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SEEDS 2024

INTERNATIONAL SUSTAINABLE ECOLOGICAL ENGINEERING DESIGN FOR SOCIETY

ABSTRACTS

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SEEDS 2024 Keynote Speakers

Dr Suresh Renukappa, University of Wolverhampton

Professor Hafiz Alaka, University of Hertfordshire

Dr Dalia Al-Tarazi, Zarqa University, Jordan

Dr Helen Bailey, Centre for Mineral Products, University of Derby & Visiting Professor in Sustainable Construction Materials & Engineering at University of Suffolk.

Madeleine Mendes, Chief of Brand and Communication Strategy at ORO

Professor Ornella Iuorio, Politecnico di Milano, Department of Architecture, Built Environment and Construction Engineering

Associate Professor Faatihah Niyi-Odumosu, University of the West of England, Bristol

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Keynote Speaker Biographies

Dr Suresh Renukappa is a Reader in Sustainable Value Creation at the University of Wolverhampton, where he leads Future Smart Cities and Mobility Lab. This research lab hosts over 10 academics whose expertise connects technology, engineering, and social sciences disciplines. With over 24 years of experience in conducting multidisciplinary research that bridges sustainable transformation, digital technologies, and innovation management, Dr Renukappa constantly introduces new theoretical and practical advancements in the field of sustainable value creation. His efforts have contributed to generating over £10 million through research and consultancy projects.

Dr Renukappa has worked with and advised many public and private sector organisations on number of social, economic and environmental sustainability issues. To-date, he has successfully executed more than 40 research projects and authored over 250 papers, in journals, book chapters, and conference proceedings. He has won several awards for his best consultancy, research, and publications. He has successfully supervised 20 PhD research projects to completion. His work has been cited in more than 2170 publications around the world resulting in a h-index of 22 and i10-index of 45 on Google Scholar profile. His work has provided significant policy impact along with outstanding scientific contribution.

His scholarly work has been widely published in prestigious journals, including Energy Policy, Energy Strategy Reviews, Renewable Energy - An International Journal, Construction Innovation, Engineering, Construction and Architectural Management, Smart and Sustainable Built Environment, International Journal of Disaster Risk Reduction, and Journal of Knowledge Management. He was part of the Research Excellence Framework (REF) 2014 and REF 2021 in the outputs, environment, and impact case study. In addition to his research and teaching work, Dr Renukappa is an active member of the editorial boards for the Engineering Sustainability Journal and Smart and Sustainable Built Environment Journal and Sustainability Journal.

Suresh's keynote talk is titled: *Business Resilience During a Global Pandemic: Exploratory Case Studies*

Professor Hafiz Alaka is the current Associate Dean Research. He is a Professor and the founding Director of the Big Data Technologies and Innovation (BDTI) laboratory. The lab currently hosts over 15 members of staff He also leads the 'Prediction of Climate and its Impacts (PCI)' group in the Centre for Climate Change Research (C3R).

Hafiz favours cross-disciplinary collaborative research for solving real-life challenges. His focus area is application of contemporary technologies (big data, artificial intelligence/machine learning, etc.) to construction, infrastructure, business/finance, and agriculture, among others. Hafiz has secured, led and participated in over £10million worth of funded research projects. He has worked with multiple clients/partners on multiple projects including Balfour, Galliford Try, Global Methods of Construction, Reusefully Ltd, Finishes and Interior Sector, Earthsense, among many others.

Hafiz is an assessor for EPSRC, ESRC, Innovate UK, Small Business Research Initiative, UK, and The National Centre of Science and Technology Evaluation, Kazakhstan. He is an editorial board member international journals and part of the International Scientific Committee for three international conferences. He has examined four PhD, completed four PhD supervisions, and is currently supervising over six PhDs as DoS. He has produced over 70 peer-reviewed articles, and currently has over 5400 citations with H-index=30 and i10-index=52 on Google Scholar.

Hafiz's keynote talk is titled: *Big Data Analytics in Construction*

Dr Dalia Al-Tarazi is an Assistant Professor in Architecture at Zarqa University, Jordan. She worked as an Associate Lecturer in Architecture at the University of the West of England, UK, where she obtained her PhD in Architecture with a particular focus on well-being in the built environment. Dalia's background is in Architectural Engineering, and is a member of Jordan Engineers Association. She has professional experience as an architect and designer for a variety of projects in Jordan. She is interested in Architectural Psychology, Health and Well-being, Sustainable Architecture, and Technology and Design.

