Sri Lanka.

Keywords:

Conceptual Frameworks, Large Contractors, Lean Integrated Life Cycle Risk Management, Lean Integrated Project Delivery, Sri Lanka

ID 35: How Build-To-Rent and Build-To-Sell Residential Developers' Model Contexts Compare, when Considering a Sustainable Construction Approach – A Case Study

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Abstract:

The New Zealand construction industry needs to decarbonise, and the country's aim is to halve carbon emissions by 2030 and achieve net zero carbon emissions by 2050. The construction industry is not yet substantively progressing sustainable building practices. Sustainable construction is often viewed as increasing the overall cost of the development, reducing the financial viability and profitability of the project, disincentivizing the developer from building sustainably. The Build-to-Sell (BTS) financial model is the primary choice for privately developed residential housing in New Zealand. The research explored the Build-to-Rent (BTR) model for residential developments, to establish if an alternative financial model would support sustainably constructed housing. The research question was "How could the Build to Rent financial model impact the economic viability of sustainable residential construction from a property developer's perspective?". The case-study focused on four Build-to-Rent projects- 'incorporating sustainable design and construction' or built to 'building industry standards'. Semi-structured interviews were conducted with key company directors that developed and operated the BTR projects, from completion till now. Comparisons between the projects were focused on financial performance, and the property developers' business perspectives. The case-study found that the BTR context takes a long-term view focussing on rental yield and long-term capital gain, whereas the BTS context only has a short-term property value focus. The BTR projects' findings established that sustainable construction does have a positive impact on financial feasibility to an extent, where buildings with moderate levels of sustainable construction experienced improved total returns.

Keywords:

Build-to-Rent, financial feasibility, residential developments, sustainable construction

ID 38: Sustainable Logistics Planning for Off-Site Construction: A Narrative Review

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Abstract:

Off-site construction, particularly using prefabricated volumetric modules, is gaining popularity due to its efficiency and sustainability. These modules with excessive size and weight necessitate heavy-duty diesel trucks to deliver, posing distinct logistic challenges compared to other construction practices, and increasing carbon footprint of transport significantly. However, research on off-site construction logistics, particularly regarding volumetric modules and their environmental impacts, remains limited compared to other stages. This review addresses the gap by investigating: (1) what are the current practices and challenges in off-site construction logistics for volumetric modules; and (2) what are the key considerations when optimising logistics plans to balance economic and environmental sustainability. A narrative literature review is conducted to examine publications on off-site construction logistics from the past decade, with an emphasis on carbon emissions and volumetric module transport. Findings from the literature review also identified practical constraints overlooked in existing studies, including time-dependent traffic conditions, road regulations, limited access for heavy vehicles, and restricted site storage space, which can lead to oversimplified logistics plans with sub-optimal costs and emissions performance. This review contributes to the body of knowledge by highlighting gaps in volumetric module transport, providing suggestions for future research. It also informs industry practitioners by enhancing their understanding of key considerations in off-site construction module transport. This knowledge would support better-informed decision making to minimise costs and decarbonise logistics operations to improve economic and environmental sustainability.

Keywords:

Decarbonisation, logistics planning, modular construction, off-site construction, sustainability

ID 46: Well-Being and Productivity in Construction Industry Through Gendered Lens: A Conceptual Framework

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Abstract:

Construction industry, characterised by its masculine work environment, is notorious for gender imbalance and reluctance to change. Women in construction encounter distinct challenges that adversely affect their health and well-being. While there exists significant research on mental health and well-being of construction workers, these studies often overlook women, focusing primarily on a predominantly male workforce. Women, however, have different stressors, triggers and coping mechanisms as compared to men. Further, despite productivity being a focal point for construction projects, the productivity of white-collar women workers remains understudied. By correlating well-being to productivity, this framework aims to interest the construction organisations and provide a profitable reason (enhanced productivity) to prioritise well-being of women professionals. This paper presents a conceptual framework that explores the intricate relationship between the potential hazards, primary preventive measures, workplace well-being and productivity of professional women in construction industry. By exploring the effect of potential hazards with direct and moderating effects from primary preventive measures on workplace well-being, the framework emphasises the unique risks and need for intervention to enhance the well-being of women. It further explores how employee well-being influences productivity, with mediating effect of the dual components of change in productivity- presenteeism and absenteeism. The gendered lens argues that despite a slow and steady increase in diversity in the construction, it is not yet excluded from gender-based discrimination and stereotypes. Thus, this framework advocates for enhancing workplace well-being of women in construction industry aligning it with industry's goal of increased productivity.

Keywords:

Construction Industry, Employee Well-being, Productivity, Presenteeism, Women

ID 54: Examining the dimensions of the relationship between the efficiency of energy consumption in residential buildings and the behaviour of residents

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Abstract:

Many efforts to reduce energy consumption have been focused on increasing the efficiency of residential buildings, which have a significant contribution to energy consumption worldwide. Achieving optimal energy efficiency in buildings, in addition to technological advances, is intricately related to the behavior of building occupants. This article deals with the multifaceted relationship between the efficiency of energy consumption in buildings and the behaviors of their occupants. Based on this, the aim of this research is to review the findings and standards of the multifaceted relationship between the efficiency of energy consumption in buildings and the behavior of residents. The research method of this article, with a mixed approach, is documentary content analysis. Relying on interdisciplinary research in the fields of environmental psychology, sociology, and building science, this study adopts a comprehensive approach to examine various aspects of this relationship. Based on the analysis, research on the relationship between energy efficiency and building occupants' behavior relies on quantitative methods. In recent years, simulation-based methods have been considered more than before. Based on the findings, it can be acknowledged that most researches have focused on architectural and physical aspects. Most of the reviewed studies have dealt with individual residential buildings. Based on the findings, it is generally concluded that addressing these different aspects of the relationship between energy efficiency in buildings and occupant behavior requires a comprehensive approach that integrates technological innovations, behavioral interventions, policy measures, and community engagement strategies. By considering these interconnected factors, stakeholders can work towards creating more sustainable and resilient built environments that prioritize both energy efficiency and human well-being.

Keywords:

Occupants' behavior, energy consumption efficiency, building energy performance, occupants' lifestyle, performance prediction

ID 55: Cost Planning for Sustainable Building Projects: Towards the Development of a Conceptual Sustainable Cost Adjustment Framework

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Abstract:

Current cost planning practice relies on historical data in order to establish initial project budgets. These initial budgets play a critical role in determining a project's feasibility and often in setting funding parameters. Any proposed changes to a project must therefore align with these fixed budgetary constraints to ensure financial viability. In the context of integrating sustainable practices into building projects, the traditional cost planning approach does not have any specific provision to consider sustainable construction practices and their deviations from past practice. While indices and locality factors facilitate the incorporation of inflation and regional cost variations, integrating "Sustainability" proves to be more difficult. True sustainability is linked to the principles of the Circular Economy and extends beyond initial capital costs, encompassing operational and end-of-life considerations from an economic perspective, along with social and environmental considerations. Therefore, the simplistic approach of adjusting historical cost data to allow for sustainable outcomes, becomes somewhat of a wicked problem. Building materials and construction methodologies from which historic cost data is derived, may no longer be suitable in a sustainable future. Drawing on insights from the literature, this paper proposes the development of a conceptual sustainable cost adjustment framework. When implemented within the early cost plan estimation process, such a framework could help ensure all of the relevant cost implications associated with the circular economy practices are systematically integrated into the initial estimates.

Keywords:

Cost Planning, Quantity Surveying, Sustainability

ID 58: Enhancing Campus Quality: A Focus on Microclimate

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Abstract:

The quality of a university campus significantly influences its overall appeal, student satisfaction, and academic performance. While defining campus quality remains a multifaceted and debatable endeavour, research has demonstrated that the microclimate within urban environments plays a pivotal role in shaping perceptions of outdoor amenities. In this paper, we delve into the impact of campus masterplan design on microclimate conditions, emphasizing the challenges posed by climate change and adjacent infrastructure in outdoor spaces. Our exploration centres on metrics for assessing outdoor environment quality, with a particular focus on acoustics, air quality and thermal comfort. Additionally, we provide an overview of existing standards and policies aimed at enhancing the quality of outdoor environment. Finally, we discuss approaches and tools that can contribute to the creation of healthier and more inviting outdoor spaces.

Keywords:

Microclimate, Outdoor Thermal Comfort, Air Quality, Acoustics, Campus experience

ID 60: The Aging Architecture Sector: Realities and Solutions

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Abstract:

The Australian architecture industry is threatened by emerging forces coupled with traditional ones to increase sector risk. Thus, professional challenges have increased, and stagnation has emerged. Billings have decreased since COVID-19. These have been well discussed in traditional media, online, and by associations, but there have been disparate leadership responses. This paper is a brief analysis of the current trends and potential solutions. The research concluded that a revitalisation initiative is required. Components include collaboration with the government and allied industries and a refocus on expanding markets. More in-depth research is needed to plan specific initiatives to strengthen the profession and its future.

Keywords:

Architect profession, association effectiveness, design vocation, Australian built environment

ID 65: Social Value Evaluation of Construction Sector: Towards a Holistic Evaluation Framework

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Abstract:

Governments worldwide are employing public procurement as a crucial instrument for implementing social welfare strategies and people-oriented actions in the construction sector to generate social value. However, due to the complexity and subjectivity of the social value concept, the existing evaluation frameworks and tools often lack a holistic view of the acquired social value by overlooking the hard-to-quantify subjective aspects of social value creating a major gap in practice and knowledge. This research aims to fill this gap in existing frameworks by developing a conceptual framework for evaluating the social value of the Australian construction sector. This study employed a qualitative research methodology consisting of a systematic literature review (SLR) to identify various factors affecting social value. Six major themes (community, corporate, relationship, personal, cultural, and career development) and forty-two social value factors have been identified through this study. The findings of this study comprehensively provide a holistic understanding of social value to support procurement professionals in contracting authorities. This will allow effective future policy- and decision-making regarding the construction projects. Furthermore, this study will support better value delivery to socially disadvantaged cohorts of society through future construction infrastructure capital allocation and procurement.

Keywords:

Evaluation, Social Value, Social Outcomes, Construction Sector, Holism

ID 68: Leveraging Stakeholder Management Strategies for Construction Project Success: A Systematic Literature Review

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Abstract:

Stakeholders play a significant role in project success or failure. The effective management of stakeholders in construction projects is vital to the project success. Conflicts between the project team and one or more stakeholders may hinder the effectiveness of Stakeholder Management (SM), hence robust Stakeholder Management Strategies (SMS) are required to be in place. This systematic literature review investigates the impact of various Stakeholder Management Strategies (SMS) on the success of construction projects. The review synthesizes findings from diverse sources to extract factors affecting the trend of SM through in-depth content analysis aiming to cover the chief objective of the research which is how to do efficient management for stakeholders in construction projects. By providing a holistic view of SM within the construction industry, this paper provides valuable insights for project managers, policymakers, and industry practitioners aiming to improve project delivery through better stakeholder management. Moreover, the study recommends exploring new means of communication, and the roles of advanced digital tools and social platforms that remain helpful in engaging stakeholders and should be aligned with the local and organizational culture. Additionally, the review explores challenges such as stakeholder misalignment and resistance to change, offering insights into overcoming these barriers to maximize project success. The findings also refine the understanding of the strategic implementation of SM in construction projects to develop guidelines and best practices for implementing SMS tailored to specific project contexts, advocating for the development of regulatory frameworks that incentivize organizations to prioritize SM in project planning and execution.

Keywords:

Stakeholder Management, Project Success, Construction, Systematic Literature Review

ID 74: Social Procurement Practice Disclosure in Project-Based Organizations: Insights of Supplier Diversity Initiatives from the Global Top 100 Construction Organizations

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Abstract

This study examines social procurement practices, specifically the supplier diversity initiatives, among the top 100 global contractors as ranked by Engineering News-Record (ENR) in 2023. Using content analysis of publicly available information, seven key items related to supplier social sustainability and diversity were assessed including presence of a supplier code of conduct, sustainability assessment criteria for suppliers/subcontractors, specifically indicating a supplier diversity policy/program, non-discrimination policy for suppliers, commitment to buying from local suppliers/subcontractors, engagement with small or medium enterprise (SME) suppliers, and engagement with minority-owned businesses. Our findings reveal significant variations in social procurement practices across regions, with European contractors demonstrating the highest level of disclosure, followed by American contractors, while Australasian contractors generally lag in all disclosure items.

Keywords:

Social procurement, supply chain, supplier diversity

ID 76: Enhancing Design Skills for Energy-Efficient Affordable Housing

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Abstract:

Energy efficiency in social and affordable housing remains a critical issue for occupiers, with rising energy costs forcing families to choose between thermal comfort and essential expenses like food and clothing. As rents rise, affordable housing tenants face increasing difficulty, particularly aging populations with fixed incomes. These challenges are compounded by aging buildings with dated heating and cooling systems, which cannot meet the required thermal comfort and energy efficiency. This paper investigates the skills required for implementing passive and active energy strategies. We assess the current status of awareness of energy efficiency in affordable housing among stakeholders from published information. Findings highlight a significant gap in occupant awareness and a lack of skilled professionals equipped to design and implement energy-saving measures. We found that occupants' behaviour plays a crucial role in energy consumption. Carpets, curtains, and airtight windows and doors can significantly affect energy performance. Our recommendation is to introduce educational programs in primary and secondary schools that focus on energy efficiency and thermal comfort. It is vital not only for energy savings but also for healthier buildings. We emphasise the need for a holistic system approach involving policymakers, regulators, educational institutions, and industry stakeholders to develop cost-effective, scalable solutions. Only through such coordinated efforts can the dual challenges of aging buildings and populations ensure higher levels of thermal comfort, sustainably and affordably. This comprehensive strategy promises significant contributions to global sustainability efforts by reducing the energy required to maintain thermal comfort in affordable housing.

Keywords:

Energy-Efficient, Affordable Housing, Building Education, Regulations

ID 81: The Impact of Timber Offsite Construction on Global Warming

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Abstract:

Nowadays, it is crucial to discover innovative strategies to lessen global warming because of the energy consumption of the construction industry on greenhouse gas emissions. Since offsite construction (OSC) is efficient and sustainable, it has become a viable solution for this problem. This research investigates the influence of OSC on global warming, focusing on its carbon footprint and associated environmental benefits. It assesses the embodied carbon emissions related to New Zealand timber manufacturing and transportation operations while considering energy use. Comparisons are made between offsite timber, concrete and steel construction techniques to estimate the possible decrease in greenhouse gas emissions of six-storey buildings in New Zealand. The results show significant environmental benefits when comparing offsite timber construction to other construction materials. It is possible to achieve substantial reductions in embodied carbon emissions through efficient production techniques, reduced material waste, and the carbon-sequestering capabilities of timber. However, issues like supply chain logistics, legal frameworks, and market acceptance must be resolved to optimise the environmental benefits of offsite timber building. According to the conclusion, offsite timber construction should be encouraged as a sustainable way to lessen the negative consequences of global warming on the building sector. It offers insightful information that stakeholders, practitioners, and legislators may use to promote sustainable building practices and create a built environment that is more resilient and environmentally friendly.

Keywords:

Offsite construction, timber, global warming, CO₂ emissions, greenhouse gas

ID 84: Towards Circular Construction: A Review of Critical Success Factors

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Abstract:

The state of New South Wales (NSW), Australia finds itself at a critical point in time, as it grapples with the far-reaching implications of an infrastructure construction industry attempting to rebuild itself after the COVID-19 epidemic. The industry is now presented with the opportunity to shape its future trajectory. Therefore, this study conducts an review of Critical Success Factors (CSFs) in the context of circular economy (CE) construction practices. Utilising a qualitative research approach, the study examines existing literature to identify key themes and factors that contribute to the success of sustainable construction initiatives. By reviewing CSFs, the study informs practitioners, policymakers, and researchers of the considerations for achieving sustainability goals in the NSW construction industry. The findings contribute to the development of strategies and frameworks that support the effective integration of sustainable practices of construction projects.

Keywords:

Circular Economy Drivers, Sustainable Construction Practices, Critical Success Factors

ID 95: Towards a Circular Construction: Stakeholder Insights on C&D Waste Management in Australia

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Abstract:

Globally, the construction industry consumes more than half of the natural resources and has a significant environmental impact, contributing to pollution, climate change, and resource depletion. In 2021-2022, the Australian construction industry generated a high amount of construction and demolition (C&D) waste, approximately 29 million metric tonnes (Mt). Out of this, approximately 6.4 Mt was disposed of in landfill sites, and 20.2 Mt (80%) of C&D waste was recovered in the same period. Despite the high recovery rate, gaps exist in implementing circular practices throughout the construction lifecycle, hindering the reduction of environmental pollution, economic prosperity and social equity. Among all C&D waste materials, mostly concrete, bricks, and rubble from large construction projects are recovered compared to smaller projects mixed materials, which are often directed to landfills. Besides, there is a discrepancy that creates an imbalance between the supply of recycled construction materials and the demand for them in the market. To investigate the gap hindering the adoption of circular construction in Australia, semi-structured expert interviews were conducted, and 'content analysis' was used for data analysis. The study findings revealed that regulatory and legislative, operational, and market barriers significantly impact stakeholders' decision-making and C&D waste management practices. These barriers pose substantial challenges to the reduction and reuse of C&D waste materials in Australian context. Finally, recommendations from this study can guide stakeholders in achieving the circular economy goals in the C&D waste management sector.

Keywords:

Construction and demolition waste, circular construction, waste management, stakeholder perception, circular economy

ID 96: Comparative Study of Offsite Construction in New Zealand and Singapore through PESTLE Framework

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Abstract:

The global demand for housing is surging, and New Zealand faces an alarming housing crisis, with a shortage of approximately 150,000 houses as of 2023. This necessitates an urgent exploration of solutions to expedite housing construction. In this regard, Offsite Construction (OSC) offers a promising alternative to traditional methods, potentially saving 34% construction time. However, OSC adoption within the New Zealand construction sector (NZCS) remains modest, at around 10%. In contrast, Singapore soars among the top countries that adopted OSC, with 51% of new homes constructed using OSC. Understanding the OSC practices of such countries is crucial in devising a robust strategy to adopt OSC in New Zealand. Hence, the research aims to uncover key practices from the OSC sectors in Singapore that can be implemented within New Zealand's context. The analysis was structured through the PESTLE (Policy, Economy, Social, Technology, Legal, and Environment) framework. The research follows a comprehensive review process, utilising Scopus and Google Scholar databases and web-based search to access industrial and government reports. The study provides potential learning from the Singapore OSC sector, which could be applicable in New Zealand. The study shows that government support in the form of economic incentives, regulations, awards, and other supporting activities could be crucial in enhancing OSC adoption. Additionally, the use of automation and improved stakeholder engagement could be a catalyst for the adoption OSC in New Zealand. The study offers a potential approach for enhancing OSC adoption in New Zealand.

Keywords:

Housing shortage, New Zealand, Offsite Construction, PESTLE, Singapore

ID 97: PESTEL Analysis of Problems Associated with Adoption of Offsite Construction: A systematic literature review

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Abstract:

Offsite construction (OSC) is fragmented and involve a complex network of stakeholders in all the stages such as planning, design, legal approval, site preparation, modular manufacturing, transportation, storage, and on-site installation. The problems include complexity of the process; lack of awareness; supply chain challenges in capacity and knowledge; cultural perception; lack of viable business process models or solutions; scarcity of skills in design/ manufacturing/construction and lack of government regulations and legislation. This study, therefore, categorises the problems according to Political, Economic, Social, Technological, Environmental and Legal (PESTEL). The PESTEL analysis aims at providing organisations a comprehensive list of all the external and internal problems against the adoption of offsite construction. A wholistic list of all problems and understanding the barriers will help them to improve the overall productivity and contribute to the economy metrics. Utilising popular databases, including Scopus, Web of Science, and Google Scholar, a systematic literature review of 56 papers relevant to OSC adoptions in the construction industry research was conducted. From the review, the barriers to the of adoption OSC in the construction research and relevant organisations reports were identified. The results show that countries such as Australia, UK, China, Hong Kong, Singapore and New Zealand have been the top countries in which papers on OSC were published.