Dalia's keynote talk is titled: *From Bricks to Bliss: Exploring Built Environment Influences on Well-being.*

Dr Helen Bailey has worked in the mineral products industry for over 17 years in various roles, the first of which was at materials supplier Aggregate Industries where she completed several research and development projects and her PhD. She later worked in the field of asphalt recycling and tar remediation before joining the Transport Research Laboratory (TRL) contributing to an international team undertaking work across Europe, the Middle East and Africa. Since leaving TRL in 2015, Helen set up her own consultancy, The Driven Company Associates Limited, where current work focusses on supporting the supply chain and clients with strategic development, the transition to the circular economy and climate resilience.

Having gained a post graduate diploma in higher education, Helen also leads the asphalt and pavement programmes within the Centre for Mineral Products at the University of Derby. She is a Visiting Professor at both the University of Northumbria and the Sustainability Institute, University of Suffolk.

A Chartered Engineer and an active member of a number of industry bodies, Helen is a non-executive director at the Institute of Asphalt Technology (IAT), Institute of Quarrying (IQ) and National Stone Centre (NSC), Fellow of the Chartered Institute of Highways and Transportation (CIHT) and Higher Education Academy, and Member of the Association of Asphalt Paving Technologists (AAPT), USA.

Helen's keynote talk is titled: *System awareness, from rocks to roads.*

Madeleine Mendes is Chief of Brand and Communication Strategy Officer at ORO (https://www.oroexchange.com.br/), a German-Brazilian Financial Technology organisation. Madeleine received a first-class honours for her BSc in Psychology at Cardiff University. She also spent time studying at The University of Hong Kong (HKU), and then worked as a Research Assistant at The University of California, San Diego (UCSD). Madeleine has made significant research contributions, notably on the development of a national Endometriosis awareness intervention with NHS Wales. Since then, Madeleine has shifted her career direction and has worked in the global fast moving consumer goods (FMCG) industry and financial sector, focusing on fintech, tech, and impact subsectors – prior to joining ORO. Since then she has immersed herself in Brazil's Amazonas community of Maués, where she has played a key role in launching ORO's reverse logistics system (alongside founder Astrid Emmerich) to provide a solution for plastic waste.

Madeline's keynote talk is titled: *Turning Plastic into Gold: Fintech ORO's Revolutionary Approach to Reverse Logistics and Converting Consumers into Rewarded Recyclers.*

Professor Ornella Iuorio is Associate Professor of Architectural Engineering at the Politecnico di Milano (IT), and Visiting Professor at the University of Leeds (UK). Formerly, she was Full Professor and Chair of Architecture and Structures at the University of Leeds, where she also acted as Director of the "Cities, Infrastructures and Energy Research group" that included about 60 members across architecture, building physics, project management and circular economy".

Iuorio passion is in development of sustainable and resilient building systems. She is international expert in the field of lightweight systems, prefab, circular economy, and digital constructions. She has been recognized as one the "Top 50 Women in Engineering: Invertors & Innovators" by the Guardian in 2022 for the development of innovative lightweight and resilient steel construction systems with high structural performance and low embodied carbon, that are finding large application in mass-manufacturing and in seismic areas. With a portfolio of research projects over £6M funded by Innovate UK, EPSRC, ESRC, and British Academy, she is contributing to the transformation of the construction sector, developing prefabrication, optimization and digital fabrication to deliver more sustainable new constructions and retrofitting the built environment. Before joining Leeds, Prof Iuorio developed her carrier at Massachusetts Institute of Technology (MIT) and University of Naples Federico II (IT). Her research is published in more 100 journal and conference papers.

Ornella's keynote talk is titled: *The balancing act of Modern Methods of Construction between Innovation and Climate Emergency.*

Dr Faatihah Niyi-Odumosu is a medical doctor and an Associate Professor of physical activity and health. She is the Founder and Lead of ALIBSA (Ageing Lifestyle in Blacks and Asians), a platform with over 100 members that aims to improve health equity through health literacy. Faatihah is also a commonwealth scholar and mentor, as well as the secretary of the low-middle-income countries (LMIC) research council for the International Society for Physical Activity and Health (ISPAH). Additionally, she holds associate editor roles with the Journal of Physical Activity and Health and Cities and Health.

Her research interests and expertise lie in multidisciplinary approaches to co-creating physical activity and health improvement interventions for individuals with chronic conditions such as chronic kidney disease and type-2 diabetes, older adults (55+), and ethnic minorities (Blacks and Asians). With a background in clinical exercise physiology, her research aims to develop tailored interventions for individuals with different long-term conditions.

Faatihah's keynote talk is titled: *Integrative Approaches towards Health Promotion and Community Resilience.*

Keynote Speaker Abstracts 2024

Business Resilience During a Global Pandemic: Exploratory Case Studies

Suresh Renukappa[1]

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Keywords: Business Model Innovation, Infrastructure sector, Pandemic, Resilient business, Smart cities, and Small businesses.

Abstract

Global challenges such as pandemic, financial crisis, climate change, social and economic inequalities, among others, force organisations to find innovative ways to operate. Evidence from literature shows that an increasing number of organisations see the challenges above as opportunities to innovate their business model. The purpose of this keynote is to share the resilient business innovation from three case studies including smart cities, infrastructure sector and small enterprises during the pandemic. Smart cities represent a substantial opportunity for city leaders and decision-makers to effectively manage the unprecedented challenges that the global pandemic has presented, with the lessons learnt helping to prepare for any future outbreaks. The first case study is based on transition theory. It explores the three stages of transition, "before", "during", and "after" as a continuous loop as people move into the transition, through the transition, and out of the transition. The second case study explores infrastructure sector resilient during the global pandemic time. What resilient measures were implemented, and challenges faced in terms of productivity and efficiency were also explored. The third case study explores the understanding of driving forces for Business Model Innovation (BMI) during the pandemic for small businesses in developing countries, comparing them with identified BMI drivers before the outbreak and evaluating how they responded to the crisis. This case study organisations that adopt innovative business models participated from technology, education, and social enterprises. The keynote finally concludes with implications for research, government, and businesses.

Big Data Analytics in Construction

Hafiz Alaka[1]

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Abstract

The capacity to handle vast quantities of data and derive valuable insights from it has transformed society. This development, known as Big Data, impacts numerous sectors, including construction. The construction industry, which already manages extensive and varied data, is anticipated to see a dramatic increase in data volume with the widespread adoption of technologies like sensor networks and the Internet of Things. This talk explores how Big Data techniques are being applied within the construction industry.

From Bricks to Bliss: Exploring Built Environment Influences on Well-being

Dalia Al-Tarazi[1]

[1] Department of Architectural Engineering, Zarqa University, Zarqa, Jordan.

Keywords: Psychological Well-being, Environmental Psychology, Design for Health, Personalisation, Physical Structure, Technology and Design.

Abstract

Psychological well-being is a key contributor to overall health, as identified by the World Health Organisation, and has become one of the most important global health concerns. This talk explores the relationship between architectural design and occupants' psychological well-being from a perspective of environmental psychology. The talk outlines research insights into the relationships between space, design, and architecture on the one hand and human behaviour, emotions, and health on the other. In particular, it provides an overview of how psychological well-being can be conceptualised in the context of architecture. It further explores the relationship between the constructs of psychological well-being and satisfaction with design. The critical role of aspects such as the physical structure of buildings and the personalisation of space on user satisfaction will be discussed. An additional case will highlight the potential role of implementing digital tools in enhancing the understanding of design requirements for vulnerable building users, and subsequently, promoting their psychological well-being. Through the presentation, the importance of leveraging design to address psychological needs as well as promote well-being will be outlined.

System awareness, from rocks to roads.

Helen Bailey[1]

[1] Centre for Mineral Products, University of Derby/Visiting Professor Suffolk Sustainability Institute, University of Suffolk.

Keywords: Highways, Sustainable, Systems

Abstract

With a £27.4 billion budget for investment in England's strategic road network between 2020 and 2025, National Highway plans alone offer a wealth of opportunity across the road construction sector. A further 158,000 miles of road in England is managed by local authorities (equating to just under 84% of England's total road length and £1.67 billion of spend), representing additional opportunity at local level. To support this delivery and in line with the sector's net-zero aims, there will be a need for increased use of secondary materials and greater utilisation of technology and manufacturing which will impact the value chains approach and interaction with materials. This paper will shine a light on how companies operating in the sector may need to adapt and take an interconnected systems based approach if they are to play their part in ensuring sustainable and equitable growth is delivered.

Turning Plastic into Gold: Fintech ORO's Revolutionary Approach to Reverse Logistics and Converting Consumers into Rewarded Recyclers.