Keywords:

Offsite construction, Modular Integrated System, Industrialised Building, barriers, problems

ID 98: Construction Sector Shocks & Stresses: Insights from Contractors

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Abstract

The construction sector is vital in national economies, contributing significantly to GDP, job creation, and employment rates. However, it is also highly susceptible to various shocks and stresses that can disrupt its operations, reduce productivity, and threaten economic stability. This study explores the critical shocks and stresses impacting construction contractors in New Zealand, focusing on political, economic, environmental, technological, and social factors. Using a qualitative research approach, semi-structured interviews with senior executives from leading construction firms provide insights into how contractors perceive and respond to these challenges. Political disruptions, particularly during election cycles, create uncertainty that impacts project pipelines, decision-making processes, and funding. Economic fluctuations, such as inflation, interest rates, and supply chain disruptions, exacerbate the volatility of construction activities. Natural disasters create opportunities for reconstruction but also present significant challenges, driving demand for reconstruction while straining labour markets and supply chains. Furthermore, skill shortages, influenced by domestic factors and immigration policies, are highlighted as a critical stressor affecting the sector's capacity. Social factors, such as the reluctance of workers to relocate and the negative stigma associated with construction work, further compound recruitment challenges. The findings suggest that the sector requires robust planning, proactive workforce development, and flexible responses to mitigate the effects of these shocks and stresses. This paper contributes to understanding how external and internal factors shape the resilience of the construction industry in New Zealand.

Keywords:

Construction sector, construction sector shocks, construction sector risks

ID 99: Experimental study comparing the thermal performance of Green and Cool Roofs as part of urban heat mitigation strategy

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Abstract:

The combination of rapid urban growth and climate change has increased the risk of the Urban Heat Island effect in recent years, posing significant challenges to human health and well-being in the built environment. As new technologies such as green roofs and cool roofs become integrated into building design and urban planning, various research efforts aim to provide feasible solutions to achieve a sustainable future. The objective of this study is to assess and compare the performance of green roofs and different types of cool roof paints, by observing the surface temperature changes and how it impacts the ambient indoor and outdoor air temperatures. The experimental set-up of the green roof and cool roofs is undertaken at Victoria University's Footscray Park Campus. By utilizing thermal infrared images and data from local weather stations, this study will help to evaluate the feasibility and scalability of cool surface technologies in various urban contexts. This research will contribute to providing enhanced real-time data collection within the pre-existing built environment, aiding in the development of effective strategies for urban heat mitigation using cool roof and green roof technologies. It also offers insights for policymakers, urban planners, and developers to implement and practice various urban heat mitigation strategies to enhance the resilience of cities under the pressure of climate change.

Keywords:

Urban heat, thermal comfort, cool roof, green roof, thermal image

ID 102: External pressures and organisational drivers: Uncover the Decision-making of IAQ Interventions in post-Covid Victoria

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Abstract:

The COVID-19 pandemic posed significant challenges for facility managers in maintaining indoor air quality (IAQ) to control respiratory infections. This study investigates the decision-making processes behind IAQ interventions in post-COVID Victoria, focusing on measures such as CO2 monitoring, air ventilation, and air filtration. Through 41 semi-structured interviews with facilities managers, health and safety managers, and infection control experts, the study identifies the interplay of internal and external factors that shape IAQ interventions. Thematic analysis using NVivo software revealed that internal factors—such as organisational characteristics, building characteristics, and occupant pressures—were the primary drivers behind IAQ decisions, while external influences, such as compliance requirements and environmental considerations, played a lesser role. The study also highlights ambiguities in building codes related to IAQ monitoring and ventilation controls, which created uncertainty for organisations and led them to rely more on internal assessments and available resources. These insights underscore the need for clearer regulatory guidance and the development of data-driven tools that integrate qualitative and quantitative evaluations. This paper provides valuable insights for practitioners and researchers to improve IAQ and occupant well-being in the built environment.

Keywords:

Compliance, Facilities Management, IAQ, infection control, occupant health

ID 104: Barriers to Circular Economy Adoption in Construction of Residential Projects: The Case of Hong Kong Transitional Housing

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Abstract

The linear economy leads to increasing resource consumption and wastage, making it highly unsustainable. A recommended alternative is circular economy (CE) which entails the triad of make, reuse and recycle. CE adoption in the construction industry is generally low, even lower in the case of its adoption in housing projects. Nonetheless, regarding emergent residential facilities or makeshift facilities (hereafter, transitional housing), CE adoption thereof is crucial to minimize or eliminate wastage. Typical in Hong Kong, transitional housing facilities are provided to reduce the waiting time of potential households who are awaiting entry into public housing. Due to the transient nature of these facilities, the integration of CE into transitional housing could reduce compounding construction and demolition (C&D) wastage that has plagued Hong Kong. This study investigates the barriers to CE integration into transitional housing construction. Through a comprehensive literature review, CE barriers were identified. This was followed by interviews with professionals who have expertise in transitional housing to refine the CE barriers garnered from the literature review. Then, a questionnaire survey was conducted among construction professionals, followed by descriptive statistical analysis of collected data. The Mann-Whitney U-test was carried out to assess statistically significant differences between views of CE adopters and non-adopters. Although common barriers were identified, some barriers revealed significant differences. The findings could inform decision-makers of general and tailored policies to expedite CE transition by adopters and to begin CE implementation by non-adopters to promote circular transitional housing in Hong Kong and beyond.

Keywords:

Barriers, circular economy, construction and demolition waste, sustainable housing, transitional housing

ID 114: Drivers and Barriers of Green Building Development in Qatar

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Abstract:

With a growing global concern for environmental conservation and sustainable urban development, the adoption of Green Building (GB) practices has emerged as a key solution. Built environment in Qatar is highly reliant on energy from non-renewable sources, hence, necessitating sustainable development in all areas of this sector, especially buildings. With a specific focus on Qatar, this study has investigated the drivers and barriers related to GB development. Within this context, 21 barriers and 17 drivers have been identified from literature review. Using a questionnaire survey, 102 building experts from Qatar have provided their opinion regarding the relative significance of drivers and barriers on a 5-point Likert scale. Drivers in the descending order of significance for Qatar are environmental, social, government-related, economic, and lastly quality-related. Barriers in the descending order of significance for Qatar are about cost and profitability, awareness, more work requirements, demand and supply issues, regulation issues, design issues, education-related, and material issues. This study contributes to a better understanding of the nature of GB development in Qatar, enabling decision-makers to ease the process as well as initiate the policymaking necessary for increased uptake of such projects. In theoretical terms, the findings of this study will also contribute to the body of knowledge related to GB projects.

Keywords:

Green Building, drivers, barriers, sustainability, Qatar

ID 159: Modelling Personnel' Acceptance of Contractor-Selection Technology in Public Procuring Entities

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Abstract

This study aimed at modelling public procurement personnel' behaviour towards acceptance of contractor-selection technology. A review of relevant literature was followed by a Delphi survey of eighteen number (18) procurement experts on an array of adoption theories which suggested a domain-specific variable; System Architecture (SA). Consequently, an extended innovation diffusion theory – technology acceptance framework was built, including SA. All emerging factors had Kendal w scores that exceeded 0.75. Empirical data from a sample of Architecture and Engineering Construction (AEC) procurement professionals drawn from eight (8) federal ministries, departments and agencies (MDAs) in Nigeria was used to model the behavioural intension (BI) of the procurement personnel. There is a nuance difference in the antecedent behaviours of procurement personnel towards contractor-selection technology along their distinct professional divide. The operationalized framework showed strong explanatory powers to procurement personnel' acceptance behaviour towards contractor selection technology. Suitability of extending a recognized integrated technology acceptance model - innovation diffusion theory (TAM-IDT) with domain-specific variable, SA was affirmed. System vendors can now rely on the developed model to carry out customer foresight enquiries on contractor selection technology before they are adopted in Nigerian public procurement.

Keywords:

Contractor selection, Delphi survey; Technology Acceptance Model (TAM) Professionalism, Structural equation modeling; Public procurement personnel

ID 168: How Building's Envelopes are Affected by Atmospheric Water Harvesting Techniques?

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Abstract:

Atmospheric water harvesting (AWH) techniques are evolving technologies that extract water from ambient air. These techniques have been used for their potential, from small scales, like portable devices for personal use, to infrastructure scales in various sciences and engineering fields, including building science, specially focusing on building's envelope. This paper carries out a Systematic Literature Review (SLR), employing the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) protocol, of the main AWH technologies implemented in the building's envelopes to provide a clear categorization of these technologies for future development of building's envelopes. It evaluates the types of AWHs by identifying the reasons behind the incorporation of such systems within the building's envelopes. The findings indicate that existing technologies have primarily been employed on the building's envelopes to sustain the thermal comfort zone within living spaces by regulating relative humidity (RH), thereby reducing the energy required to maintain a specific temperature. Additionally, these techniques have been utilized to provide a sustainable water supply for households through the envelopes, which is the second key area of focus. This study sets the groundwork for further investigations into the role and use of atmospheric water harvesting systems in enhancing buildings' performance through building's envelopes.

Keywords:

Atmospheric water harvesting (AWH), building's envelope, systematic literature review, thermal comfort zone, water supply

ID 172: Mixed-Income Housing Developments in Africa: Lessons Learned

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Abstract

Mixed-income housing developments have gained prominence as a strategy to address housing inequality and foster social integration in urban areas across the globe. In the African context, where rapid urbanization and informal settlements continue to pose significant challenges, mixed-income housing developments have emerged as a promising solution. This study aims to analyse and distil valuable lessons learned from various mixed-income housing projects in Africa, shedding light on their successes, challenges, and potential for broader applicability. Drawing on a comprehensive review of existing literature, and case studies, this research identifies key themes and trends in mixed-income housing development across the African continent. It examines factors contributing to successful implementation, such as effective governance, community engagement, financial sustainability, and design considerations. The findings underscore the importance of a contextualized approach to mixed-income housing development in Africa, acknowledging the diversity of socio-economic, cultural, and political landscapes across the continent. By synthesizing experiences from different African contexts, this study contributes to a broader understanding of the potential and challenges associated with mixed-income housing, ultimately facilitating more equitable and resilient urban development in the region.

Keywords:

Mixed-income housing, Africa, Socio-economic disparities, Rapid urbanization, Inclusive housing

ID 173: Achieving Net Zero Energy Homes Through Space Heating Electrification

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Abstract:

Solar photovoltaic (PV) systems have been adopted worldwide to increase renewable energy generation and reduce fossil fuel consumption. Despite this, many of the PV households in Australia still rely on natural gas for space heating and domestic hot water (DHW) needs, resulting in excess fossil fuel use and a low level of PV self-consumption. Therefore, this paper aims to investigate the viability of electrifying conventional gas ducted heaters using heat pumps plus fan coil units and thermal storage to achieve net zero energy homes. A case study was conducted on a typical Australian house located in Geelong, Victoria, with a 10-kW solar PV system, a hot water heat pump, and a gas ducted heater. Transient System Simulation (TRNSYS) is employed to model the existing space heating and hot water system (ESH): a gas ducted heater + a PV-driven hot water heat pump, and the proposed space heating and hot water system (PSH): a heating tank + a heating element + fan coil units + a PV-driven hot water heat pump. The simulated space heating loads, PV generation and heat pump power consumption, were verified using actual measurements. Results demonstrated that PSH eliminated the annual gas demand of 4093 kWh needed for ESH, and its annual exported energy of 10804 kWh was higher than its annual grid energy demand of 3893 kWh, thus achieving the net zero energy home goal. This study showcases the successful implementation of a PV-driven heat pump with thermal storage to achieve a net zero energy home.

Keywords:

heat pumps, net zero energy homes, solar PV, services system electrification, thermal storage

ID 175: Understanding the Circular Economy Implications of Net Zero Policies in the Built Environment

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Abstract

As Australia aims at achieving a net zero economy there are system-wide changes that are required. From a built environment perspective, a net zero economy will see increased use of electricity use within buildings, with older energy systems being decommissioned and necessary retrofitting being conducted. As these systems come to their end-of-life proper management and recovery processes need to be in place so that resource use is optimized. If Australia is to address waste associated with the clean energy transition, it is vital that the move is underpinned by circular economy principles. To overcome this challenge environmental and sustainability policies at all levels of government need to take a holistic approach. This paper aims to understand the different political and regulatory levers, driving the renewable energy transition to understand the best approach to apply circular economy principles in a decarbonised built environment. This initial understanding will help policy makers and industry practitioners develop system-wide processes to overcome the waste related challenges that the net zero economy will bring.

Keywords:

Circular economy, government policy, net zero, regulatory analysis

ID 181: Exploring Factors Influencing Residential Property Purchase Decisions: A Pilot Study in New Zealand

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Abstract:

Real estate is pivotal in New Zealand's economy, contributing significantly to economic activity and employment. Understanding the factors influencing residential property purchase decisions is crucial for stakeholders including real estate agents, property developers, urban planners and policy makers aiming to align offerings with client preferences. This study explores the key factors influencing home purchase decision-making in New Zealand, focusing on internal and external factors. An analytical approach was employed using convenience sampling, with a pilot study involving 10 participants to assess all factors. Data was collected via a questionnaire survey and analysed using descriptive statistics and non-parametric analysis. The findings indicate strong positive correlations between home purchase decisions and amenities, legal considerations, financial options, neighbourhood quality, property conditions and smart features, including smart homes, security systems, smart lighting, smart appliances and home automation systems. This study highlights the multiple dimensions of home purchase decisions in New Zealand. Insights from this research could guide developers, real estate agents, policymakers, and researchers in enhancing market strategies and policy frameworks to meet client needs effectively.

Keywords:

Decision-Making, housing preferences, residential Pproperty, buyer behaviour, pilot study

ID 188: The Future of Reconciliation Action Plans (RAPs) and the Australian Construction Industry

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Abstract:

Many Australian construction industry bodies have enthusiastically embraced the potential advantages of engaging with our indigenous peoples in planning, design, procurement and delivery of building and infrastructure projects. Several companies have recruitment campaigns to lift the employment of Aboriginal people at all levels. The benefit of holistic traditional knowledge is widely acknowledged. Reconciliation Action Plans (RAPs) have been adopted by some companies to assist with cultural preservation and generate improved socioeconomic outcomes for indigenous people. The stated aim is the promotion of respect and understanding between indigenous and non-indigenous stakeholders on projects. This paper will examine case studies of some of these initiatives and will comment on their relative effectiveness and on the barriers to successful implementation of the plans. The distribution of measurable benefits for the common good must be demonstrated if RAPs are to be regarded as a successful strategy.

Keywords:

Aboriginal engagement, cultural awareness, indigenous participation, procurement challenges

ID 204: Sustainable Building Practices

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Abstract:

Sustainable building practices are shifting from conventional buildings to modern ones, known as "Green, intelligent, and smart buildings," which are currently attracting significant attention due to the escalating energy crisis caused mainly by conventional buildings. According to recent research results, the building sector accounts for 30 to 40% of the world's annual energy consumption, leading to increased prices of fossil fuels and heightened CO₂ emissions. Hence, sustainable building practices aim to enhance environmental sustainability, conserve natural resources, and develop alternate power sources while reducing pollution without significant environmental harm. In addition, sustainable buildings include environmental, ecological Air Quality (AQ), which is a critical aspect of sustainable building design as it pertains to the accumulation of harmful particles due to indoor pollution influenced by factors such as thermal conditions, humidity, and various substances known as Volatile Organic Compounds (VOC). Moreover, recent research results also show that CO₂ emissions today can contribute to rising temperatures in future centuries. Thus, sustainable building practices are crucial in achieving a circular economy, an economic concept that involves continuously reusing materials to prevent them from being disposed of as waste. Furthermore, Building Information Modelling (BIM) and Digital Twin are other virtual models that mirror a physical object in real-time and enhance project collaboration, transparency, and engineering efficiency. Thus, this paper aims to introduce a conceptual sustainable building simulation with immense potential to reduce CO₂ emissions and promote sustainable materials. The design concentrates and approaches on the sustainability of structural, energy-efficient resources and mitigation of air pollutants.

Keywords:

Sustainable building development, shifting from conventional building practices to sustainable building practices, next generation building practices, and air pollutant mitigation building practices

ID 207: Principal indicators for universities reporting on Sustainable Development Goals

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Abstract:

Sustainable Development Goal (SDG) implementation positions organizations as key agents and universities work as testbeds for broader organizational practices. Addressing SDGs in sustainability reports provides a holistic way for universities to demonstrate their impacts. However, unavailability of frameworks in reporting on SDGs comprehensively create difficulties on identifying indicators for universities reporting their contributions to SDG implementation. This study aims to identify principal indicators for universities reporting their contributions to SDG implementation to make their performance accountable and inform the decisions, with universities in Victoria, Australia as cases. Natural Language Processing compares semantic similarities between words in sustainability reports by Victorian universities and SDG keywords to determine the indicators, their weights, and their linkages with SDGs. Results indicate that economic, education, society, energy, development, environmental, and habitat are principal indicators for universities reporting on multiple SDGs, which include SDG 1, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 17. The study identifies principal indicators for the advancement of comparison between universities operate in same environment. This is to minimize information asymmetry between universities and their stakeholders to ensure quality and transparency of reporting. By reporting on SDGs, the study enables universities to demonstrate their long-term impacts on society and the bio-environment and translate their sustainability actions into communication to engage internal and external stakeholders. The indicators can also be a foundation for developing SDG assessment tools for universities. Eventually, the principle indicators identified by the study engage universities to support the achievement of SDGs through appropriate reporting.

Keywords:

University, Sustainable Development Goals, Natural Language Processing, Sustainability report

ID 209: Alone Time: Individual Quiet Study Spaces in Green Academic Libraries

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Abstract:

The aim of this paper is to examine the role of individual quiet study spaces in today's academic libraries. One feature of green libraries is to provide comfortable spaces for all users that enhance well-being and productivity and the argument of this paper is that a key role of green academic libraries still remains as to provide spaces for individual quiet study. Little empirical research focused on students' preferences for individual quiet study spaces. This paper reports an evaluation study of library spaces in an Australian university main campus and look at the data in relation to the existing literature. A survey which included questions about students' patterns of library space use and their perception of the quality and function of library spaces was administered to all students enrolled in the university. 1505 students completed the survey. The findings indicate that students mainly visit the libraries for individual study. From 1505 survey respondents, around 60% either Always or Often come to library to study alone (n=852). Of the four types of library furniture evaluated, individual study carrels ranked as the most frequently used type. A detailed examination of the factors affecting students' preferences for study carrels identified the four most frequently referred to considerations as presence of windows i.e. views and natural lighting, access to power points, acoustics, and privacy. The findings highlight the importance of individual study spaces, provide evidence on factors that determine students' seating preferences in academic libraries and recommend issues and challenges to be considered.

Keywords:

Academic library Spaces, Design, Green Library, Individual study space, Study carrel

ID 222: An Architectural Response to African Spiritual Healing Practises: Towards A Spiritual Healing Centre in Ulundi, South Africa

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Abstract:

Approximately 80% of Africans depend on traditional healthcare as their basic medical need. Indigenous medicine is usually the only form of healthcare that many individuals across the continent have access to, find easily accessible, and can pay for. South African traditional medicine, and its practice were pronounced illegal under the pretext of witchcraft in South Africa during the apartheid era in 1953. Consequently, the healing practice was kept secret, and no infrastructure was in place to support it. Although African traditional healing methods have been legalised, little has been achieved to establish dedicated facilities supportive of this worldview. The study aims to explore an architectural response to African spiritual healing practices. The study theoretical framework will employ decoloniality, Afrocentrism, and critical regionalism to analyse how architecture might adapt to African spiritual well-being practices. The data collected through a survey of relevant literature will then employ the path analysis method to identify ways of creating built environments that are culturally sound and sensitive to Indigenous healing practices.