Madeleine Mendes[1]

[1] ORO, i2020 Pagamentos Digitais SA, São Paulo, Brazil. College of Arts, Technology and Environment, University of the West of England, Bristol, BS16 1QY

Keywords: Reverse Logistics, Circular Economy, Waste, Plastic, Community, App, Payment

Abstract

Discarded waste plastics are an environmental exasperation that are not only spoiling the aesthetics of the world's natural environments but are polluting and devastating their long-term futures, particularly across many developing nations. One third of Brazil's municipalities and remote regions lack sustainable practical solutions to resolve this eco-nuisance. That said, Fintech ORO (www.oroexchange.com.br) has developed an innovative approach to address this problem; whereby, they incentivise consumers to collect and return used plastics (e.g. bottles, coffee capsules and fast-food packaging) by means of a proprietary financial technology that uses geo-positioning for tracking, collecting and paying participants through a digital wallet system.

The stepwise process involves: (i) first, a consumer registers online using the ORO Pay app; (ii) next they access an ORO bag from a local retailer or from a nearby ORO ambassador site; (iii) since each ORO collection bag (Bolsa ORO) has a unique QR code, the bag is scanned using the ORO Pay app to 'check-in' the empty bag; (iv) the consumer now collects and stores their plastic waste in the bag until it is full (up to one kilogram); (v) the consumer re-scans the QR code to 'check-out' the full bag and send collection coordinates to arrange for its pick-up by a caroneiro (i.e. a handler); (vi) during collection, the caroneiro checks that the content of the bag accords with expectations and, once approved, the caroneiro uses the same QR code to 'check-in' the bag on their app and confirm they have received the full bag. This now triggers a payment to the consumer; (vii) the caroneiro then transfers the bag along their intended travel route, for which they had idle capacity, before 'checking-out' the bag at their destination; (viii) this process is repeated by other caroneiros until the bag finally reaches a repurposing or recycling facility/factory (or circular economy destination). At each handover point the bags are quality control checked through a transparent back panel; (ix) once received by the facility/factory, each of the caroneiros receives a distance-related payment to reward them for their efforts.

Knowing that each bag represents a standardised weight and knowing what type of plastics are contained therein, who collected it and who recycles it, lets the consumer essentially "sell" their plastic waste directly to a repurposing/recycling centre. Using this reverse logistic technology optimizes existing transport routes. It connects handlers/riders/drivers with any type of vehicle (e.g. bicycle, scooter, motorcycle, car, or other) with idle capacity to "give the ORO collection bags a ride" for all or part of the way to the repurposing/recycling centre. The fundamental advantage of this system is that it turns post-consumption domestically-used plastic into a tradable valuable commodity. This encourages plastic to be collected at the consumer level, as it can now be sold to repurposing or recycling centres directly by the consumer from the convenience of their home and, thus, increase the overall percentage of post-used plastic recycled and, moreover, contribute to a circular economy. It is important to note; this innovation has already attracted support from large manufacturing organisations (existing clients include: Innova and Nestlé's Dolce Gusto).

The balancing act of Modern Methods of Construction between Innovation and Climate Emergency

Ornella Iuorio[1]

[1]Department of Architecture, Built Environment and Construction Engineering, Politecnico di Milano, Italy, ornella.iuorio@polimi.it

Abstract

Modern Methods of Construction (MMC) generally refers to various forms of prefabrication conducted within a factory setting. While prefabrication is not a novel practice, MMC has recently gained prominence as a critical approach to address pressing global issues, including the housing shortage, environmental sustainability, and resilience. This lecture will discuss the latest innovations embedded in prefab systems to low carbon systems, advance circularity in the built environment and retrofit the existing building stock. It will reflect upon recent experiences in optimizing systems for mass manufacturing, while reducing carbon footprint. It opens up to the challenges of deconstruction and reuse, discussing the opportunity to reuse lightweight façade systems to shed light on the carbon benefits of closing the loop. The discussion will conclude by exploring how the integration of cutting-edge automated construction techniques, grounded in robotic manufacturing and assembly, from the earliest stages of building system design, has the potential to unlock new formal and technical paradigms. These paradigms, deeply connected to traditional scientific principles, remain largely unexplored

Integrative Approaches towards Health Promotion and Community Resilience

Faatihah Niyi-Odumosu[1], Gisele Abissegue[2], Abolanle Adesope[1], Oluwatobi Fatola[1], Alosh K Jose[3]

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[3] Cricketqube, Newcastle, United Kingdom.