Keywords:

Traditional wellbeing practices, Decoloniality, Identity, Afrocentricity, Critical regionalism

ID 223: Gender Roles in Nguni Culture and Its Implications on Architectural Design: Towards a Mixed-Use Development in Warwick Junction, Durban

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Abstract:

There is a growing scholarly interest in examining the impact of Nguni cultural practices on urban development. For successful implementation, it is essential to consider gender roles, as they significantly influence Nguni architecture and way of life. This research investigates the integration of cultural paradigms within globalising urban cities, focusing on gender roles in Nguni communities and their impact on architectural design. The study delves into the theoretical foundations of societal constructs and spatial justice, analysing the evolution of gender roles and their intersection with the built environment. The research methodology exploits extant literature on Nguni culture and urban development. The findings of this research are intended to guide best practices for culturally integrated urban development, with specific recommendations for a mixed-use project in Durban. This project aims to promote empowerment and inclusivity by involving users in discussing gender roles and cultural evolution within urban spaces.

Keywords:

Gender roles, Spatial justice, Inclusivity

ID 226: Assessing Zero-Carbon Measures in New Zealand's Building Sector: Insights from Industry Professionals

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Abstract:

New Zealand has been acting to meet the zero-carbon target set out after signing the Paris Agreement 2015. Construction is one of the main sectors contributing to carbon emissions; once it takes steps to reduce them, it may significantly contribute to New Zealand's zero-carbon goals. However, although practitioners and academia put forward plenty of beneficial measures for the climate goals, limited research summarises the effectiveness of New Zealand's zero-carbon measures from industry professionals' viewpoints. This study investigates the typical measures for achieving New Zealand's zero-carbon goals. To address the research gap, this study examined the effective zero-carbon measures in construction projects by conducting fifteen semi-structured interviews with construction professionals in New Zealand. Findings indicated that early adoption of zero-carbon targets is essential for cost-effectiveness and sustainability. Key strategies include designing high-performing building envelopes, reusing or retaining existing structures, and implementing an integrated approach that combines electrification, renewable energy, smart meters, and smart grids to enhance energy efficiency and reduce carbon emissions. Additionally, using sustainable materials and fostering user behaviour is crucial to the success of zero-carbon practices. This research provides valuable insights and directions for stakeholders in the construction industry to significantly advance New Zealand's progress towards its zero-carbon goals by 2050.

Keywords:

New Zealand, sustainability, sustainable materials, technologies, zero carbon

ID 227: Factors Influencing the Embodied Carbon of Concrete Structures

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Abstract:

The construction industry is a major contributor to global CO₂ emissions, with concrete being the primary material used worldwide. Reducing the embodied carbon of concrete structures is crucial for sustainability and achieving net-zero aspirations. This paper investigates the factors influencing the embodied carbon of concrete structures, providing a comprehensive understanding of the various elements contributing to the overall carbon footprint. Significant research has focused on reducing the carbon footprint of concrete materials, assuming that if the strength of different concretes is the same, the volume of concrete used in a structure will also be the same. Consequently, concrete with a lower carbon footprint will result in a structure with lower embodied carbon. However, from a structural design perspective, factors other than concrete strength affect the size and volume of concrete elements, complicating the assessment of embodied carbon reduction. Using Australian Standards and common industry practices, this paper examines how different factors, including material choices and design considerations, influence the embodied carbon of concrete structures. It highlights the need for an integrated approach to minimise embodied carbon, emphasising that merely focusing on concrete strength is insufficient. The study identifies key factors and offers practical insights to support the development of more sustainable materials and design methods. The findings aim to empower engineers and policymakers to make informed decisions, leading to lower carbon footprints in future concrete constructions. Ultimately, this research contributes to broader objectives of environmental sustainability and climate change mitigation, underscoring the importance of holistic strategies in reducing the carbon impact of concrete structures.

Keywords:

Embodied carbon; Low-carbon structures; Net-zero

ID 237: Towards a Conceptual Framework to Assess the Understanding of a Relevant Construction Issue: Proposing a Methodological Framework

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Abstract:

This paper develops a methodological framework designed to assess the understanding of a relevant construction issue. The framework development is under an inductive approach and is structured into five key steps, where theory and practical applicability are considered. The first step implies reaching a consensus among experts to establish consensus about the understanding of vital concepts. This consensus-building process ensures that the framework is grounded in practical knowledge from expert perceptions. The second step consists of conducting a systematic literature review. In the third step, a prototype conceptual framework is developed based on the findings from the previous steps by linking the findings. The fourth step focuses on developing case studies to operationalize the prototype framework, allowing for real-world testing and feedback. Finally, the fifth step involves refining the conceptual framework based on feedback and findings from the case study phase. This paper contributes to the field by providing a structured methodology for developing frameworks that enhance the understanding of complex issues in the construction industry.

Keywords:

Research methodology, safety culture, construction industry, inductive approach

ID 239: Collaboration and the Future Focus on Sustainability and Digitalisation: An Explorative Comparative Analysis

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Abstract:

The conference theme of “Building for a Sustainable Future: Innovations, Challenges, and Collaboration” provides an ideal platform from which to examine how, over time, the theme collaboration has changed and developed. The paper draws parallels between UK and NZ thinking. The paper reflects on the past and how it informs our future thinking through the main theme of collaboration and the new movement for collaboration in digitalisation and sustainability. The core of the paper examines government and industry initiatives to understand to what extent collaboration has been viewed, and advanced, in the UK and New Zealand construction industries. Project 13 and the New Zealand Accord are examples of transformation initiatives aimed at improving delivery and management. Such initiatives are not new, but draw on historic reports, such as Latham's "Constructing the Team" (1994) and Egan's "Rethinking Construction" (1998). Latham and Egan emphasised changing the ways in which the industry conducts business, including focussing on relationships, collaboration, clients and improving efficiency and performance. Successive reports in the UK also emphasised the need to improve collaboration. UK reports and initiatives are influential in New Zealand, including focussing on the key themes of better relationships and genuine collaboration. The purpose of this paper is to draw parallels with the UK's past and current initiatives and New Zealand's past and current initiatives. Digitalisation and sustainability are at the forefront of the UK and NZ government initiatives, but the recurring issues of how to integrate collaboration, client relationships and overall efficiency remain. In this paper, parallels are drawn between the countries, with cases, differences and lessons provided. Key findings show how collaboration, in different locations, is debated and addressed.

Keywords:

Government, collaboration, construction, construction accord, project 13

ID 240: Integration of BIM with the Last Planner System for Construction Planning and Scheduling

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Abstract:

The integration of Building Information Modeling (BIM) with the Last Planner System (LPS) offers a promising approach to enhance construction planning and scheduling (P&S). Despite their potential, limited research exists on their integration. Therefore, this study aims to investigate the integration of BIM and LPS for improved construction P&S. A qualitative research approach using two rounds of Delphi expert interviews was involved to collect data. The first round clarified the findings of the literature and identified phases and tools for BIM-LPS integration. The second round confirmed the initial findings and examined the practical implementation of BIM tools at each LPS phase. The findings revealed the adaptation of BIM tools across five main LPS phases: work structure and master scheduling, phase scheduling, lookahead planning, weekly work planning, and percent plan completion. Additionally, six BIM workflows were categorized under phases of LPS. The study findings can be used to enhance overall construction P&S performance by improving communication, reducing waste, and increasing project predictability and efficiency through BIM-LPS integration.

Keywords:

Building Information Modeling, BIM tools, Construction planning and scheduling, Phases of Last Planner System

ID 243: Deciphering Smart Heritage: Current Technologies and Best Practice Strategies

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Abstract:

Smart Heritage, an emerging trend in the realm of heritage conservation, is gaining increasing attention for its autonomous capacity to collect and analyse data within heritage sites. Nonetheless, extant studies reveal an enduring confusion among heritage site stakeholders between digital heritage and Smart Heritage. Consequently, this study aims to delineate key technologies and strategies from existing Smart Heritage exemplars, aiming to elucidate the practicality underpinning this innovative concept. Employing a cross-case analysis methodology, the study scrutinises, compares, and illuminates extant practical implementations in the Smart Heritage context. In so doing, this study contributes significantly to the existing knowledge base by addressing a research inquiry pertaining to the core of Smart Heritage, while also identifying tangible examples of its practical realisations to assist relevant decision-makers and designers. One identified limitation of this study relates to the absence of stakeholder engagement, thus precluding feedback on experiential factors or opportunities for improvement within the current Smart Heritage paradigm. Future studies are encouraged to delve into methods of enhancing data integration within Smart Heritage frameworks, thereby advancing the realisation of Smart Heritage's autonomous ability from a user-centric standpoint.

Keywords:

Heritage Adaptation, Smart City, Smart Heritage, Urban Heritage

ID 246: Promoting Environmental Sustainability Performance of Tensile Membrane Structures: Expert Interviews

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Abstract

This paper explores the promotion of environmental sustainability in tensile membrane structures (TMS) through a focused examination of design aspects, based on semi-structured expert interviews and NVivo analysis. The interviews aim to investigate material selection, innovative sustainable design features, and the role of lightweight materials in enhancing the environmental performance of TMS. NVivo analysis is used to develop thematic patterns, coding frequency counts, and qualitative insights from interview data. Findings reveal that careful material choice and innovative design practices are crucial for minimizing environmental impact and improving energy efficiency. Notably, the use of advanced, lightweight materials in TMS roofs emerges as a key factor in achieving optimal sustainability and structural performance. This study addresses current gaps in understanding how design innovations contribute to the environmental sustainability of TMS. By highlighting effective strategies and providing insights into best practices, the research offers valuable guidance for architects and engineers striving to advance sustainable design in the field. The practical significance lies in its potential to inform future design approaches and contribute to the development of more environmentally responsible and efficient TMS solutions.

Keywords:

Design, Environmental Sustainability, Expert Interviews, Sustainable Materials, Tensile Membrane Structures

ID 248: Integrating Heritage Building Information Modelling and Energy Retrofitting for Sustainable Preservation: A Review of Challenges and Opportunities in New Zealand

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Abstract:

The intersection of heritage conservation practices and environmental sustainability considerations, particularly in retrofitting historic buildings in New Zealand, has created a challenge that plays an important role in the conservation of these buildings. In recent decades, reducing energy consumption in buildings, including heritage structures, has attracted increasing attention. Notwithstanding initial concerns about jeopardising architectural heritage values, research has shown that improving energy efficiency in historic buildings can be achieved without compromising the integrity of their values. However, in New Zealand, industry practices often prioritise more superficial improvements over the meaningful reforms needed to achieve energy efficiency and preserve heritage values. This paper presents a review that examines the developments in energy retrofitting methods and the application of Heritage Building Information Modelling (HBIM) technology in enabling energy retrofitting in heritage conservation. It discusses the potential of HBIM to facilitate data collection, modelling and energy analysis during the retrofit process. Future trends and challenges are discussed, highlighting the need for comprehensive strategies to ensure the long-term sustainability and resilience of New Zealand's historic built environment. This can be done through interdisciplinary collaboration and stakeholder participation in the development and implementation of energy simulation strategies in historic buildings and its implementation. The most practical solution should be to respect the heritage values of the building and optimise energy consumption. Communicating the complex intersection of heritage conservation and environmental sustainability is the main goal of this paper.

Keywords:

Sustainability, Energy retrofitting, Heritage Building Information Modelling (HBIM), Energy efficiency

ID 250: Promoting Technologies to Improve Construction Productivity: A Perspective of First-Tier New Zealand Construction Companies

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Abstract:

This paper aims to identify the challenges and barriers to adopting Industry 4.0 technologies that can enhance productivity in New Zealand's tier-one construction companies. The persistent issue of low construction productivity in New Zealand, along with the industry's underutilisation of technological advancements, warrants further investigation. Semi-structured interviews were conducted to elucidate the benefits and challenges of using technology, as well as the criteria for selecting appropriate technologies. The insights gained from these identified challenges and barriers can inform the development of a framework for effective persuasion and implementation of Industry 4.0 technologies in New Zealand, ultimately improving construction productivity.

Keywords:

Industry 4.0 technology, Construction Productivity, Technology Adoption, First-Tier Construction Companies

ID 255: Emerging Technologies in Site Management: Insights from New Zealand

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Abstract:

This study investigates the adoption and impact of emerging technologies in site management within New Zealand's construction industry. Through semi-structured interviews with ten construction professionals across different management levels, it evaluates how technologies such as Building Information Modelling (BIM), Virtual Reality (VR), Augmented Reality (AR), drones, and Artificial Intelligence (AI) enhance site management. Despite their advantages in reducing errors, improving health and safety, and optimising resource allocation, challenges such as high initial costs, complex training needs, and data compatibility issues hinder widespread adoption. The study proposes solutions like rental strategies, enhanced data integration, and flexible training programs to overcome these barriers. This research outlines a strategic roadmap for integrating advanced technologies in New Zealand's construction practices, offering actionable insights for practitioners, policymakers, and technology providers to foster industry development and innovation.

Keywords:

BIM, AR/VR, drones, UAVs, construction technologies, site management, New Zealand

ID 259: Managing Project Quality Risks Using Design and Construction with Novation

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Abstract:

In construction procurement, novation is a strategy aimed at enhancing project outcomes by more closely integrating the design and construction phases. However, challenges arise when roles and expectations are unclear, leading to projects that don't always meet quality standards. Our study scrutinises novation through the lens of the Royal Institute of British Architects (RIBA) Plan of Work to identify the critical stage—specifically, the design/documentation completion percentage—at which novation introduces the most significant risk to project design quality success. Employing a mixed-method approach based on the analysis of existing literature and industry reports, this research crafts a nuanced understanding of the implications of various novation stages on project quality delivery. The proposed introduction of a risk barometer emerges as a pivotal innovation, offering a pragmatic tool for stakeholders to gauge and navigate the complexities of novation decisions effectively. Our findings reveal that a significant proportion of project failures associated with novation can be attributed to premature design handovers and inadequate risk assessments. They underscore the need for clear, articulated risk management strategies in optimising novation practices. We advocate a validated, industry-wide adoption of the proposed framework, in order to achieve greater transparency, efficiency, and quality in project delivery.

Keywords:

Construction, novation, procurement, project, quality risk

ID 264: Barriers to Uptake of Low-Carbon Concrete in Construction: Insights from New Zealand

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Abstract:

The study emphasises crucial role of low-carbon concrete in advancing the construction industry toward net-zero carbon goals. Through semi-structured interviews with seven experts, the research identifies barriers to the uptake of low-carbon concrete to reduce CO₂ emissions in the construction industry in New Zealand. The barriers were categorised into standards and regulation barriers, people-related barriers, technical challenges, material supply limitations, and cost concerns. The findings reveal that New Zealand lags behind other countries in using low-carbon materials, with only 2% of supplementary cementitious materials (SCMs) in concrete binders. The study compares these results with global contexts and highlights similar challenges in other countries. The research also identifies future opportunities for low-carbon concrete development in New Zealand, particularly the potential of fly ash, slag, and natural pozzolans. Recommendations include increased investment in research, knowledge sharing, training programs, and regulations and monitoring benchmarks for enhancing the use of low-carbon concrete, aligning with the goals of the New Zealand Climate Change Response (Zero Carbon) Act 2019.

Keywords:

Low-carbon concrete, net-zero carbon, green concrete, sustainable materials, New Zealand

ID 267: Applying lessons from COVID-19's impact on office operations to Occupancy Optimisation Strategies: A new era of Occupancy Rate performance

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Abstract:

Since early 2000's, organisations operating large commercial office properties have attempted to address desks left vacant by staff not using them. Desk vacancies offer a considerable overhead saving resulting in profitable outcomes. Programs of work coordinating initiatives that reduce vacancies, and reduce surplus desks and therefore costs, without impacting office staff productivity, are called Occupancy Optimisation Strategies (OOS). These OOS programs achieve 'reasonable' outcomes, but are impeded from modelled outcomes, predominantly through resistance to fully adopting place agnostic ways of working. Place agnostic working encourages staff to work from home/remotely, and only attend the office for mandated presence. During COVID (circa. 2020-23), government lockdowns prevented staff from attending their organisations commercial offices. These restrictions did not lead to failure of productivity, staff culture, nor consequential issues as were the excuses for OOS prior sub-optimal OOS performance. This research reported in this paper investigates the lessons learnt from the COVID era that enable commercial office occupancy performance levels originally thought impossible. Furthermore, the research examines the ways in which conditions of government lockdowns (restrictions) can be replicated in the post-COVID era, including in a sustainable way that accomodates underlying negative issues learnt from the same period.

Keywords:

Commercial Property, Occupancy Performance, Post-COVID Environment

ID 270: On the Development of Solar Air Heaters for Heating and Ventilation Purposes

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Abstract

Together with the increase in the energy demand and depletion of fossil fuels as well as the United Nations sustainable development goals and initiatives on energy and climate, there has been a noticeable surge in research on alternative and green energy resources, energy harnessing technologies and optimization of these technologies and equipment. Solar energy has proven to have a strong potential. Hence, extensive work has been undertaken to deploy the solar energy for various heating and ventilation purposes. Various types of solar air heaters have been developed and investigated in the literature and research is ongoing to further improve their performance. In this work, different components, design configurations and considerations for such solar air heaters are elaborated on in an attempt to elucidate the future research avenues for the development of more efficient solar air heaters for heating and ventilation purposes.

Keywords:

Energy Harnessing, Green Energy, Heating and Ventilation, Solar Air Heater, Sustainability

ID 272: The Integration of Geospatial Artificial Intelligence for Enhancing Built Environment Sustainability

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Abstract:

Geospatial artificial intelligence (GeoAI) is an innovative mechanism that uses artificial intelligence (AI) techniques integrated with geospatial information systems (GIS) and geospatial datasets. This study investigates the potential applicability of GeoAI to enhance sustainability, efficiency, and regulatory compliance in built environment projects. A comprehensive review of 72 articles published between 2020 and 2024 revealed four dominant application areas of GeoAI in the built environment: Sustainable Built Environment, Analysis of Built Environment, Environmental and Natural Resource Management, and Sustainable Urban Planning and Smart Cities. GeoAI's applications span diverse domains, including Natural Language Processing for location identification and semantic derivation from geographical information. Geo-visual applications enable visual classification and geo-object recognition. GeoAI analyses facilitate pattern recognition in multidimensional data captured through various techniques. This paper provides an overview of GeoAI integration into design and planning processes, highlighting its ability to extract insights from large-scale geospatial datasets such as satellite imagery, terrain models, and environmental data. AI algorithms can optimize site selection, building orientation, energy efficiency, and infrastructure planning while ensuring adherence to regulations and standards. While GeoAI's full potential in urban design, building design, disaster management, and compliance is yet to be fully explored, it promises significant advancements in these areas. This study also identifies key challenges and opportunities for future research in GeoAI applications within built environments, paving the way for a more sustainable and efficient built environment.