Keywords: Integrative approaches, Community resilience, Health promotion, Holistic frameworks

Abstract

In the face of increasing health disparities and environmental challenges, integrative approaches to health promotion and community resilience have emerged as essential strategies for fostering sustainable health and well-being. This abstract presents the confluence of diverse methodologies, including public health initiatives, ecological interventions, and socio-cultural practices, that collectively enhance health, social cohesion, and the resilience of the Black and Asian communities. By leveraging holistic frameworks that encompass physical, mental, and social health dimensions, these approaches aim to create adaptive and robust systems capable of withstanding and thriving amidst adversities. Key components include community-driven health education through our monthly Ageing Lifestyle in Blacks and Asians (ALIBSA) knowledge-exchange webinar and integration of traditional and modern sporting activity (cricket sports), environmental consideration, and policy advocacy. Case studies such as the Family Backyard Cricket (Family BYC aimed at promoting intergenerational physical activity and social connections) as well as the ALIBSA webinar and annual congress (a community-driven platform aimed at reducing health inequality through tailored health literacy for the underserved Blacks and Asian older adults) illustrate successful implementations of integrative strategies, highlighting the role of cross-sector collaborations and the active participation of community members in shaping resilient futures. The findings underscore the importance of a multifaceted perspective in addressing complex health challenges, advocating for a paradigm shift towards inclusive and synergistic health promotion efforts. This integrative model not only enhances immediate health outcomes but also builds long-term community resilience, ensuring a holistic approach to future health and sustainability.

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Adapting to Environmental Challenges: Resilience through Innovation and Collaboration

#515 - Standard Forms of Contracts and the intricacies of Force Majeure in Demystifying Unexpected Events in Construction Projects.

Tracey Lancaster[1], Temitope Omotayo[1], Ping Yung[1]

[1] School of the Built Environment and Engineering, Leeds Beckett University, Leeds, LS2 8AG, United Kingdom

Keywords: Building Contracts, Construction, Force Majeure. Unexpected Events, UK.

Abstract

This study examined the effectiveness of standard forms of contracts in managing the consequences of unexpected events in construction projects from the UK perspective. In this study, unexpected events are restricted to those that affect the whole UK construction industry, such as COVID-19 or the war in Ukraine, which have affected supply chains. No obvious clauses and provisions exist in the standard forms of construction contracts such as JCT and to date, there has been no construction-related decision from the courts. Current contractual provisions were examined to assess if they are straightforward to implement when relief from the impact of unexpected events is required. This investigation concluded that the NEC 4 provisions appear straightforward to implement and likely to apply to various unexpected events. However, the JCT 2016 force majeure provisions have led to widespread confusion. Although the current opinion is that COVID-19 is likely to fall under force majeure due to the widespread impact this event had, for other events such as war in Ukraine or supply chain difficulties, the situation remains unclear.

#569 - Agricultural Irrigation Water and Wastewater Management Strategies for Reduction of Environmental Hazards and Risks on Agricultural Lands In the Caribbean: A Case Study in the Caroni River Basin, Trinidad & Tobago, West Indies

Michelle Shah[1], Professor Dr. Kiran Tota-Maharaj[2,3], Professor Dr. Hazi Azamathulla[4], Dr. Seevali Surendran[5]

[1] Ph.D. Student, Department of Water Resources Management and Infrastructure, Royal Agricultural University, Cirencester, GL7 6JS, England, United Kingdom
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[4] Professor of Civil & Environmental Engineering, The University of the West Indies, St. Augustine Campus, Trinidad and Tobago, West Indies.
[5] Doctor of Engineering, Department of Civil Engineering, Environment Agency, Kings Meadow House, Kings Meadow Road, Reading, RG1 8DQ, United Kingdom

Keywords: Wastewater, Reclamation, Geotextile, Irrigation.