Keywords:

Artificial Intelligence, Built Environment, Geospatial Artificial Intelligence, Geospatial Datasets, Sustainability

ID 274: Artificial Intelligence Techniques to Develop a Predictive Model Using Textual Data: A Literature Review

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Abstract

The construction industry is experiencing a data revolution, with vast amounts of digital information now available. This shift has facilitated the widespread adoption of Artificial Intelligence (AI) applications within the sector. The capability to extract valuable insights and make precise predictions has become increasingly crucial for decision-making. A comprehensive methodology for developing AI models using textual data is fundamental in this context. Therefore, this study initially examines the AI techniques used to develop predictive models to train the textual data available from construction projects. Thereby the study aims to develop an AI methodology for predictive models using textual data in construction projects. The review was carried out under four themes: Introduction to AI technologies, Emergence of digital data in the construction industry, AI Applications using textual data in the construction industry, and Proposed AI Methodology. The review identified the AI Applications using textual data under risk management, accident management, contract and compliance management, and dispute management. The research findings indicate that Natural Language Processing (NLP) is highly effective for data preprocessing and feature extraction tasks. The study suggests that combining NLP techniques with deep learning algorithms for model development could be a promising approach for developing predictive models based on textual data. An integrated approach strengthens both NLP and deep learning. NLP transforms the unstructured to structured data which the computer can understand while deep learning algorithms learn the complex patterns and relationships from the large dataset. Thus, construction professionals can utilise more accurate predictive models, leading to enhanced decision-making.

Keywords:

Artificial Intelligence, Deep Learning, Natural Language Processing, Predictive Models, Text-based data

Resilient Infrastructure and Disaster Management



ID 50: Machine Learning Based Real Time Noise Estimation for Safety Monitoring in Construction Sites

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Abstract:

Noise induced by the operation of machinery and equipment is one of the major hazards identified in construction sites. Workers' long-term exposure to noise causes physical and physiological damages that could directly affect productivity, safety and work performance. With these negative effects, field managers need to predict the noise in construction environment. In current construction industry, noise related safety monitoring is practiced manually, which is not practical, accurate and effective with dynamic nature in site environment. Objective of this study is to develop a machine learning based real-time noise estimation model to identify the noise exposure of workers. Revit was used to generate a set of noise data for machine learning model training. Methodology consists of construction site selection and model development, noise estimation of modelled site, model validation, machine learning model training and performance evaluation. Decision tree (DT), K nearest neighbours (KNN), random forest (RF) and support vector machine (SVM) were used for noise estimation. The KNN model performed well with the least RMSE of 1 dB and R^2 of 0.96. SVM showed similar performance with RMSE of 1.03 dB and R^2 of 0.96. The average absolute difference between KNN predicted and noise levels measured were recorded as 1.2 dB. The system enables us to identify precision of noise estimation at working areas, assess exposure of workers and assessment of system through field managers and officials. Results enable safety officials and managers to assess noise exposure to implement safety measures and assess potential of environmental complaints.

Keywords:

Construction noise, noise prediction, machine learning, noise safety, noise pollution

ID 82: Identifying Primary Factors Behind Construction Project Failure: A Global Perspective with New Zealand Case Study

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Abstract:

Each year, numerous construction projects are either cancelled before they commence, postponed at different stages or halted at the initial stage for a range of reasons. Despite the array of preventive measures and risk management strategies in place, cancellations, delays, and postponements remain significant issues in the construction sector. Political, economic, and operational factors, including disruptions, shocks, stress, and labour shortages, often drive these challenges. These issues are particularly pronounced in large-scale projects, where the stakes and complexities are higher. This research aims to identify the primary factors contributing to construction project failure across different countries. It explores why many construction projects fail globally and reveals that the main reason is the loss of economic viability and failure to meet objectives. The study also provides a brief overview of project cancellations in New Zealand, including the number and estimated value of cancelled projects in NZD, to shed light on local trends and challenges. Understanding the primary causes of these cancellations is crucial for developing effective strategies to prevent them. By investigating these factors, the study seeks to enhance the understanding of the underlying reasons for construction project cancellations and offer valuable insights into how these issues can be addressed to improve project outcomes on a global scale.

Keywords:

Project cancellations, project failures, risk management

ID 89: A review of technologies that improve flood resilience in residential buildings

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Abstract:

Flooding is a key natural disaster that causes significant damage to residential buildings worldwide, necessitating the need for proactive measures to improve resilience. Developments in digital technology and their applications to building construction are creating a multitude of options to enhance structures' resilience to flooding as well as approaches for assessing flood damage after an incident. Therefore, it is imperative to identify the damage prone building elements and explore the types and extent of damages typically affecting them. This paper presents the results of systematic literature reviews (SLR) carried out utilising product information available online to identify existing flood resilient features of building elements that are prone to flood damage, as well as the technologies being adopted in these features. These reviews have revealed that walls, and openings (doors & windows) were among some of the elements that are most prone to flood damage. Further it has revealed a significant gap in the existing body of knowledge where scientific publications exploring the flood resilient technologies for such elements are lacking. The results were collated and flood resilient features of the technologies available on the market were systematically categorised. Product features relevant to flood resilience were found to be the flood depth to withstand, loading type, building standard followed, usage, material composition, appearance, installation method, sealing mechanism and maintenance. The findings also provide the basis for improving flood damage assessment technologies currently utilised.

Keywords:

Flood, Resilience, Smart technologies, Residential buildings, Building elements

ID 100: A Review of Urban Water Demand Influencing Factors and Forecasting Methods for Infrastructure Planning

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Abstract:

This paper provides a systematic review of urban water demand forecasting methodologies, focusing on the key factors that influence water consumption. The study aims to identify gaps in current research, assess challenges in existing methodologies, and explore emerging trends to enhance forecasting accuracy. It examines critical factors such as population growth, economic development, climate change, water pricing, and technological advancements. By analysing a variety of forecasting models, ranging from traditional to advanced computational approaches, the paper offers insights into their strengths, weaknesses, and suitability for different urban contexts. The comparative analysis highlights the applicability of methods for both short-term and long-term forecasting. The findings aim to guide researchers and policymakers in selecting appropriate models for urban water management, ultimately contributing to improved water infrastructure planning and sustainable management in cities facing growing water scarcity challenges.

Keywords:

Urban Water Demand; Influencing Factors; Forecasting; Systematic Literature; Infrastructure Planning

ID 107: Information Management Systems in Construction: A Narrative Review of Approaches and Solutions from Past to Present

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Abstract:

This paper provides a comprehensive review of information management systems in the construction industry, tracing the transition from conventional methods to advanced digital solutions such as Building Information Modelling and knowledge graph. As diverse types and formats of data become increasingly involved in construction projects, the need for more sophisticated and complex Information Management System becomes critical for effective project management. This review examines historical and more recent approaches, evaluates their strengths and limitations, and discusses emerging trends, particularly focusing on the integration of graph-structured information management system like knowledge graph to enhance data interoperability and decision-making processes. The paper provides a guide to future researchers and practitioners in developing efficient information management system that can meet the demands of modern construction projects.

Keywords:

Building Information Modelling, graph theory, information management systems, knowledge graph, project data integration

ID 122: Automated Information Extraction and Graph Representation to Support Tunnel Infrastructure Management

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Abstract:

The knowledge graph is an emerging technology for digitized operation and maintenance of civil infrastructure systems. To automatically construct knowledge graphs, information extraction is employed to identify valuable and structured knowledge from specification documents. However, information extraction that relies on learning numerous labelled samples is challenging to implement in the actual tunnel field due to the scarcity and imbalance of data. This paper aims to develop an automated information extraction and graph representation architecture to effectively build knowledge graphs under these constraints. In terms of model architecture, a pre-trained language model is utilized to obtain rich word embeddings that incorporate prior knowledge. These feature representations are then processed by an architecture composed of a bidirectional long short-term memory and a conditional random field layer, where the contextual dependencies between words are captured and the globally optimal label sequence are output. In terms of training strategy, contrastive learning is employed to learn more discriminative feature representations. By constructing triple samples, efficient model training is achieved even with limited labelled data. Based on the extracted information, the Neo4j graph database is used to build a knowledge graph that supports query and other functions. Evaluation based on Australian tunnel specification documents demonstrates the architecture's effectiveness in extraction and representations, even when samples are sparse and unbalanced.

Keywords:

Asset operation and maintenance, knowledge graph, information extraction, infrastructure management, tunnel engineering.

ID 133: Bridging Gaps in Early Warning Systems: A Web-based Solution for Enhanced Emergency Response in Sri Lanka

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Abstract:

This paper investigates the significant gaps in the current early warning systems and emergency response strategies during disasters in Sri Lanka. Sri Lanka, a nation prone to various disasters, frequently faces floods that have a profound impact on its vulnerable communities more than any other hazard. Therefore, the effective dissemination of Early Warnings (EW) plays a crucial role in protecting at-risk communities against disasters induced by natural hazards. This study assesses the current practices of national and local authorities, as well as their Standard Operating Procedures (SOPs) for warning dissemination and emergency response during disasters. To address these issues, the study has developed a web-based tool to aid emergency officials and other relevant technical agencies in disseminating critical disaster information to vulnerable communities and supporting emergency response procedures during disasters. To identify the gaps in the existing warning mechanism and emergency response strategies, a comprehensive literature review was conducted, followed by a series of key informant interviews with different stakeholders involved in Disaster Risk Management (DRM) activities. These stakeholders include officials from the Disaster Management Centre (DMC), technical agencies issuing early warnings, and authorities at the district and divisional levels. A web architecture was developed after finalizing the framework for the identified requirements and features. The proposed solution offers a technology-enabled mechanism to enhance warning dissemination and emergency response strategies during disasters.

Keywords:

Disasters, Early warnings, Emergency response, Web-based tool

ID 137: Construction and Monitoring of a Road Trial with Asphalt Mixtures Incorporating High Recycled Aggregate Content

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Abstract:

With natural sand and gravel becoming increasingly scarce, this research investigates the feasibility of using asphalt mixtures containing over 80% recycled materials for road construction. The mixture included recycled concrete aggregate (RCA), recycled glass (RG), and reclaimed asphalt pavement (RAP). Prior to construction, a comprehensive mix design phase, including fatigue and durability testing, was conducted in a previous study by this research group to optimize the mixture's strength and performance. In this project, the road was paved with a control section of conventional materials and two sections using recycled mixtures derived from lab testing. The road was closely monitored for rutting using a walking profiler and for crack development using a high-precision camera and image processing techniques. The performance monitoring over 17 months demonstrated that the recycled material mix exhibited superior performance compared to conventional materials. The paper additionally outlines the obstacles encountered in producing asphalt mixtures with a high recycled material content and suggests solutions to overcome these challenges. This pioneering study not only aims to address the challenge of diminishing natural resources but also seeks to pave the way for more sustainable transportation infrastructure. The results of this research offer insights into the practical feasibility and performance of high recycled material content asphalt mixtures for road construction.

Keywords:

Green asphalt mixture, Field monitoring, Road trial, Fatigue cracks, Sustainable pavements

ID 145: Risk Management for Renewable Energy Project Development: Insights and Challenges in the Indonesian Context

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Abstract:

As global energy transitions toward renewable sources, Indonesia, a major energy consumer in Southeast Asia, faces significant challenges in aligning with sustainable energy goals. With energy consumption projected to rise by 80% in 2030, Indonesia's ambition to achieve a 44% renewable energy mix by 2030 is critical. However, the development of these projects is surrounded by a wide range of risks. This paper aims to evaluate these risks and assess the challenges and risk management strategies currently employed in the region. Utilizing a naturalistic research method, the study synthesizes literature and document analysis from peer-reviewed articles, government reports, and other relevant sources to identify key risks and assess current management strategies. This paper delves into the multifaceted nature of risks inherent in renewable energy projects, including technical failures, financing constraints, policy instability, and community engagement complexities. This research contributes to the expanding literature on sustainable energy transitions and provides the groundwork for policy formulation to advance renewable energy initiatives in the region.

Keywords:

Risk management, renewable energy, Indonesia

ID 156: Shelter After Disasters in Australia

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Abstract:

Australia has experienced a series of disasters in recent times, destroying many homes and displacing many people. A range of different approaches to post-disaster shelter have been implemented in the wake of these disasters, including accommodation provided by the government in hotels, caravan parks, social housing, or 'temporary villages' where shipping containers and modular prefabricated dwellings called 'pods' are provided as shelters. While these initiatives have some positive outcomes, a range of problems are also evident, particularly the protracted nature of the displacement. For people without adequate insurance, or with limited options for relocation, and in an environment of housing shortages, access to permanent housing becomes uncertain, and the makeshift solutions that they are compelled to adopt can have severe consequences. This is demonstrated in the 2022 floods in Northern Rivers where people reported mental health and wellbeing decline after residing in interim housing for extended periods. There are also anomalies in access to different forms of shelter, and even in purpose-built temporary villages there are reports of friction and stigma. In some cases, previously inhabited sites have become uninhabitable because of the high risk of future disasters and environmental degradation. Given the inevitability of climate change-induced increases to the frequency and magnitude of disasters, living in such places is untenable. Further, the development of new building regulations to address disaster risk, such as those related to the Bushfire Attack Level (BAL) ratings, add costs and can further impede access to permanent housing. There are scant studies on shelter after disasters in Australia, pointing to the need for in-depth research that can inform policy and practice.

Keywords:

Australia, disasters, displacement, housing, shelter

ID 183: Key Variables Influencing the Cooling Performance of Urban Parks: A Scoping Review of Internal and External Factors

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Abstract:

Rapid urbanization, global warming, and the emergence of urban heat islands pose significant challenges for cities, particularly regarding thermal comfort, which is crucial for human well-being. Urban Green Infrastructure (UGI) is increasingly recognized as a viable solution for mitigating the effects of climate change, with urban parks being a primary focus for researchers due to their variety of cooling benefits. This study aims to identify the key internal and external variables that impact the cooling performance of urban parks through a scoping review. The results indicate that the cooling effects of urban parks are influenced by factors such as size, shape, vegetation coverage, and water features, along with external factors like urban form and local climate. However, current research often overlooks aspects such as plant arrangement, plant species, and near-surface layers. The review reveals that park size is the primary factor affecting its cooling performance. Additionally, the percentage of water bodies and tree coverage significantly impact cooling performance, though the effectiveness of each variable may vary depending on the background climate condition. This scoping review aims to identify the range of variables that play a pivotal role in the cooling effects of urban parks, providing valuable insights for urban planners and landscape designers to mitigate heat stress through more effective park design.

Keywords:

Cooling impact, urban green infrastructure, urban parks, urban heat island, heat mitigation

ID 195: Identification of Data-Driven methods for Risk Assessment in Public-Private Partnership Projects

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Abstract:

Public-private partnerships (PPPs) are essential for delivering public infrastructure worldwide, enabling the leveraging of private sector investment and expertise. However, these projects involve significant risks, such as financial and operational uncertainties, which can threaten their success and lead to substantial losses for both public and private stakeholders. Effective risk assessment is crucial to manage these challenges. This paper identifies major risks inherent in PPP projects that can significantly affect their success and presents various data-driven methods for risk assessment, such as traditional statistical models and Artificial Intelligence (AI) techniques. Despite the growing adoption of these methods, there remains a need to expand the use of advanced AI techniques to enhance predictive accuracy and reliability. This paper aims to understand the salient features of commonly used AI techniques and how it can be utilised to improve risk management practices in PPP projects. This research highlights opportunities for further exploration and application of AI methods to achieve more robust and transparent risk assessments in the context of PPP infrastructure projects.

Keywords:

Data-driven approaches, Natural Language Processing (NLP), Project management, Public-Private Partnerships, Risk

ID 205: Predictive Modelling for Road Maintenance: A Data-Driven Machine Learning Approach Using Gradient Boosting Regression

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Abstract:

Effective road maintenance is crucial for infrastructure sustainability and national development. However, the prediction of road maintenance needs is complicated by the influence of dynamic socio-economic factors. Currently, there is a significant gap in predictive road maintenance models that account for these factors, leading to challenges in strategic planning and resource allocation. This study aims to address this gap by developing a data-driven machine-learning model that accurately forecasts road maintenance requirements. Using the New Zealand Transport Agency (NZTA) dataset, which includes road maintenance expenditure data from 2000 to the present, the model incorporates key socio-economic indicators such as inflation, death rate, labor force participation, birth rate, population, construction GDP, and historical road maintenance costs. A Gradient Boosting Regression model, enhanced through advanced feature engineering and selection techniques, was employed to make these predictions. The model achieved an R-squared value of 0.7635, indicating strong predictive potential. The motivation behind this research is to improve decision-making and optimise resource allocation in road maintenance by providing more accurate and reliable forecasts. While the preliminary results are promising, the study highlights the need for further refinement, suggesting that future research should integrate additional features and explore alternative models to enhance predictive accuracy.

Keywords:

Road Maintenance, Gradient Boosting Regression, Predictive Modeling, Infrastructure Management, New Zealand

ID 208: Enhancing Social Acceptance for Renewable Energy Transition Through the Ladder of Citizen Participation

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Abstract:

The world in the 21st century deals with frightening energy and environmental challenges. Fossil fuel consumption increases greenhouse gas (GHG) emissions, which is the leading cause of climate change and global warming. With this, Renewable Energy (RE) derived from non-depletable sources with little GHG emissions has been identified as a prominent solution for net zero emissions. Apart from the technological and financial aspects, social acceptance of RE projects is significant for their success. Social factors such as community perceptions of benefits such as the perceived relative advantage of RE and compatibility of RE projects with existing practices and social norms significantly influence how rapidly a transition occurs. Thus, citizen participation in the renewable energy transition (RET) is conspicuous. This paper explores three main models for assessing the level of citizen participation out of that Arnstein's ladder of participation has been identified as one of the most referenced and popular models in analysing citizen participation. Thus, this article aims to present a theoretical framework for explaining citizen's level of participation in RE projects through Arnstein's ladder of participation. An extensive literature synthesis will be conducted concerning the social acceptance of RET and citizen participation towards it. The proposed theoretical framework will provide useful insights for industry practitioners and policy developers about the aspects they should consider while enforcing social acceptance for RE projects through efficient and effective citizen participation.

Keywords:

Arnstein's ladder of participation, citizen participation, renewable energy transition, social acceptance

Innovative Teaching and Learning Approaches in Building Education



ID 05: Online Engagement and Academic Performance in Construction Management Education: An analysis by Gender and Residency Status

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Abstract:

In the post-pandemic era, online learning has continued to become part of the learning experience of construction management students. This learning approach is also appreciated by these students given that they tend to work during their study. However, the effectiveness and impact of online learning on the performance of construction management students have not been adequately understood. This research, therefore, aims to understand how different groups of students, classified by their gender and residency status, engage with the online resources, and establish the relationship between their engagement and academic performance. Data were collected from 141 students enrolled in a second-year construction management course at the University of New South Wales (UNSW). The findings reveal that female students engaged the online materials more frequently than male students, resulting in them having better overall marks than their male counterparts. For male students, accessing pre-recorded content was correlated positively with their final marks. There was no significant difference in the way local and international students engaged with online content, resulting in them having similar academic performance. However, watching online videos and tutorial recordings were correlated positively with final marks for the local student cohort. These findings highlight the importance of asynchronous learning resources in enhancing academic outcomes and emphasise the need for tailored educational strategies to improve online learning effectiveness in construction management education. The revealed students' preferred learning mechanisms are valuable for improving students' learning experiences and outcomes.

Keywords:

Construction management, gender, online learning, preferred learning mechanisms, residency status

ID 08: Evaluating the Virtual Desktop Performance of ArchiCAD Software within Simulation-Based Teaching of Two New Zealand Diploma in Architectural Technology Papers

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Abstract:

This research investigates the performance of ArchiCAD Building Information Modelling software when used virtually in level 5 studio papers of the New Zealand Diploma in Architectural Technology. The report will identify technical issues encountered by students using ArchiCAD, describe the context of tasks ongoing when problems occur, and subsequent resolution methods. The project's purpose is to inform other institutes considering the virtual implementation of ArchiCAD or other similar professional software applications. This research will allow them to make more informed decisions about future software deployment strategies especially regarding specific discipline areas such as Architecture, Engineering and Construction. Methodology will include a literature review but mainly be in the form of classroom observation of ArchiCAD performance, recording of issues encountered, and collaboration with IT colleagues towards means of resolution. The investigation will focus on end-user experience from both student and tutor sides but also address from the perspective of the college Information Technology staff providing and monitoring VDI performance. Findings will identify issues, their context, and specific tasks that caused problems such as VDI system loading. Solutions found to problems will be described together with recommendations for institutes considering similar software VDI deployment. This project is significant because it highlights how sophisticated discipline-specific software can be taught and utilised virtually providing valuable information that will help tertiary providers make more informed decisions regarding their means of future software provision. This project is important as the findings could inform future Information Technology strategies within both academia and industry in years to come.

Keywords:

ArchiCAD, education, performance, software, virtual

ID 37: Timetable Tactics - Boosting Level 3 Engagement and Retention in Built Environment Courses

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Abstract:

Effective management of a student timetable plays a crucial role in fostering student engagement and retention, particularly at Level 3 in Higher Education. This research explores the strategic utilisation of timetables as a powerful tool to enhance student outcomes and mitigate attrition rates. Timetables serve as the structural backbone of academic programmes, shaping the distribution of modules and other enhancement activities. By strategically designing timetables that prioritise optimal learning journeys and student well-being, educational institutions can significantly impact student engagement and retention at Level 3. A block-hybrid approach has been introduced in Built Environment courses for level 3 students at the University of South Wales (USW), marking a departure from the 'block teaching' model used elsewhere in the sector, namely DeMontford, (2023); Victoria University (2018); Southern Cross University (2021). Key considerations in block-hybrid timetable design include balancing course load, allocating sufficient time for study, integrating diverse learning modalities to accommodate different student needs and preferences and more recently, the need to adjust approaches to reflect changing student habits and external factors. The strategic implementation of block-hybrid timetable offers a promising avenue for educational institutions to bolster student engagement and retention at Level 3. This study collected Examining Board data to assess whether timetable tactics and modes of delivery were able to improve academic success.

Keywords:

Block-hybrid delivery, Engagement, Higher Education, Retention, Student Success

ID 52: Framework for Student Wellbeing-Centered Built Environment Education

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Abstract

Recent studies claim that Built Environment (BE) undergraduate students who work in the construction industry while studying endure chronic burnout and stress owing to balancing the demands of their work and studies. This affects their academic performance and overall physical and mental well-being. These, in turn, adversely affect student retention rates in BE programs. While previous studies demonstrated the poor mental well-being of BE undergraduate students, they did not explore in detail stressors and the relationships between mental stressors and academic performance and well-being of the students. This research explores different stressors encountered by BE undergraduate students in Australian universities and the impact of those stressors on their academic performance and well-being. An online questionnaire survey was conducted with students enrolled in BE programs at the authors' universities. The data was analysed statistically to draw findings. It was found that balancing work and studies was significantly associated with the intention to quit or defer studies and academic performance. Six academic stressors are significantly associated with these adverse impacts, which are self-expectations of high performance, anxious of underperforming in studies, high academic demands, worried/anxious about tests/exams and problems when doing group assignments, and inadequate time for academic work due to work or social activities. Similarly, five work stressors are significantly associated with these adverse impacts, including difficulties in balancing study and work demands, study interference with paid work, high time pressure at work, excessive workload and doubts about finding a job after graduation. Drawing from the findings, a new well-being centred BE education framework is proposed. The framework can potentially improve the learning experiences in the Australian Built Environment discipline. It will not only foster the holistic development and success of students but also pave the way for a more supportive and nurturing academic landscape.

Keywords:

Built environment undergraduate students, Academic performance, Construction industry, Stressors, Wellbeing-centred educational design

ID 56: Building Stronger Foundations: Exploring the Impact of Tutor and Peer Connections.

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Abstract:

Foundation year courses are designed to equip students with essential skills and knowledge crucial for a successful transition to undergraduate studies. Foundation programs often serve as a pathway for students from underrepresented or disadvantaged backgrounds, who may not have attained the grades necessary for direct entry or feel they lack academic prowess. (Clifford, 2022) Foundation years have grown in popularity within the UK higher education sector. Despite their significance, foundation year courses typically experience higher attrition rates compared to direct undergraduate entry, posing a prevalent challenge within the sector. (Freeman, 2023) The study investigates the impact of tutor and peer relationships in cultivating a supportive learning atmosphere, with a focus on building internal support networks. Strategic adjustments were made to the engineering foundation year program, introducing a dedicated personal tutor, scheduled tutorial sessions, course-specific extracurricular activities, and tailored social and academic events. The objective was to examine the correlation between positive relationships with peers and tutors and their influence on retention rates. The results highlighted the importance of tutor and peer relationships in strengthening students' academic involvement, self-assurance, and advancement. However, they also revealed hesitancy among certain members of the cohort to participate in the arranged activities. Moreover, the study emphasised the critical nature of selecting the appropriate individuals to support the cohort.

Keywords:

Foundation Year, Higher Education, Social Connections; Retention; Belonging

ID 67: Effective BIM Training Approaches in the Construction Industry

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Abstract

A critical strategy identified in literature for effective BIM implementation is teaching BIM in higher education by incorporating it into the curriculum. However, there has not been enough research on how this can be effectively achieved. This study identifies the different ways of achieving this. A quantitative approach was adopted, and 183 responses were collected from industry professionals and academia through a structured questionnaire administered online. Through an analysis of the gathered data, the approaches were identified and discussed under structure, pedagogical strategies, tutor engagement and assessment methods. The identified strategies were ranked, and the most significant approaches were outlined. In addition, recommendations were appropriately made. The study makes a case for incorporating flexible teaching and inviting industry experts to teach BIM.

Keywords:

BIM Pedagogy, South Africa

ID 94: Integrating Engineering Management Principles to Enhance Farm Safety: A Collaborative Experiential Learning Approach

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Abstract:

Experiential learning offers a dynamic approach that allows students to engage directly with real-world challenges. In this work, postgraduate engineering students participated in field visits to farms as part of their capstone project on engineering management. The project aimed to expose students to a real-world environment in this case farm operations, to investigate and solve problems related to risks and hazard management in real-world settings. The project brief was carefully prepared together with our project sponsor, a farmer-owned research organisation, and was done in alignment with the subject's intended learning outcomes. Following the visits, students collaborated to develop a consulting report focused on identifying potential risks and hazards on farms and proposing effective mitigation strategies to enhance farm safety. Students reflected on their hands-on experience in writing as part of the assessment process, providing an opportunity to analyse their experiences critically and to consolidate their learning. This paper showcases the capstone project, the definition of the project brief, and the alignment with the subject. We also showcase the impact emphasising its experiential learning process and its role in cultivating practical skills and promoting critical thinking. The findings underscore the significance of integrating hands-on experiences into academic curricula that make a positive impact on engagement and reflection on students' development of critical thinking skills and their ability to apply engineering management principles to real-world scenarios.

Keywords:

Experiential learning, capstone project, reflective writing, engineering management

ID 180: Integrating AI and 4D BIM for Enhanced Construction Project Resource Management: Challenges, Solutions, and Future Research Directions

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Abstract:

The construction industry has increasingly integrated advanced technologies such as Building Information Modelling (BIM) and Artificial Intelligence (AI) to address complex project management challenges. BIM, particularly 4D BIM, enhances project planning by linking construction schedules with 3D models, facilitating improved logistical decision-making. However, automating 4D BIM scheduling remains a challenge due to the extensive manual efforts required. This study investigates the potential of integrating AI with 4D BIM to overcome these challenges and enhance resource management and scheduling in construction projects. Through a systematic literature review, the study identifies six key challenge areas: communication and coordination, data integration and uncertainty management, resource allocation and levelling, labour and skill management, material supply chain management, and technological and methodological limitations. The findings reveal that AI, particularly through machine learning and optimization algorithms, can significantly improve construction project efficiency by automating processes that are traditionally manual and error prone. The study also highlights the barriers to AI and BIM integration, such as the need for specialized technical expertise and the lack of standardized data collection models. This research contributes to the construction management literature by providing a comprehensive understanding of the challenges and solutions associated with the integration of AI and BIM technologies.

Keywords:

Artificial Intelligence, Building Information Modelling, Resource Management, Scheduling, Construction Industry, SDG 9: Industry, Innovation, and Infrastructure

ID 182: Prototyping a Serious Game for Education on Mold and Indoor Air Quality in Dwellings

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Abstract:

Poor indoor air quality can negatively impact public health and create conditions for dangerous pollutants such as mold. Raising awareness about these issues and educating people on how to address them in their homes is essential. Serious game is an innovative approach for delivering educational content effectively and engagingly. While various gaming applications exist, none specifically focus on the complexities of mold growth and prevention in residential settings. In this paper, the research team proposes a serious game for indoor air quality education to teach people how to prevent mold growth in dwellings. This serious game is designed to educate players about i) where mold is likely to occur in residential buildings, ii) the key elements required for mold formation, iii) the optimal temperature and humidity ranges to prevent mold growth, and iv) strategies to prevent mold growth. Articulate Storyline 360 was used to develop this game. This study provides an overview of the requirements and stages of developing a serious game, including defining learning objectives and educational content, designing game elements and mechanics, and identifying necessary tools and resources. This ensures that this game can deliver educational content by triggering the users' intrinsic and extrinsic motivation to learn and retain the knowledge. In the future, the researchers will assess the effectiveness of various game mechanics and elements affecting the users' motivation and experience.

Keywords:

Gamification, Indoor Air Quality, Mold Prevention, Dwellings, Residential Buildings, Serious Games.

ID 212: Design and Evaluation of IATC Microcredential Building Information Modelling (BIM) in Construction

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Abstract:

Australian building industry suffers skilled worker shortage, low efficiency of traditional construction project delivery, and thus incurs dwelling supply insufficiency on its property market. These problems are significant in the post pandemic era due to complex societal-technological impacts, in which workforce training for digital transformation is urgent. Targeting the building and infrastructure industry, the microcredential of building information modelling (BIM) in construction is developed for the Institute of Applied Technology – Construction (IATC) to satisfy needs from Australia in general and New South Wales (NSW) in particular. Based on literature review, body of knowledge in BIM is structured by considering BIM competencies and levels. Moreover, cognitivism and constructivism from the psychological domain are recognised to be applicable rationales for contents development by adopting chunking and scaffolds strategies. Teacher-focused and learner-focused features are designed in contents with eight modules to fulfil teaching and learning objectives. The microcredential is evaluated during its actual delivery through reflective practice from self, students, and peer. Further feedback will be gathered and analysed for future improvements.

Keywords:

BIM, Construction, Microcredential, Vocational Education

ID 220: Discourse On Cutting Edge Innovative Research at Universities Through Responsive Placemaking

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Abstract:

South Africa has made great strides in transforming the Higher education sector since the fall of the apartheid system. However, the sector, like the rest of the country, is facing challenges that include but are not limited to escalating operational costs, the quality of tuition, and quality control. It appears the university is failing to prepare graduates for the prevailing environment and to produce ideas that meet the complex triple challenges South Africa and the world face. The physical infrastructure at South African universities is inimical to social cohesion, communal leadership, and innovation. A context responsive model of social practice and creative placemaking, rooted in the rich indigenous knowledge and principles of social justice, is needed to create an environment which nurtures graduates and researchers with abilities to address the complexities of today and future challenges through research and innovation. The hypothesis is that current unfriendly physical environments in institutions of learning in Africa inhibit innovative research activities. It is argued in this paper that innovative research has both academic and applied components. Understanding the nature of innovative research would inspire the designing of responsive built environments. This conceptual paper contributes to the debate on improving the quality of research in Higher Education Institutions. It advances the adaptation of responsive placemaking to ensure that the campus physical learning environments can be grafted into a micro-public where entrepreneurship, social justice and innovative research thrives.

Keywords:

Social justice, learning environments, afrocentricity

ID 232: Digital Innovation to Enhance Tertiary Education

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Abstract:

This article endeavours to explore the best practices of technology-enhanced learning strategies through a systematic literature review with innovative outcomes to develop digital curriculum. Findings demonstrate the practical implications for creating interactive learning and teaching programmes will facilitate cognitive growth through developing a positive and supportive approach. Stimulating student knowledge, skills and learning behaviours with an online curriculum design that is interactive and dynamic with results in effective communication and sharing of knowledge. The use of digital innovations in e-learning designs for technology-enhanced learning activities in higher education require learning-management systems to guide educators in changing circumstances for a fully online delivery. Recommendations suggest educators need to share their innovations allowing others to develop a technological pedagogy content knowledge and teaching design for student learning. Inclusive practices and digital equity and leverage to facilitate student learning with sufficient detail to enable access to context. In the years following post Covid-19 pandemic, there has been conclusive innovation to teaching and learning with technologies promoting widespread adoption of online offerings in tertiary education.

Keywords:

Online tertiary education, Systematic literature review, Smartphone-based application, Technology-enhanced learning and Teaching and learning strategies

ID 253: Student Experiences of Challenge-Based Learning and Sustainable Mindset Development

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Abstract:

Universities are innovating curriculum and pedagogies towards value-based and transformative student learning. This includes preparing learners and educators in engineering and built environment for sustainable future pathways. The modes and models for sustainability integration and sustainable mindset development are challenging traditional disciplinary boundaries with diverse approaches emerging. Yet few studies have captured the students' self-development journeys along these new learning-focused approaches. This research investigates graduate students' sustainable mindset development through the innovative cross-disciplinary ATLAS program at the University of Twente, Netherlands. The curriculum is scaffolded along broadened course pathways based on a challenge-based learning premise. In diverse project teams students work with industry partners to experiment, design and build solutions for specific challenges our society is facing today. Utilising Wilber's integral theory the future-ready skills of graduates are mapped through the United Nations sustainable mindset theoretical concept and its specific attributes. Student interview data is thematically analysed for internal, external, individual and collective course and cohort experiences and behavioural development changes. Findings demonstrate that students of this program have experienced transformative changes. Data analysis identified development of students' personal and professional values in correlation with key sustainable mindset attributes. Graduates expressed how course learning experiences shifted their attributes from rigid to becoming flexible and innovative in their approaches to learning and working, from reactive to reflective and from defensive to more confident and thoughtful in their outlook beyond themselves. These are sustainable mindset attributes for higher education institutions and industry employers to consider as we prepare for challenging societal futures.

Keywords:

Challenged-based learning, Integral theory, Sustainable mindset, Transformative learning

ID 257: Developing a virtual inspection platform for online teaching and training of construction students

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Abstract:

This paper addresses the challenge of providing practical construction training in online education by introducing a Virtual Inspection (VI) platform designed to simulate real-world construction environments. The VI platform was integrated into an Online Real-Time (ORT) course for construction and building surveying students, enabling them to gain practical experience in quality control remotely. The study involved implementing the platform in the NBC 2109 Performance Based Solutions for Building unit at Victoria University and collecting feedback from students through Student Evaluation of Unit (SEU) surveys. Additional surveys were conducted among both students and educators to evaluate the platform's effectiveness and suggest areas for improvement. The findings indicate that the VI platform enhanced student engagement, satisfaction, and comprehension compared to ORT delivery methods excluding VI. Despite these successes, challenges such as improving the resolution of 360-degree images and addressing technical issues were identified. This research contributes to advancing digital learning in construction education by offering interactive experiences. Future developments will focus on refining the platform's features and expanding its capabilities to further improve educational outcomes.

Keywords:

Online teaching and learning; Construction; Virtual inspection platform; Training

ID 263: COVID-19 New Normal: Planning for the Future

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Abstract:

COVID-19 pandemic impacted higher education drastically. Original face-to-face teaching on campus were converted to fully online delivery. Under the COVID-19 new normal era, the delivery mode of higher education is required to be flexible enough to cope with potential disruptions and fluctuating conditions. Through literature review, three delivery options of blended/ hybrid, flexible hybrid and intensive mode of delivery are discussed and compared. Each option has its own merits and considerations. This article offers a comprehensive analysis of pros and cons of a collection of approaches and a consideration of alternative modes under the new normal. It is crucial for higher education institutions to plan ahead based on own scenarios to develop resilient educational solutions to turn challenges into opportunities.

Keywords:

COVID-19 new normal; blended/ hybrid; flexible hybrid; intensive mode of delivery

ID 265: The Effectiveness of Mathematics Modules for Online Construction Management Students: A Scoping Review

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Abstract:

This research aims to evaluate the effectiveness of the University of South Australia (UniSA) Online Mathematics Modules within the Undergraduate Construction Management (CM) program, which attracts students from varied backgrounds, including school leavers, mature entry candidates, and career professionals seeking advancement or a career change into construction management. Recognising the critical role of mathematics proficiency in construction management for tasks such as estimating, budgeting, and dimensioning-scaling, this study addresses the challenge posed by students' gaps in foundational mathematics knowledge, which can hinder their academic progress and professional success. Through a scoping review methodology that examines 38 scholarly publications related to mathematics education, math anxiety, diverse learning styles, and pedagogical approaches to Math-Related Content, the research provides insights into the adaptability of math supplements or modules to diverse learning styles and their scalability within construction education. Additionally, it investigates potential gaps in resource allocation that may affect the modules' effectiveness. By exploring two main research questions regarding the customization and scalability of math supplements in construction management education, this study aims to offer valuable strategies for enhancing student outcomes in technical aspects of construction management courses.

Keywords:

Andragogy, Learning Style, Mathematics Anxiety, Mathematics Modules, Online Learning

ID 268: Cross-disciplinary Collaborative Problem-based Learning on Smart Home Design and Implementation

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Abstract:

Cross-disciplinary collaboration has been encouraged in tertiary education to enhance skills and prepare students for the challenges they may encounter in professional settings. This project explores the collaboration between Building Design (BD) students, Architectural Engineering (AE) students, Electrical and Electronics Engineering (EEE) students, focusing on designing and implementing smart home features within tiny house models. BD and AE students were tasked to design and construct physical models of tiny houses. Upon completion, those physical models were transitioned to EEE students who were responsible for designing, installing, and testing multiple smart home functionalities. These included energy harvesting, light control based on human presence, temperature regulation, and the display of environmental data along with other operating features. In this simulated real-world scenario, BD and AE students functioned as contract issuers who provided the initial tasks and outlined job requirements. EEE students then evaluated the feasibility, executed tasks, and reported the completed tasks to the issuers. This cross-disciplinary collaborative project is structured to highlight practical hands-on skills and foster teamwork, both of which are fundamental in contemporary design and engineering practices.

Keywords:

Cross-disciplinary collaboration, smart home design, problem-based learning, industry ready, simulated real-world scenario

Building Regulations vs Innovations



ID 29: A Critical Examination of Mandatory Building Inspections: Perspectives from Australian Contractors

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Abstract:

In Australia, the construction industry relies on building inspections conducted by statutory building surveyors and/or independent building inspectors to ensure regulatory compliance with the National Construction Code. Despite the essential role of these inspections, there is growing concern about the effectiveness and evidence of compliance. This issue is intensified by the complexities of modern construction practices and the pressures from the housing crisis, highlighting the need for a critical re-evaluation of inspection practices to reflect their impact on completed buildings better. This study explores the perspectives of contractors who closely interact with the regulatory inspection process to examine its influence on construction practices, the challenges in meeting standards, and its effects on project timelines and quality. Through qualitative interviews with five experienced contractors in the Victorian construction industry, a pilot study was undertaken, and the aim was to evaluate the feasibility of a holistic study. The findings reveal a consensus among contractors on the need for improved inspection processes, advocating for more comprehensive oversight and the integration of technology to bridge the compliance-quality gap. The study critically assesses the current mandatory inspection approach as inadequate for ensuring comprehensive regulatory compliance. It calls for a collective effort to enhance construction practices, aiming for regulatory mechanisms that better align with the complexities of modern construction, thereby ensuring safer, higher-quality building outcomes. With an emphasis on contractor experiences, this exploratory study sets the stage for more extensive research to refine inspection processes and improve construction quality and compliance.