Abstract

Water and wastewater management, a topic of immense significance, encompasses various initiatives such as reuse, recycling, and discharge, all aimed at promoting responsible water utilisation, treatment, and disposal, with a focus on watershed preservation. This research study aims to explore the approaches suitable for assessing performance of permeable geotextile materials to improve water supply and wastewater quality for agricultural irrigation, to assess and quantify the performance of permeable geotextile membranes installed in water storage tanks for reducing wastewater pollution loads and effectively mitigate potential environmental hazards and risks on agricultural lands in the Caribbean. The study uses a permeable geotextile membrane in a WWR-prototype placed in a storage tank, a state-of-the-art compact combination of water treatment technologies based on filtration through a gravel profile, which will be employed to reclaim water for agricultural irrigation. Water reclaimed through the WWR-prototype (RW) from a secondary effluent of a wastewater treatment plant (WWTP), conventional irrigation water (CW) and the secondary effluent (SW) from the WWTP, were employed to cultivate lettuces in a shade house in Trinidad and Tobago, West Indies (W.I.), using drip and sprinkler irrigation methods, thus establishing six treatments. Assessments of irrigation water's physicochemical and microbiological quality and the agronomic and microbial quality of crops from all treatments showed that results associated with RW complied with relevant standards and guidelines in all cases. The assessments will conclude that the WWR-prototype is an appropriate technology for safe water reclamation oriented to agricultural production that can be complemented by a proper irrigation method to reach safety targets. The research will conduct assessments of knowledge, attitudes and practices (KAP) and willingness to pay (WTP) to inform the national voluntary standard for wastewater reuse and for implementation of treated wastewater and water management strategies for effectively mitigating environmental hazards and risks on agricultural lands.

#470 - How can future developments in architecture and landscape allow dementia to be inclusive?

Ria Needham[1], Tahira Hamid[1]

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Keywords: Inclusivity, Architectural Practice and Modus Operandi

Abstract

When architects create their blueprints, they must keep in mind how their buildings will impact all members of society, including those with dementia. Dementia is a neurocognitive disorder that affects memory, movement, and understanding. The research will explore whether current practices sufficiently accommodate the needs of dementia design.

This research paper will use a constructivist method to analyse the current position of dementia design and how this should change in the future. The constructivist method allows the aim of the paper to be investigated in how different factors can all contribute. The paper will reflect participants views such as a specialist in dementia or an architect. It will look at social factors and how the problem has developed from the past and why it has not gone further in such a robust world. The research will delve into pragmatism in which it will look at the centre of the problem, what consequences this has, and what actions can be adopted into practice. The research will be conducted through primary and secondary data in which articles and case studies such as Hogeweyk (Dementia Village Associates, 2020), a model village created for dementia, will be investigated. This will allow questionnaires to be conducted so current conditions and views can be explored so the project can develop an understanding of how we should be incorporating dementia design into the future.

The aim for this paper is to research how practices can adopt processes so that dementia design is included in all future developments. The objectives for the paper are to look at technological advances, for example Plan-EAT (Sheffield University, 2023), a design assessment tool, and how this will benefit practices; exploring the ideal of the medical and social model of disability and how this could be influential; comparing different architectural styles and evaluating which could benefit and looking further into thoughts and feelings of creating a fake reality for people with dementia. Dementia is more frequent in this era therefore the architectural industry should be prepared for what this looks like in the future.

#490 - The Sustainability Implications of Hybrid Working Practices on Offices in A Post-Covid 19 World.

Dr James Ritson[1], Dr Kate Van Someren[2], Dr Alan Bourne [3] & Dr Graeme Larsen[1]

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Keywords: Office buildings, BREEAM, Hybrid working.

Abstract

As part of the response to the COVID-19 pandemic, patterns in working practices shifted. This legacy remains and has caused a fundamental shift in how office buildings are used. Hybrid and remote working for office-based staff gained significant traction and continues to do so. The impact of these changes in working patterns has far-reaching implications, in essence, resetting a number of long-held practices. Operationally, there are real questions around the need to rethink office building purpose and re-evaluate office energy and spatial use. This rethinking presents a challenge for office users and managers as well as for how we understand and measure the sustainability of these changing office buildings.

The research focuses on the broader sustainability and management implications of this changing office working environment, mobilising the Methodology for Interdisciplinary Research (MIR) framework and drawing upon a BREEAM Excellent case study office building. The research uses a multi-disciplinary approach involving industry and academic professionals from various disciplines, from the built environment to psychology. Using building data, interviews and broader published research, the study considers the reliability of past strategies for measuring sustainability against this more dynamic working environment and whether they are still fit for purpose. The challenges faced in the transition to new hybrid working practices are unpacked.

The research posits the broader implications for office buildings. Findings illustrate how perceptions of actors shift regarding office buildings and how technology will impact the office and energy use. In particular, the transition to the requirement for much more tailored and dynamic building management systems, working practices and the increased importance of corporate responsibility for scope three and digital carbon emissions.