Keywords:

Building Standards, Construction, Contractor Perspectives, Mandatory Inspections, Regulatory Compliance

ID 92: Introducing An Agent-Based Model of Construction Multi-Project Portfolios

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Abstract:

Agent-based modelling (ABM) is a powerful tool to explore and explain complex systems. This technique is rarely utilized in construction-related multi-project portfolios (C-MPPs) management, where resource allocation is often highly complex and the portfolio situation is uncertain. This study aims to provide insights into prospective demanded resources and probable re-scheduled projects. Therefore, an agent-based (AB) model of C-MPPs is conceptually developed to help portfolio stakeholders understand the dynamic nature of constraint resource allocation. This AB model is coded, and the computational feasibility of the concept is proved using a pipeline project portfolio from a local council in New Zealand. Accordingly, the model operates well while assessing the time extension and corresponding re-scheduled expenditures, as well as impacted portfolio projects. This study contributes to the body of research on ABM applications and C-MPP management. It extends the field researchers' perceptions of the individual-based modelling approach and its usefulness in solving complex problems such as resource allocation under constraints and evaluating the long-term impact of managerial decisions.

Keywords:

Agent-Based Modelling, Projects Portfolio, Resource Allocation

ID 142: Is the Australian National Construction Code sufficient to deliver the net-zero transition?

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Abstract:

The Australian National Construction Code (NCC) sets the foundational regulatory framework for building safety, health, and environmental performance. Yet, as international targets for net-zero carbon emissions become more stringent, mere compliance with these basic regulations is no longer sufficient. This study explores the discrepancies between existing building code mandates and the stringent requirements for achieving net-zero emissions, assessing the NCC's effectiveness in supporting the building sector's transition towards net-zero. Through a detailed literature review, this research pinpoints significant deficiencies in current practices that hinder progress towards more sustainable construction. The analysis reveals that while the NCC includes initiatives to enhance energy efficiency, it primarily focuses on the construction and operational phases, neglecting the full life cycle of buildings, including material sourcing and end-of-life phases. Furthermore, the effectiveness of the NCC is contingent upon consistent enforcement and compliance across jurisdictions, along with the adoption of emerging sustainable technologies. This paper concludes that a shift towards performance-based regulations is necessary and recommends that the NCC be part of a broader, multi-faceted policy approach that includes incentives for renewable energy, low-carbon technologies, and whole life cycle emission assessment to effectively meet net-zero goals. These findings are essential in ensuring that the building sector aligns with global environmental objectives and the pursuit of net-zero emissions.

Keywords:

Australian National Construction Code, building regulations, energy efficiency, lifecycle emissions, net-zero emissions, performance-based codes, sustainability.

ID 150: Readability and comprehensibility of payment clause in FIDIC Red Book 2017 and NZS 3910:2023

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Abstract:

Low readability contracts would result in comprehension disparity. When contract comprehensions are disparate, conflicts and disputes are likely to ensue. Therefore, analysing contract readability and its textual properties are vital towards achieving uniformity in contract comprehension and reducing conflicts and disputes in construction projects. This paper examines and compares the readability and textual properties of payment claim clauses taken from two standard forms of construction contracts – NZS 3910 and FIDIC Red Book. Coh-Metrix measures of text readability and easability were used to analyse the textual properties in both forms. The results revealed higher referential cohesion in NZS payment clause compared to FIDIC. High referential cohesion suggests more overlapping words, ideas and concepts in the clause, making it easier to understand. NZS has lower concrete words compared to FIDIC indicating high word abstractness and low imaginability within its clause. NZS too has higher negation incidence compared to FIDIC. Both FIDIC and NZS clauses are average in terms of narrativity and syntactic simplicity. These suggest both forms were written in a less story-like manner and have moderate sentence complexity. Both forms are average in passive voice sentence relative frequency. Finally, both NZS and FIDIC have high deep cohesions indicating explicit causal relationship within the clauses. Therefore, the clauses in both forms may be easier to understand on unfamiliar topics. The findings of this paper can be used by contract drafters to identify and improve the textual properties in construction contracts resulting in higher readability and comprehensibility.

Keywords:

Coh-Metrix, construction contract, FIDIC Red Book 2017, NZS 3910:2023, readability

ID 162: Greening Australian Homes: Investigating the Readiness of Building and Real Estate Sectors for Energy Efficiency Disclosure

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Abstract:

Despite several attempts, the Energy Efficiency Disclosure (EED) for residential buildings at the federal level in Australia has historically failed due to industrial resistance and lack of consensus. However, a new EED framework has been approved for implementation by the end of 2025. The policy draft, however, lacks a comprehensive assessment of the readiness of delivery partners, particularly the real estate and building sectors, which are crucial to its success. This study, therefore, assessed and compared the readiness of real estate and building sectors through two key steps: a scoping review of the history and objectives of EED in Australia, followed by 12 semi-structured interviews with industry and policy professionals familiar with the proposed EED. The interview transcripts were analysed using the thematic analysis. Research findings revealed significant differences between the sectors, with the building sector showing higher awareness and support for mandatory disclosure, while the real estate sector expressed low to moderate interest, favouring voluntary disclosure and emphasising the need for flexibility and trust-building. Both sectors highlighted capacity constraints in retrofitting, such as skill shortages and limited infrastructure. Given these differences, a phased approach focusing on upskilling the workforce and initially limiting EED implementation to real estate sales is recommended for Victoria.

Keywords:

Building and Services Sector, Home Energy Ratings Disclosure Framework, Real Estate Sector, Residential Buildings, Victoria, Workforce Readiness

ID 229: An Investigation into the Causes of, and Potential Regulatory Remedies For, Insolvency in the South Australian Construction Industry

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Abstract:

The rate of construction business insolvencies in Australia has reached alarming heights with ASIC reporting 2,977 companies entering external administration in 2023/24 – at 27%, this represents the highest share of any individual industry in the Australian economy. Consequently, there is an increasing view that the prevailing business model under which the construction industry operates is dysfunctional. This paper presents and discusses the results of a questionnaire survey carried out with stakeholders in the South Australian construction industry to determine their views as to the primary causes of construction insolvency, the extent to which current regulation effectively addresses these causes, and whether/how this regulation needs to be strengthened. The research found that low profit margins, imbalanced risk allocation in construction contracts and poor payment practices are among the biggest causes of insolvency, and there is a need for the current regulatory framework to be strengthened to address the insolvency problem. In this respect, there was strong support for the introduction of statutory payment trusts and a mandatory prescribed construction industry code of conduct. The findings, although preliminary in nature, are significant as they indicate a general appetite exists among South Australian construction industry stakeholders for the government to enact further regulation targeted at alleviating the construction insolvency problem.

Keywords:

Construction insolvency, prescribed industry code of conduct, security of payment legislation, unfair contract terms

ID 249: A User-Centred Framework for Pre-Occupancy Evaluation to Improve Building Design Performance

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Abstract:

Studies highlight the failure of buildings to meet occupants' needs, causing performance gaps and sick building syndromes. Poor integration of end-user inputs for design is a key reason. Post-occupancy evaluations (POEs) are used for understanding occupants' perspectives from similar buildings. This is a laggard, retrospective approach. The design of proposed buildings should be evaluated proactively by end-users. A lack of robust frameworks with comprehensive performance assessment criteria hinders it. This study aims to propose a framework to catalyse user-centred design and pre-occupancy evaluation (ProE) of building performance of buildings. A systematic literature review of 43 relevant journal articles and a synthesis of the knowledge contained in them was undertaken to achieve the aim. This study identified forty-one design performance attributes under 12 design performance constructs to support the ProE of building performance at the design stage from end-user perspectives. The performance aspects include aesthetics, spatial configuration, accessibility, building services, IAQ, privacy, biophilia and views, lighting, sustainability, ergonomics, thermal, and safety and security. Then a framework is developed for user-centred design and ProE of buildings. The findings can enhance the building design process in three ways: (1) strengthening end-user requirement acquisition, (2) fostering occupant-centred building design, and (3) facilitating ProE building designs by end-users.

Keywords:

Building performance, end-users, pre-occupancy design evaluation, performance indicators, systematic literature review

ID 249: A User-Centred Framework for Pre-Occupancy Evaluation to Improve Building Design Performance

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Abstract:

Studies highlight the failure of buildings to meet occupants' needs, causing performance gaps and sick building syndromes. Poor integration of end-user inputs for design is a key reason. Post-occupancy evaluations (POEs) are used for understanding occupants' perspectives from similar buildings. This is a laggard, retrospective approach. The design of proposed buildings should be evaluated proactively by end-users. A lack of robust frameworks with comprehensive performance assessment criteria hinders it. This study aims to propose a framework to catalyse user-centred design and pre-occupancy evaluation (ProE) of building performance of buildings. A systematic literature review of 43 relevant journal articles and a synthesis of the knowledge contained in them was undertaken to achieve the aim. This study identified forty-one design performance attributes under 12 design performance constructs to support the ProE of building performance at the design stage from end-user perspectives. The performance aspects include aesthetics, spatial configuration, accessibility, building services, IAQ, privacy, biophilia and views, lighting, sustainability, ergonomics, thermal, and safety and security. Then a framework is developed for user-centred design and ProE of buildings. The findings can enhance the building design process in three ways: (1) strengthening end-user requirement acquisition, (2) fostering occupant-centred building design, and (3) facilitating ProE building designs by end-users.

Keywords:

Building performance, end-users, pre-occupancy design evaluation, performance indicators, systematic literature review

ID 251: Fit For Purpose? Establishing Regulatory Clarity Around Disability Housing

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Abstract:

The National Disability Insurance Scheme (NDIS) is primarily a service support for Australians with a disability, however it does contain a sizeable housing component, known as Specialist Disability Accommodation (SDA). A key feature of SDA housing is that it is intended to be developed by the private housing industry. The NDIS has guidelines and specifications, and its own accreditation process, for SDA dwellings but they are subordinate to the National Construction Code (NCC) and the relevant building surveyor process to secure a building permit and occupancy status. However, housing for people with a disability has been considered a specialist – and government – responsibility for the last 215 years since the first building controls were introduced to Australia in NSW in 1810. The lack of content and clarity around disability in the NCC concerning housing – including in NCC 2022 with its additional accessibility requirements – has led to a situation in which developers are unable to effectively marry together the intention and expectations of people with disability around their accommodation and the building code requirements they must adhere to. This research interviewed developers, building surveyors, and fire specialists and identified how uncertainty, lack of clarity, and confusion caused by the ambiguous or absent status of disability in the NCC around housing has led to a series of workarounds and strategies to complete building projects. The research highlights how community expectations and government policy can move faster than the NCC and regulators can adapt, and the consequences of this market failure for accessible dwellings.

Keywords:

Disability, Housing, Regulation, SDA

ID 258: A Preliminary Investigation of the Requirements for Enhancing Personal Integrity of Construction Professionals In a Developing Economy

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Abstract:

The construction industry is labelled as one of the most corrupt as a result of various unethical conducts of professionals and stakeholders seeking to get contract awards for their construction firms and/or personal gain. In fact, corrupt actions in the industry have degenerated into social norms, contributing to constant cost overrun, time overrun, building collapse, and risks to lives and properties. As it stands, the personal integrity of construction professionals appears to be the way to realize the judicious use of limited construction resources and minimize unethical practices in developing countries full of porous legal systems and economic hardship, among others. Meanwhile, the requirements for enhancing the personal integrity of construction professionals in the industry are yet to be explored. Therefore, the study investigated the relationship between integrity management (IM) requirements and personal integrity using a survey of construction professionals. The results of Pearson correlation and multiple stepwise regression analyses revealed that: (i) management responsibility ($R^2=0.273$) and training and awareness ($R^2=0.394$) boost personal integrity directly, and (ii) management responsibility and internal audit ($R^2=0.630$) enhance personal integrity of construction professionals via training and awareness. Based on the findings of the study, several recommendations, namely (i) comprehensive knowledge of ethical conduct by management representatives, (ii) ethical conduct of top management officials for effective top-down approach in passing ethical values, and (iii) constant internal audits within the organisation to understand the areas of improvement in the ethical delivery of services to construction clients and business partners were posited.

Keywords:

Ethical conduct, construction industry, integrity management, personal integrity

ID 262: Early Contractor Involvement in a Mandaean Place of Worship

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Abstract:

Early Contractor Involvement (ECI) can offer significant benefits for construction projects. However, ECI is scarcely discussed in relation to place of worship projects, particularly that of minority communities. The Mandaean, an ethnoreligious group that follow Mandaeanism a Monotheistic religion. This article will aim to discuss the necessity of a collaborative approach for their place of worship (Mandi). Literature will be reviewed on ECI, brief liturgical requirements in Mandaeanism and lastly barriers minority communities face in the construction of their places of worship. The research methodology will be focused on a case study of Mandi Wallacia which will provide insights into the issues faced in the past. From this, it is seen that there are multiple issues that occur in place of worship construction for minority communities. It is evident, that through this research ECI and the relation of function and form must be harmonious to achieve the successful construction of places of worship.

Keywords:

Early contractor involvement, mandaean, Mandi, place of worship, planning

ID 266: Perceptions of Industry Professionals on the National Construction Code 2022

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Abstract:

The National Construction Code (NCC) 2022 is an Australian legislated document that has introduced new sustainability initiatives for design and construction professionals to adhere to. This study was undertaken to gauge attitudes and perception of residential building construction industry professionals (builders, architects, certifiers, etc.) to NCC 2022 and the impact of sustainability provisions have had in the workplace. Data was collected by sending a questionnaire survey to 84 industry professionals who were chosen via a quota sampling technique. The survey indicated that building industry members are pro sustainability, and that sustainability needs to be approached holistically rather than based on discrete elements and cost is the most pressing issue for sustainable construction. Greater efforts by the ABCB are needed to increase the participation of key stakeholders and incorporation of more holistic views of the Australian building and construction professionals in the future editions of the NCC to achieve better sustainability outcomes on building projects and in the industry.

Keywords:

Australia, Energy Efficiency, Legislation, National Construction Code, Sustainability

ID 268: Evaluating Blockchain Platforms for Trustworthy Procurement and Management of Building Services

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Abstract:

Many blockchain platforms have emerged with the widespread adoption of blockchain technology across many industries. Developers often use a blockchain platform (BP) they encounter, which may not be the most suitable for their specific project. Selecting suitable BP is further complicated because existing BPs exhibit different capabilities and features, particularly when applied to specific domains. Thus, choosing the most appropriate BP has become challenging. This research aims to identify criteria for BP selection and provide guidelines to select a suitable BP for procurement and management of building services (PM of BS). A critical literature review was conducted to identify existing BPs and criteria for their selection. Multi-Attribute Rating Technique (SMART) was used to select the suitable BP. Weights for the selection criteria were assigned based on the features of the desired application (PM of BS). Each BP was then evaluated against the selected criteria and given a rank from 1 to 3 where 1 denotes the lowest suitability while 3 denotes the highest suitability. The study identified 16 prominent BPs, including Hyperledger, Ethereum, IBM, and R3 Corda. The three most heavily weighted criteria in the selection process were learning materials, the presence of permissioned networks and the cost of running/storing data. Findings revealed that Hyperledger fabric supported by Firefly, achieved high scores and could be a suitable BP for developing applications in the PM of BS domain. The results will assist developers in selecting the most appropriate BPs for their blockchain project.

Keywords:

Blockchain Technology, Blockchain Platforms, Procurement and Management, Building Services, Multi-Attribute Rating Technique (SMART)

Building Industry Workforce Development



ID 03: Gender-fair advertising in New Zealand: How inclusive is the construction industry?

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Abstract:

Widening the talent pool is critical to addressing the construction industry's ongoing labour shortages, creating an urgency to challenge longstanding practices that deter women from entering and advancing in the sector. The recruitment of women into construction roles depends on gender-fair job advertising to create a more gender-inclusive industry. The construction industry is historically considered male-dominant, and there is a higher likelihood of using masculine-stereotyped words in classified advertisements, which may discourage women from applying for open vacancies. This exploratory study examines recruitment practices and their influence on improving gender diversity in the New Zealand construction industry. The research used content analysis to evaluate the use of gender-inclusive language in 169 construction vacancies in New Zealand. The findings underscore the high degree of feminine-coded language in construction vacancies, indicating that the industry is increasingly becoming gender-inclusive and exploring various avenues for encouraging women's engagement in the sector.

Keywords:

Gender inclusivity, gender coding, gender diversity, recruitment, construction

ID 04: Women Balancing Identities: Navigating Leadership and Gender in the Built Environment

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Abstract:

Women remain under-represented in leadership positions in the built environment sector, largely due to structural and cultural barriers that impeded their career advancement. Despite recognition of these barriers, the responsibility for overcoming them continues to fall predominantly on individual women, rather than the organisations and systems that perpetuate inequality. Current initiatives aimed at improving work-life balance focus primarily on managing time-based conflicts, often overlooking the crucial need for identity reconciliation. In male-dominated sectors like the built environment, women leaders frequently encounter identity conflicts where societal expectations of femininity clash with the assertive traits typically associated with leadership roles. These conflicts create intrapersonal barriers that can negatively impact self-perception and hinder career progression. This research explores how women leaders in the built environment experience and navigate these identity conflicts. Through interviews with 19 women leaders, the study reveals the complex ways in which these tensions manifest, and the strategies women employ to manage them. The findings suggest that achieving work-life balance for women leaders involves more than just time management; it requires a deeper reconciliation of their professional and personal identities. This research highlights the critical need for organisational cultures to recognise and address these unique challenges. Without such recognition, women leaders will continue to face significant barriers to their career advancement and overall wellbeing. By emphasising the importance of identity reconciliation within organisational contexts, alongside time management strategies, this study provides key insights into how women leaders can be better supported, ultimately advancing gender equality in the built environment.

Keywords:

Women leadership, work-life balance, woman-leader-identity conflict

ID 07: Unlocking Hidden Potential: Exploring Tacit Knowledge Capture for Enhanced Productivity in Construction Firms

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Abstract:

This qualitative collective case study investigates the potential of capturing tacit knowledge in construction firms to improve project productivity. The study explores two key themes: (1) project managers' awareness of tacit knowledge capture's significance, and (2) its perceived effectiveness in boosting productivity. Interviews with 10 project managers from distinct construction firms revealed a limited understanding of the concept. However, upon explanation, participants recognised potential benefits including: (a) enhanced decision-making, problem-solving, and crisis management, (b) improved work execution methods, (c) reduced rework, and (d) facilitated training. Interestingly, the perceived knowledge flow was primarily top-down, with minimal upward knowledge sharing. The participants acknowledged that knowledge management systems could provide a competitive edge by offering platforms to: (a) document lessons learned, (b) enhance strategic decision-making for competitive bidding, and (c) support procurement and estimating departments. The study highlights a crucial disconnect: while project managers intuitively recognise the benefits of capturing tacit knowledge, there seems to be a lack of established practices for harnessing and utilising this valuable resource within these firms. This research contributes to a more comprehensive understanding of knowledge management practices in construction and emphasises the need for strategies to capture and leverage tacit knowledge for improved project productivity and competitive advantage.

Keywords:

Construction, knowledge capture, productivity, tacit knowledge, unlocking hidden potential

ID 11: Addressing Shortage of Building Construction Academics in Papua New Guinea Tertiary Institutions

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Abstract:

There is a growing concern of labour shortage of building construction academics in Papua New Guinea Tertiary Institutions. To attract and retain qualified national construction academics have been oversighted for many years and need addressing to highlight the main cause of the labour shortage. With the Papua New Guinea Government agenda to increase students' intakes in order to accomplish its medium-term strategic plan goals have placed an additional stress on the current construction academic professionals. The structured survey questionnaires were developed from identifying key measurable variables from the literature review and from interviewing experienced construction academic staffs. It is found that the main causes were salary and staff welfare being the key sensitive variables causing poor attraction of qualified national academic. This study will assist and guide the Papua New Guinea responsible stakeholders to review their employment condition policies to attract qualified national construction academics.