#585 - Bridging the Global North and South for Sustainable Environmental Governance: Equitable Resource Sharing, Citizen Science, Technology Transfer and Cultural Synergy

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Keywords: Community Sustainability, Global South, Social Responsibility, Environmental Justice, Cultural Norms, Global South, Citizen Science, Technology

Abstract

This study explores the intersection of sustainability and social responsibility, aiming to develop equitable and eco-friendly solutions at various levels by focusing on grassroots initiatives in Nigeria and citizen science integration in environmental governance in Kenya, highlighting inclusivity, effective policies, and technological advancements. The research employs qualitative methods including interviews with community members, municipal officials, and policymakers to identify successful characteristics of sustainability initiatives. Key findings reveal that inclusive decision making, integration of local knowledge and cultural expertise, and adaptive management strategies are crucial. The study underscores the need for robust environmental legal frameworks, participatory environmental management, incentivization and communitybased approaches in achieving sustainable and equitable development. Furthermore, the research highlights the critical role of technology transfer and cultural integration in enhancing environmental governance. Effective technology transfer involves adapting innovative technologies to local contexts and aligning them with cultural norms. By examining case studies in Nigeria and Kenya, the study offers insights for community leaders, policymakers, and academics to harmonize traditional practices with innovative sustainability initiatives. This approach aims to create positive environmental and social impacts at both the grassroots and global levels, bridging the gap between the Global North and South.

#570 - Bio-Electrochemical Evaluation of Constructed Wetland-Microbial Fuel Cells for Wastewater Treatment and Simultaneous Bioenergy Recovery

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Keywords: Sustainable Drainage System, Constructed wetlands, Microbial fuel cell, Energy Recovery, Water and Wastewater, wastewater resources and Flooding.