Keywords:

Building Construction National Academics, Government Agenda, Labour Shortage, Papua New Guinea, Tertiary Institutions.

ID 15: Comparative Analysis of PM Emissions in Construction Sites and Surrounding Areas

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Abstract:

The construction industry is a significant source of particulate matter (PM) pollution, contributing to varying emission levels across different environments. Despite its impact, there is limited understanding of how PM concentrations within construction sites compare to those in surrounding areas. This study focuses on real-time monitoring of PM₁, PM_{2.5}, and PM₁₀ concentrations across four distinct scenarios: within the construction site, near the site, farther away, and the broader urban background. Using high-resolution data from strategically placed sensors, the study identified significantly high PM levels within the construction site compared to the surrounding areas. The strongest correlation was observed between PM₁ and PM_{2.5} within the construction site, highlighting the importance of independent monitoring of these pollutants in such environments. These findings emphasize the necessity for dedicated PM monitoring strategies tailored to the specific conditions of construction sites, aiming to mitigate health risks for workers and nearby residents. This research provides critical insights that can inform the development of more effective environmental health practices and regulatory frameworks.

Keywords:

Construction Site Pollution, Particulate Matter (PM), PM Monitoring

ID 39: Building Regulations: Quality or Compliance?

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Abstract:

Stakeholders and the public often confuse the terms "quality" and "compliance" when discussing the significance of building regulations. This misunderstanding can permeate the supply chain and infiltrate educational settings, where the responsibility for ensuring technical adherence to building standards falls under the purview of building regulations and the role of building surveyors in granting permits and conducting inspections. This study embarks on a preliminary investigation to uncover concerns voiced by key stakeholders involved at the frontline of building project execution regarding the adequacy of regulatory compliance. This pilot study lays the groundwork for a broader research endeavour to examine the management and accountability stemming from regulatory mandates. The findings from the pilot pinpointed critical issues regarding adherence to the Australian National Construction Code. Furthermore, they shed light on areas requiring consideration to better reflect contemporary construction industry practices, which may, in turn, influence the education of future construction professionals. What role do entities overseeing the implementation of building regulations play in ensuring regulatory compliance, and to what extent does this translate into the delivery of building quality?

Keywords:

Australian Codes, Building regulations, Quality vs. Compliance, Regulatory Compliance

ID 44: Towards smart supply chains in construction: a systematic literature review

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Abstract:

The construction sector recognizes the critical role of supply chain management in achieving project success. The integration of digital technology into supply chain management has been hastened by the Fourth Industrial Revolution, offering new advantages to enhance efficiency and establish standardised processes. This study will employ a systematic literature review methodology and bibliometric analysis techniques like VOSviewer and tabular sorting to explore the significant impact of digital technologies on construction supply chains. Through a systematic analysis of previous scholarly works, it aims to demonstrate how digital technologies can improve supply chain transparency, optimize resource allocation, and facilitate data-driven decision-making. The study will also compare common digital technologies used in construction supply chains. By systematically and critically reviewing existing literature, this research adds valuable insights into the roles and challenges of digital technologies in construction supply chain. The research recommendations will benefit future studies aiming to advance smart supply chain practices in the construction sector.

Keywords:

Digital technologies, Construction supply chain, Technological adoption, Smart supply chain, Literature review

ID 47: Uncovering Skills: University Curriculum Coverage

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Abstract:

The construction industry necessitates a diverse set of both technical and transferable skills from its graduates to meet its evolving demands. Yet, there is a prevalent skill gap where graduates are failing to meet their employers' expectations on their proficiency of transferable skills. Higher education plays a pivotal role in developing a student's, or graduate's readiness to enter the workplace. Therefore, to ensure graduates are well-prepared for their roles, it is essential for university construction programs to be adaptable and responsive to the ongoing expectations of the industry. This research determines the coverage, depth, and scaffolding of 18 key transferrable skills within the Bachelor of Construction Management and Bachelor of Building Design Management at Western Sydney University. Through a comprehensive curriculum review, transferable skills such as communication, self-management, time-management were found to be well covered with ample opportunity for students to develop. However, the findings suggested that some skills were either not being adequately covered or were not being effectively scaffolded. Various trends emerged which highlighted the need for universities to explicitly integrate and scaffold transferable skills to provide opportunities for students to develop and better prepare themselves to meet the industry demands of its cadets and graduates. This paper ultimately worked towards minimizing the prevalent skill gap of current and future construction programs, so that university programs are better aligned with industry demands.

Keywords:

Employability, Transferable Skills, University Curriculum, Workforce Readiness

ID 48: Uncovering Skills: Construction Industry Expectations

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Abstract:

The construction industry necessitates a diverse set of skills from its graduates to meet its evolving demands. Yet, there is a prevalent skill gap where cadets and graduates are failing to meet their employers' expectations on their proficiency of transferable skills. Higher education plays a pivotal role in developing a student's, or graduate's readiness to enter the workplace. Therefore, to ensure students are well-prepared for their roles, it is essential for university construction programs to be adaptable and responsive to the ongoing demands of the industry. This research determines the skills needed to meet current industry demands for construction students entering the industry as cadets or graduates. A detailed review of public job advertisements was conducted. 18 recurring transferrable skills were identified with the greatest demand being for written and verbal communication, self-management, information interpretation, interpersonal skills, and organizational skills. This research ultimately works towards minimizing the prevalent skill gap of current and future construction programs so that university programs are better aligned with industry demands.

Keywords:

Construction Industry, Employability, Transferable Skills, Workforce Readiness

ID 62: Strategies for Improving Work-Life Balance in Small Construction Firms in New Zealand

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Abstract:

Maintaining a work-life balance (WLB) in the construction sector is often challenging due to the demanding nature of the industry. The existing work culture dictates long working hours, disruptive work schedules and high-pressure deadlines that affects the well-being of construction professionals. Poor work-life balance has significant impacts, resulting in absenteeism, low job satisfaction, high employee turnover, low productivity, demotivated workers, reduced mental health, and a stressful work environment. Strategies to maintain a work-life balance are necessary for construction professionals to achieve higher job satisfaction and successful careers in the industry. This qualitative research investigated the strategies employed within a small construction company to improve its employees' work-life balance. Furthermore, it evaluated the impacts of these work-life balance strategies and their appropriateness for adoption by small construction organisations in New Zealand. A case study was conducted on a small construction company in Auckland using document analysis and semi-structured interviews as data collection methods. The findings indicate that smaller organisations often utilise informal approaches to WLB compared to larger organisations with formalised processes. The research also identified that workplace culture and company size affected WLB approaches, with smaller organisations focusing on enhancing workplace connections and creating a positive environment for employees compared to larger organisations centering on providing incentives. However, compared to larger firms, smaller construction organisations need to have adequate systems to raise awareness of work-life balance strategies that will benefit their employees.

Keywords:

Construction; work-life balance, job satisfaction; small business; strategies; incentives

ID 64: Examining Employee Attrition Factors in the Indian Construction Industry: Insights from Project Engineers' Perspectives

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Abstract:

Employee attrition presents a significant challenge within the Indian construction industry, impacting productivity, project management, and overall organizational success. This study focuses on uncovering the root causes of attrition, particularly among project engineers. Through an extensive literature review, a multitude of factors influencing employees' daily experiences within organizations were identified. Hypothesizing that key constructs such as Job Satisfaction, Organizational Commitment, and Occupational Stress play pivotal roles in attrition dynamics, a questionnaire comprising 18 variables was developed. Quantitative data were collected from 179 respondents out of a sample of 465 project engineers across various organizations in the Indian construction sector. Structural equation modelling (SEM) was utilized for data analysis, with all 18 variables demonstrating reliability and significance, surpassing the requisite factor loadings in exploratory factor analysis. Three models were constructed: the initial hypothesis model, conceptual model, and final SEM model, with adjustments made to variables as necessary for model fit. The findings highlight job insecurity and workload as prominent drivers of occupational stress among project engineers. Furthermore, the implementation of favourable organizational policies concerning aspects such as the work environment, promotional opportunities, rewards, personal growth, salary, and interpersonal relationships was identified as instrumental in reducing attrition rates by enhancing job satisfaction. Notably, organizational commitment emerged as the least influential factor, indicative of younger project engineers' inclination towards alternative career paths for personal development. From the valuable insights gathered, strategies can be developed to address and reduce employee turnover in construction companies.

Keywords:

Job Satisfaction, Organizational Commitment, Occupational Stress, Employee Attrition, Indian Construction Industry

ID 73: Advancing Gender Inclusion in Construction 4.0: Insights from Prefabrication Practices

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Abstract:

Construction, one of the largest and most project-intensive industries, is characterised by male dominance and significant underrepresentation of women. This gender gap persists amidst shortage of skilled labour and is exacerbated by project-based practices reinforcing traditional gender power relations, hindering women's inclusion in the industry. In the advent of Construction 4.0, this study aims to explore how process-based practices, particularly in prefabricated construction, impact women's inclusion and advancement. Drawing on a feminist institutional perspective and ethnography research conducted at a modular construction off-site factory in Melbourne, this study involves shadowing of 12 male and female prefabrication professionals and factory workers over 21 days, non-participant observation of factory workers at the production line for three weeks, and interviews with five male managers and nine male and female factory workers. It finds that rules around how work is structured including shift and job design, and skill development produce a gendered effect that impacts women's attraction and retention to the construction industry. Traditional rules around gender were also challenged within the context of this worksite including the tolerance for sexism and sexual harassment and the notion of the ideal worker, resulting in women feeling safer in their workplace and valued as employees. For these reasons, women tended to remain in prefabricated construction workplaces due to better workplace support, career advancement opportunities, and good work-life balance. These insights contribute to understanding how the construction industry may change to be inclusive of women and others and highlight the potential of prefabrication in promoting gender equity.

Keywords:

Construction 4.0, feminist institutionalism, gender equity, off-site construction, prefabrication

ID 88: Building Consent Datasets as Predictor for Construction Workforce Forecasts

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Abstract:

Robust workforce demand forecasting is crucial in ensuring sustained growth for the construction industry. Forecasts are typically generated using a univariate time series analysis of historical construction workforce size records; however, this approach is unable to integrate the various factors that influence construction human resource dynamics. This paper aims to investigate the predictive importance of building consent data in forecasting construction workforce demand in New Zealand. Time series data on construction industry employment and building consents issued, spanning the period from 1994 to 2023, were obtained from Statistics New Zealand. The analysis involves investigating relationships between construction workforce size and building consents issued using various predictive analysis methods, specifically, Granger Causality Analysis and Vector Autoregression (VAR). Results suggest that the quarterly monetary value of building consents issued is a significant predictor for construction workforce size. These findings are significant for human resource planning in the construction industry, as well as in the finetuning of a skills development framework for the sector.

Keywords:

Building consents, construction industry, time series analysis, workforce demand forecasting

ID 91: Analysis of Prefabrications Contribution to The Liquidation of New Zealand Construction Industry

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Abstract:

This study analyzes the financial and company risks of liquidated prefabrication versus non-prefabrication firms in New Zealand's residential building sector. By examining 5 successful and 4 liquidated prefabrication firms, alongside 3 liquidated non-prefabrication firms, it explores key success and failure factors. Using document analysis and data from New Zealand Construction Companies, the study found that liquidated prefabrication firms had significantly higher credit claims and lower recovery rates compared to non-prefabrication firms. Factors such as market demand, pricing strategies, and the benefits of technology for successful firms are discussed. Recommendations for prefabrication firms include adopting successful technologies, ensuring sufficient margins, and leveraging high productive capacity.

Keywords:

Building, Construction, Liquidation, Prefabrications, Residential

ID 129: Preventing Occupational Noise-induced Hearing Loss in Construction

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Abstract:

Construction workers are exposed to hazardous noise levels at work. As a result, occupational noise-induced hearing loss (ONIHL) is a common occupational disease in the construction industry, affecting a large number of workers worldwide. ONIHL is currently an irreversible condition with no effective treatment available. In addition, hazardous noise has several non-auditory health effects, such as disrupted sleep, reduced concentration and performance, behavioural changes and depression. The auditory and non-auditory effects collectively exert a significant socioeconomic burden through diminished quality of life for workers and their families, work impairment, workforce attrition, productivity losses, compensation, and medical and welfare costs. Hence, it is paramount to understand the prevalence and severity distribution of ONIHL in the construction industry and associated risk factors to develop pertinent prevention and control strategies. This study statistically analysed workers' compensation data from the Australian construction industry for 11 years, obtained from Safe Work Australia. Two-way contingency chi-square tests were deployed to examine the association of incident severity with worker and work characteristics. The findings of this study would help reduce ONIHL in the construction industry through improvements to occupational health policies and practices.

Keywords:

Occupational hearing loss, noise, construction, Australia

ID 130: Beneficial Impacts of Construction Learnership in Developing economy

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Abstract:

Reducing poverty and minimising unemployment remains high on the government's agenda in developing countries. To address these challenges, the government established and funded several initiatives to alleviate poverty and close the skills shortage gap. The construction learnership programme is an example of such an initiative aimed at addressing the socioeconomic issues of the citizens. Hence, this paper is aimed at assessing the several benefits of construction learnership programmes in South Africa. An extensive literature review was conducted on various learnership programmes globally with a focus on developing countries. A comprehensive review of existing literature was performed to present and evaluate the various learnership schemes in developing countries and their roles in addressing the menace of unemployment, poverty, and skills shortage among others. The results show that learnerships combine both practical and theoretical outcomes of a qualification thereby providing employers with skilled people who can work more independently. Also, the government get to improve domestic expenditure and spur economic growth and global competitiveness. Significantly, the learner's knowledge, skills and employment prospects are improved through their participation in these programmes. Considering the various benefits attributed to the implementation of learnership programmes, it is essential to support the programme so that it meets its objectives. It is recommended that qualified learners must be recruited, registration procedures must be followed, and learners must be prioritised for all stakeholders to maximise the benefits of these programmes.

Keywords:

Unemployment; Poverty alleviation; Learnership programme; South Africa; Sustainable development

ID 141: Skilling the Australian workforce for the net-zero transition

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Abstract:

The Australian infrastructure sector is set to manage a substantial pipeline of public infrastructure projects worth \$230 billion over the next five years, alongside significant energy sector investments and initiatives to construct 1.2 million new homes. In line with Australia's ambitious goals to expand its clean energy sector, there is an anticipated need for a 30% increase in the workforce by 2033 to support this essential energy transition, necessitating the addition of over 200,000 professionals in a rapidly changing environment. Nevertheless, the nation encounters a significant challenge in expanding training capacities for existing roles like engineers but also in pioneering the development of new job categories and skill sets that are currently undefined. Against this backdrop, this research effort conducts an in-depth analysis of labour market training needs against the existing university curricula to identify misalignments and emerging needs in skills training. Synthesising insights from published literature, this research maps out the trajectory of workforce requirements, offering a dual perspective on both immediate and future skill demands. It proposes an initial strategic framework for skilling and reskilling the existing workforce, alongside developing a robust training pipeline for future skill sets. This framework focuses on enhancing curriculum agility, integrating industry-specific competencies, and fostering public-private partnerships to ensure a resilient and adaptive training ecosystem. Through this analysis, this research effort seeks to provide policymakers, educational institutions, and industry stakeholders with actionable strategies to bolster a sustainable and efficient transition within the stipulated timeframe, ensuring Australia's competitive edge in the global energy market.

Keywords:

Curriculum agility, labour market, net-zero, skill demand, sustainable energy transition, workforce development

ID 143: Apprenticeships in construction: Barriers for completion of training

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Abstract:

The construction industry is experiencing severe shortages of trained workers joining the sector. This study explores the various obstacles that apprentices encounter during their apprenticeship programs, that hinder their successful completion. The research data was collected by conducting in-depth interviews with focus groups comprising apprentices and teachers who were involved in Certificate 3 training program in building and construction at a Melbourne-based TAFE provider. The qualitative data was analysed using the content analysis method in NVivo 12. The dropout rate of apprentices in Australia is high, and this has remained steady over a long period of time. The study identified various barriers to the completion of apprenticeships such as schooling issues, employer-related problems, career pathway uncertainties, financial difficulties, lack of accountability, the impact of the pandemic, transportation challenges, insufficient incentives for apprenticeship completion, poor work ethics and unclear responsibilities. This research contributes to understanding of the specific challenges within apprenticeship training programs, thereby informing targeted interventions and improvements to enhance apprentices' completion rates and address workforce challenges in the construction industry. Additionally, the paper offers practical help to those involved in technical training for construction work. The research offers new insight into the interplay between apprentices and their teachers, particularly, highlighting poor practices that create a non-supportive training culture in the construction industry.

Keywords:

Apprenticeship, skills, training, building, construction

ID 154: What Does Decarbonising of Buildings Mean to Construction Cost Planners?

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Abstract:

Increasingly Carbon Accounting or Carbon Cost Management is being promoted as a service by cost planners, complementary to the more traditional cost management on projects. This paper investigates the quantity surveying industries move to such carbon cost services across the project life cycle. Embodied Carbon Measurement, Benchmarking, Carbon Budgets and Risk Allocation for Carbon Pricing impacts are discussed with reference to the leading industry firms and their services marketing to clients. This paper investigates Quantity Surveying(QS) firms moves to Carbon Assessments, training and software via a desktop survey of QS websites and interview with practitioners and content analysis of new carbon cost assessment Professional Standards and Guidance. Using critical content analysis and literature review of key industry publications and new training programs such as the latest RICS Whole Life Carbon Assessment (WLCA) standard, the latest industry-agreed definitions for carbon terminology are compared, as are guidelines on approaches to carbon cost planning and risk provisions for carbon impacts on projects. Results indicate that Embodied Carbon measurement is now well established across the industry, however with some caution in using carbon factor database figures in calculations. The results also indicate peak professional bodies have prioritised developing a robust carbon assessment methodology and appropriate training for the QS industry as it increasingly develops new approaches to assessing cost and risk in terms of carbon assessment reporting.

Keywords:

Carbon Accounting, Carbon Budget, Embodied CO₂-e, Carbon Assessment

ID 158: Is It ‘Really’ Corrosive Behaviour?

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Abstract:

Workplace bullying is one of the widespread problems that face women in leadership roles within the Australian construction industry. This study is one part of a larger research project. The aim of this study was to expand the discourse in scholarly research on the lived experience regarding gender-based incivility and violence directed towards women leaders in both onsite and offsite roles within the Australian construction industry and the influence of phenomena such as emotional intelligence, intellectual humility, and hegemonic masculinity has on the project actors. Twenty women leaders working either onsite or in off-site support roles were interviewed to explore their lived experience in the construction workplace. The interviews were recorded, transcribed and thematically analysed. The incivility experienced by the participants was categorized under three general headings related to harassment: (a) personal abuse and bullying, (b) psychological abuse, and (c) physical threats and assaults. The findings reveal that all the women leaders experienced some form of gendered incivility, with personal harassment being the most common form of abuse. Often, intimidatory behaviours may not involve a direct attack and may be ambiguous in nature, enabling the incident to fall between the cracks and go unreported, which in effect reinforces the perpetrator’s hegemonic and misogynistic behaviours and the opportunity for an intervention to correct behaviour is missed. The authors had hoped for a much larger sample, unfortunately, the participant population was limited due to the lack of availability of women in leadership roles within the Australian construction industry.

Keywords:

Emotional intelligence, gendered incivility, hegemonic masculinity, intellectual humility

ID 192: Addressing the Barriers for Women in Construction Project Leadership: A Self-Determination Theory Perspective

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Abstract:

The construction industry, one of Australia's largest employment sectors, faces significant gender diversity challenges, with women representing only 13.3% of the workforce. This study explores the barriers and drivers that impact women's retention and progression into leadership roles within the construction industry. Using Self-Determination Theory (SDT) as a framework, this research investigates how fulfilling the psychological needs of autonomy, competence, and relatedness influences women's intentions to remain in the industry and their leadership aspirations. The study employs a mixed-methods approach, combining quantitative surveys and semi-structured interviews with industry leaders, to examine the factors affecting gender diversity and propose actionable strategies for change. Key findings indicate that fulfilling the needs for autonomy and competence positively impacts women's intentions to stay and their leadership aspirations, while relatedness showed no significant influence. The research highlights effective strategies for improving gender diversity in leadership roles and emphasizes the importance of supportive workplace policies and male allies in driving industry-wide change. Practical implications include recommendations for construction organizations to adopt targeted diversity and inclusion initiatives that meet women's psychological needs, thereby enhancing motivation, engagement, and leadership development.

Keywords:

Construction leadership, gender diversity, self-Determination theory (SDT)

ID 206: A Conceptual Framework to Manage Intragroup Conflicts in Construction Projects: The Role of Team Climate and Stakeholder Engagement

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Abstract:

Conflicts are inevitable in construction projects due to the participation of various stakeholders with different interests. These conflicts can have negative and positive effects on construction projects and proper conflict management is essential to retain the positive effects while mitigating the negative effects. The selection of proper conflict management procedures can be obstructed by various factors such as the stress and anxiety experienced by team members to reach an agreement, power dissimilarities, task complexities, culture and leadership models used by the leaders. Therefore, proper consideration should be given to developing creative solutions to manage conflicts by enhancing the conflict competency of the team members. This could be achieved by creating the appropriate team climate in construction projects by engaging stakeholders. Thus, this research aims to explore the role of team climate and stakeholder engagement in managing intragroup conflicts in construction projects. To achieve this aim, a comprehensive literature review was conducted. The findings revealed that in order to create a team climate to manage conflicts, components such as attitudes, trust, psychological safety, behavioural integration and emotional intelligence of the team members should be improved. The stakeholder engagement process can be incorporated to improve the components that create the team climate and by integrating the stakeholder engagement process, effective communication and information sharing, increased involvement and commitment of stakeholders, and conflict management can be achieved. Finally, a conceptual framework was developed based on the findings that can be used by the project stakeholders to manage conflicts in construction projects.

Keywords:

Construction projects; Intragroup conflicts; Intragroup conflict management; Team climate; Stakeholder engagement

ID 230: Barriers to Achieving Positive Mental Health Among Professionals in the Construction Industry

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Abstract:

The mental health of professionals has a great impact on their productivity. This has been observed to be a challenge more pronounced post covid 19. The literature review identified barriers and classified them into Economic factors, political factors, physical and political factors. This study investigates barriers impeding achieving mental health of professionals. A quantitative approach was adopted, and questionnaires were distributed to construction industry professionals in South Africa. The most significant barrier identified is related to cost and finance. Also, many professionals are not aware of mental health services. The study highlights the multifaceted barriers to mental health in the construction industry. It also underscores the need for targeted strategies to improve support and accessibility for professionals in this field.

Keywords:

Mental health, efficiency, welfare, employee productivity, AEC, SDG 3

ID 244: Competitiveness of South African Construction Firms in the Business Environment of Other African Countries

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Abstract:

This paper presents the findings of evaluating the factors influencing the competitive abilities of South African construction organizations in other African countries. This was conducted to unravel a roadmap to aid the penetration of contractors domiciled in South Africa into other African countries' construction markets. Using a post-positivism philosophical approach, the study employed a quantitative method for data collection from construction professionals, forming the target respondents. Collected data were analysed using mean item score, Kruskal-Wallis h-test, and Student Newman Kaul post hoc test. The analysis showed that the most significant factors influencing the participation of South African construction organizations in other African countries are clients' procurement strategy, government policies, and contractor management strategy. Based on the study's findings, recommendations were proffered to boost the competitive capacity of South African construction organizations in the construction market of other African countries.

Keywords:

African countries, Construction, Contractors, Competitiveness, South Africa

ID 245: Review of Decision-Making Models for Prioritizing and Analysing Risk Factors in Construction Projects

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Abstract:

The construction industry, a crucial driver of economic growth, encounters various challenges that frequently obstruct the efficient advancement of construction projects. These impediments often stem from critical risk factors (CRFs) that adversely affect project outcomes, especially in terms of cost, time, and quality. Extensive research has been undertaken to identify, prioritize, and analyze the relationships among these CRFs to enhance project success. This article presents a comprehensive review of decision-making models used in prioritizing construction project risk factors and evaluating their interrelations. The mathematical models explored in the literature are categorized into six groups: Pairwise Comparison Methods, Outranking Methods, Distance-based Methods, Interaction-based Methods, Utility-based Methods, and Other Methods. In addition to exploring commonly used models for prioritizing and analyzing the relationships among factors, the study also examines the critical aspect of the consistency index, which is used to evaluate the reliability and coherence of survey data. All commonly used models were extracted and compared, resulting in the identification of nine standardized steps for risk analysis and prioritization in projects.

Keywords:

Multi-attribute decision-making, Consistency Rate, Critical Risk Factor, Analytic Hierarchy Process, Topsiss

ID 261: Emotional Intelligence as a Predictor of Job Satisfaction Level in the Construction Industry

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Abstract:

This article examines the role of Emotional Intelligence (EI) as a predictor of job satisfaction (JS) within the construction industry, with Nigeria as a focal point. Utilizing a methodology that combines mean comparison and correlation analysis, the research explores how EI influences JS across diverse demographic and professional categories of quantity surveyors (QS). The construction industry, known for its dynamic and often challenging work environment, provides a unique context to investigate how EI contributes to professional perceived JS. The findings reveal a significant positive correlation between EI and JS. Gender-based analysis shows that male QS typically report higher EI and JS levels compared to their female counterparts, although the impact of EI on JS is more substantial among women. The study further explores the relationship between trait EI and specific JS categories, identifying a general positive association with overall JS, but not with supervisor-related satisfaction. The participants were categorized into four EI classes, consistently showing that higher EI levels correspond to greater JS. These findings align with existing literature, underscoring EI's pivotal role in enhancing JS in the construction sector. The study concludes that fostering EI among construction industry professionals can lead to improved JS and performance. Consequently, organizations are encouraged to integrate EI development into their professional growth programs to cultivate a more satisfied and effective workforce.

Keywords:

Construction, Emotional, Intelligence, Job, Satisfaction

ID 283: Enhancing Gender Equity in Construction Education through Online Real-Time Learning and Teaching

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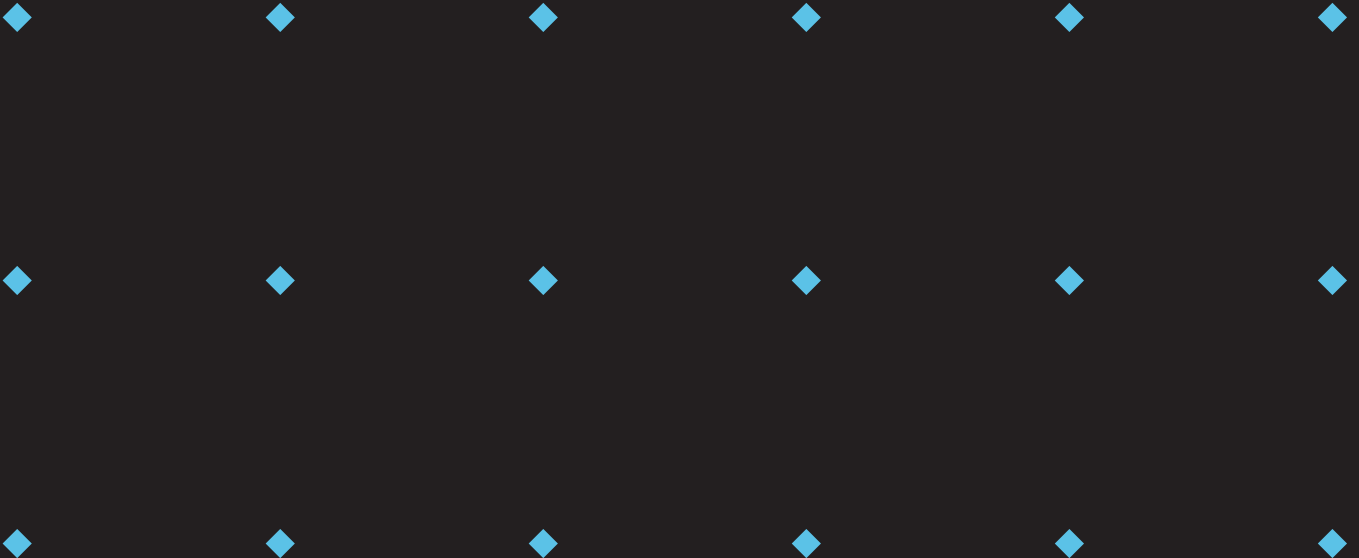
Abstract:

The construction industry remains male-dominated, with women comprising only 15% of the workforce, highlighting the importance of examining educational pathways that promote gender equity. The Online Real-Time Block Model (ORT-BM), offering enhanced flexibility and accessibility, has the potential to improve gender balance in construction education by addressing specific barriers that female students face. Previous research has highlighted ORT's role in creating inclusive learning environments, yet little is known about its effectiveness in combination with the Block Model (BM)'s intensive, single-unit focus on advancing gender equity. Through a comparative of enrolment data from the Bachelor of Building Surveying (NBBS) program at Victoria University across two phases: the In-Person Block Model (IP-BM) from 2019-2020 and the ORT-BM from 2020 onward, this study investigates the impact of these delivery models on female participation. The results confirm that ORT increases female student participation by eliminating obstacles, such as geographic limitations and rigid schedules, considering their family commitments. The intensive BM approach could help them focus on one subject, enabling a deeper understanding without distractions from multiple units. The innovative integration of ORT into BM can further encourage women to pursue their career in this male-dominated field and ultimately contribute to gender equity and a diverse workforce in the construction sector.

Keywords:

Block Model, Building Surveying, Gender Equity, Learning Experience, Online Real Time (ORT)

CIB Doctoral School



ID 19: Integrating Building Information Modelling (BIM) Into Construction Project Management Education in Australia

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Abstract

Building Information Modelling (BIM) is currently reshaping the construction industry but faces challenges in hiring competent professionals with skills and technical knowledge of BIM for 'constructability Review', 'Cost Management', 'Value Engineering', and '4D/5D simulation' that are in high demand. Likewise, academia is also equally faced with unique challenges in introducing such knowledge into the existing curriculum of construction education and project management studies. This research study provides a fresh perspective on global BIM education, aiming to understand the existing examples of BIM education for construction project management within academic institutions worldwide. It examines their characteristics, the challenges encountered during implementation, and any discernible trends that may guide the broader doctoral research effort. The primary objective is to investigate the integration of BIM technology into the Construction Project Management (CPM) curricula in the Higher Education (HE) System of Australia. The goal is to develop an academic framework that aligns BIM education with the current industry needs, thereby preparing future project management professionals with the necessary BIM competencies. These competencies are vital for improving project outcomes, leveraging BIM's transformative potential for planning, execution, and enhancing collaborative project delivery mechanisms. This academic research work aims to make a significant contribution to preparing industry-ready professionals. By adopting deeper integration of BIM skills in educational settings, this project seeks to enable these professionals to leverage BIM technologies for enhanced efficiency, sustainability, and innovation in construction projects. A mixed method approach with a combination of systematic literature review, curriculum analysis with a pilot study, and engagement with industry and academic experts through interviews, surveys, and discussions, will help to identify the core competencies required, for the effective implementation of BIM into construction projects.

Key Words:

BIM education; BIM-based curriculum; building engineering studies; construction project management; higher education framework; systematic literature review

ID 234: Evaluating and Maximising the Park Cooling Capacity During Extreme Heat Events: The Role of Urban Form, and Climate Zone

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Abstract:

Rapid urbanization, coupled with the escalating impacts of global warming and the intensification of urban heat islands, presents significant challenges for cities. As key elements of green infrastructure, urban parks play a critical role in mitigating urban heat. This research aims to investigate how different urban forms and climate zones influence the cooling performance of urban parks. Additionally, this study will investigate the interaction of different park sizes with their surrounding urban form. While previous studies have examined various factors affecting park cooling, the specific impact of surrounding urban form and climate zone on park cooling impact, particularly during extreme heat events has been less investigated. ENVI-met simulations will be conducted to evaluate the cooling performance of urban parks and identify their connection with the surrounding urban form and the climate zone. Field measurements will be also carried out to verify the simulated outputs. This research's outcomes will also be used as blueprints for landscape designers and built environment professionals to design urban parks with optimized cooling performance across diverse background climatic conditions, and urban forms.

Keywords:

Cooling impact, urban green infrastructure, urban parks, urban heat island, heat mitigation

ID 238: Gig Workforce Management: An Employee Share Ownership Approach

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Abstract:

South African construction industry plays a significant role in South Africa's gross domestic product (GDP) and accounts for both formal and informal employment. Adopting technology in the industry will further aggravate the provision of formal and informal jobs in the construction industry by introducing a digital platform enabling people to work from anywhere and enabling companies to virtually balance between the archaic full-time and gig workforce models. The study aims to manage the gig workforce by employing the employee share ownership approach to attract, retain, and motivate the gig workforce. The methodology adopted for this study is a review approach based on secondary data sources such as articles and journals. The study reveals that the gig workforce is confronted with issues such as the lack of benefits and pay, challenges with working conditions, and issues related to the digital divide. To address these gig workforce issues, the study reveals that the concept of "Ownership as a form of empowerment" (i.e., employee share ownership approach) be adopted to align the interests of gig workers with their employers. Furthermore, the study recommends adopting this approach as a secondary measure after necessary primary measures, such as regulatory measures, have been taken. Also, since this approach is commonly suitable for public limited companies, the government should stimulate the economy so as to enable much smaller companies to earn more and become listed as public limited companies to enable them to adopt this approach to gig workforce management in the construction industry.

Keywords:

Construction industry, technology, GIG workforce, employee share ownership, workforce management

ID 256: Enhancing Construction Safety Through the Integration of Lean Construction And BIM

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Abstract

Although Building Information Modelling (BIM) and Lean Construction (LC) have each independently proven effective in improving project safety performance, it is hypothesized that their integrated application offers greater potential for improving safety. However, current literature regards BIM primarily as a technological Lean enabler by focusing one direction of LC-BIM integration, overlooking the full potential of BIM to enhance safety performance. Therefore, a Lean-supported holistic BIM methodology for safety is needed by considering other direction of this integration. Considering these, this research aims to comprehensively explore the potential of BIM as a holistic methodology in combination with LC principles to improve safety performance in construction projects. Initially, this study conducts a survey to qualitatively capture the extent of BIM implementation in the industry, including the challenges and opportunities. Then, case studies including interviews are conducted to explore what is required to effectively move BIM from being used solely as a technology toward being used as a methodology. Through these case studies, a holistic BIM framework supported by LC is developed. Finally, the effectiveness of this framework in improving project performance is validated through structured interviews. Overall, the results of this study offer two main contributions to researchers and construction practitioners. First, this study provides clear evidence of the mutual synergy between LC and BIM by emphasizing that the LC-BIM synergy is not one-sided, demonstrating that LC goals enhance BIM. Secondly, the study highlights the true potential of BIM to enhance construction safety, moving beyond its use merely as a technological tool.

Keywords:

BIM, lean construction , construction safety

ID 260: Improving Project Management Performance by Implementing Systems Thinking and System Dynamics Modelling in Managing Risk and Stakeholders in the Australian Construction Industry

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Abstract

The complex nature of construction projects requires the appropriate analysis of multiple stakeholders, the risks due to unforeseen changes resulting from their expectations, and the variety of risk and stakeholder management methods used to achieve project objectives. In recent years, Systems Thinking (ST) and System Dynamics (SD) have been widely applied to effectively solve complex and dynamic problems, including managing risks and stakeholders. However, its use in construction risk and stakeholder management has yet to be optimized. An integrated system must be used to utilize SD models in project risk management to address the inherent complexities and optimize project outcomes. This research aims to explore the integration of System Dynamics (SD) modeling with risk and stakeholder management in construction project management. Utilizing a mixed-methods approach, it combines a systematic literature review, focus group, survey, interview, and SD model simulation. It then examines the model's effectiveness in enhancing project performance and, ultimately, project success by integrating SD models with the Project Delivery Success (PDS) model and complexity models. The study aims to propose a novel SD model designed to improve decision-making, forecast project system behavior, and enhance stakeholder engagement, contributing to both academic knowledge and practical project management strategies to improve project outcomes in the construction industry.

Keywords

System dynamics, system thinking, project delivery success

ID 278: Framework of End-user-Integrated Design Process for Improving the Performance of Buildings

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Abstract

Studies highlight the failure of buildings to meet occupants' needs, causing performance gaps and sick building syndromes. Poor integration of end-user inputs for design is a key reason. Post-occupancy evaluations (POEs) are used for understanding occupants' perspectives from similar buildings. This is a laggard, retrospective approach. The design of proposed buildings should be evaluated proactively by end-users. A lack of robust frameworks with comprehensive performance assessment criteria hinders it. This study aims to propose a framework to catalyse user-centred design and pre-occupancy evaluation (ProE) of building performance of buildings. A systematic literature review of 43 relevant journal articles and a synthesis of the knowledge contained in them was undertaken to achieve the aim. Forty-one design performance attributes under 12 design performance constructs are established to support the ProE of building performance at the design stage from end-user perspectives. The performance aspects include aesthetics, spatial configuration, accessibility, building services, IAQ, privacy, biophilia and views, lighting, sustainability, ergonomics, thermal, and safety and security. Then a framework is developed for user-centred design and ProE of buildings. The findings can enhance the building design process in three ways: (1) strengthening end-user requirement acquisition, (2) fostering occupant-centred building design, and (3) facilitating ProE building designs by end-users.

Keywords:

Building performance, end-users, design evaluation, pre-occupancy evaluation, performance indicators, systematic literature review

ID 279: The role of demonstration projects in facilitating the transition towards sustainable construction

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Abstract

The impacts of the construction industry on the natural environment necessitate the transition to sustainability and a Circular Economy (CE). To accelerate this shift, demonstration projects are considered as valuable tools for facilitating upscaling and replication. However, while demonstration projects are seen to be important, there is limited evidence of how demonstration projects influence the wider industry and share knowledge and lessons learned. Therefore, this thesis explores the role of demonstration projects in knowledge transfer to the wider industry for facilitating the sustainability transition in the built environment. A narrative review was conducted to identify the CE demonstration projects in the building sector, the knowledge sharing processes, and the upscaling frameworks from the wider literature. The next steps will be to conduct semi-structured interviews (n=30) with industry stakeholders in Australia and Europe to identify potential impacts of demonstration projects, upscaling factors, challenges and drivers of upscaling in the context of CE. Following this, a Social Network Analysis (SNA) will be conducted to map the key stakeholders involved in dissemination of knowledge from demonstration projects to the broader industry to assess knowledge transfer processes. Based on the results from the interviews and the SNA, an initial knowledge sharing framework will be proposed and validated through a focus group with industry experts. Thus, this study will provide insights on the role of demonstration projects in influencing the wider construction sector and collecting and using knowledge and lessons learned from demonstration projects for facilitating the transition to a CE in the sector

Keywords:

Circular economy, social network analysis, sustainable construction, construction projects

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