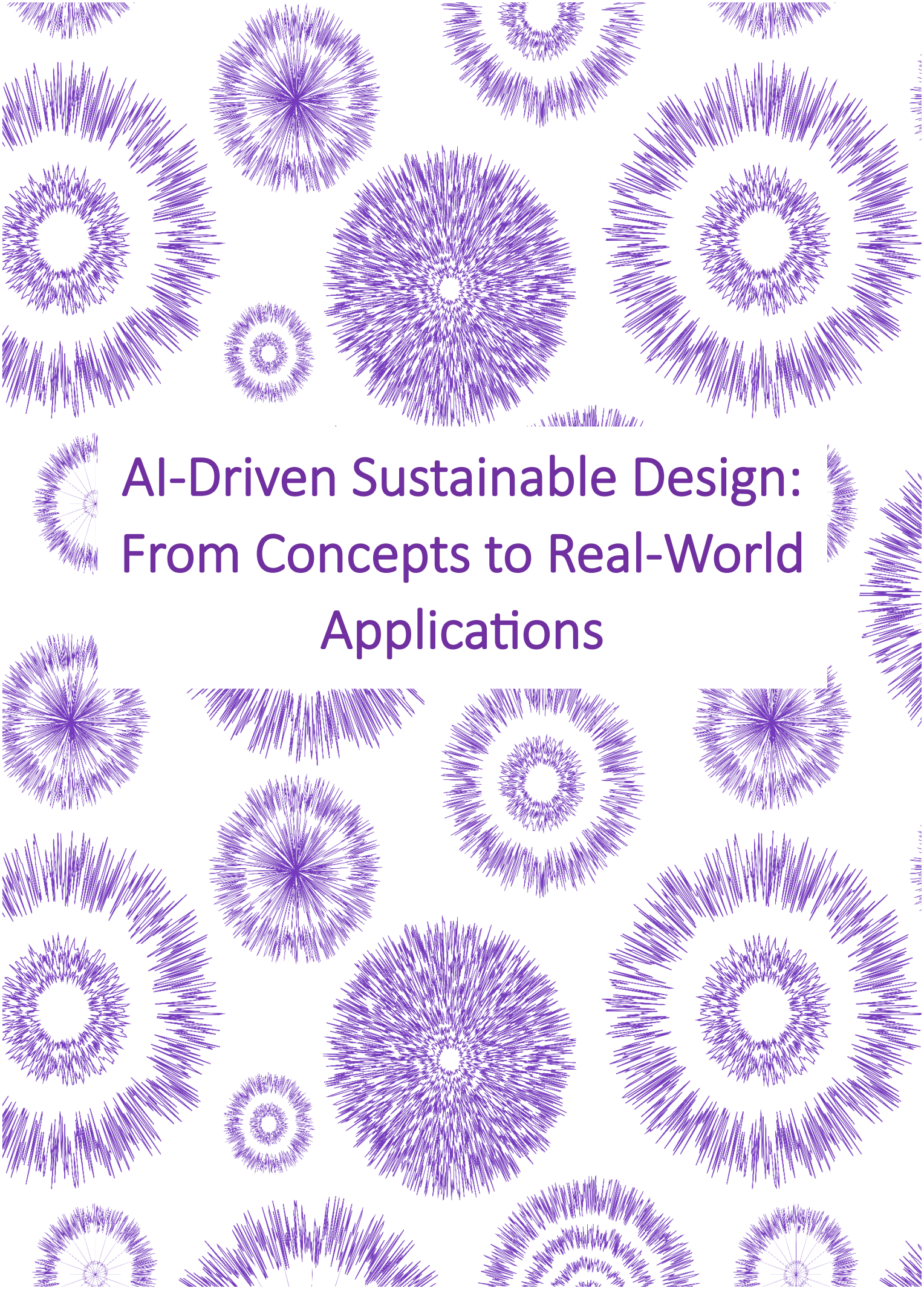
Abstract

Addressing the urgent need for sustainable solutions in stormwater and wastewater treatment is a global concern, this study explores innovative methods for effective wastewater management and simultaneous resource recovery from the process. Traditional "grey infrastructure" techniques often fall short, leading to flooding, pollution, and overburdened treatment facilities. Additionally, conventional water treatment methods typically focus on pollutant removal, neglecting the potential for valuable resource recovery from wastewater streams. With increasing water scarcity, there is a great need for a paradigm shift from only pollutant removal from wastewater to simultaneous resource recovery in the wastewater treatment processes.

Using the positivism approach, this research investigated the integration of constructed wetlands (CWs) with microbial fuel cells (MFCs) for dual purposes: enhancing wastewater treatment and generating bioenergy. A lab-scale trial with four CW configurations used a downhill vertical flow arrangement. These configurations incorporated aggregates, graphite plates, copper wires, granulated activated carbon, and stainless steel wire meshes to function as anodes and cathodes.

Stormwater samples were tested for colour, turbidity, pH, and nitrate levels before and after treatment in the CW rigs. Results showed that influent stormwater quality significantly impacted effluent parameters, with higher influent levels resulting in higher effluent values. Notably, the pH levels in the effluent were mostly alkaline, which is suspected to have hindered power production in the CW-MFC systems. However, nitrate concentrations in the effluent were significantly reduced, aligning with studies demonstrating CWs' effectiveness in removing wastewater pollutants.

This study highlights the potential of CW-MFC systems in achieving sustainable wastewater management and resource recovery, contributing to global sustainable development goals.



AI-Driven Sustainable Design: From Concepts to Real-World Applications

#482 - Unlocking brownfield project delays by leveraging on the nexus of digital technologies: A review

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Keywords: Brownfield Projects, Construction, Digitalisation, Project Delays.

Abstract

This research underscores the pivotal role of digital technology in addressing the obstacles and time delays that can hinder brownfield rehabilitation projects. Brownfield sites, often hampered by pollution, regulatory intricacies, and diverse socioeconomic challenges, necessitate innovative strategies for successful restoration. The research draws on evidence from current literature to identify the main barriers to brownfield project timescales, which include significant upfront expenses, intricate integration processes, data management difficulties, and hurdles related to regulatory compliance. This study explores the potential of new digital technologies, such as Laser-Scan Technology, 7-Dimensional (7D) Building Information Modelling (BIM), and blockchain, to provide effective solutions. These technologies can potentially optimise project management, facilitate stakeholder cooperation, increase data integrity, and ensure privacy and compliance. However, the study strongly advocates for a multidisciplinary approach that includes the expertise and involvement of urban planners, environmental engineers, policymakers, and academic researchers. This collaboration, in addition to digital technologies and legislative change, is crucial to fully utilise the potential of brownfield sites. This text contributes to discussing urban regeneration, sustainability, and digital innovation. It presents a framework for using digital technology to address challenges in rehabilitation, making brownfield projects more efficient, transparent, and successful.

#511 - Adoption of Artificial Intelligence (Ai) in Real Estate Valuation Practice in Lagos, Nigeria

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Keywords: Artificial Intelligent, Adoption, Real Estate valuation Practice, Lagos city

Abstract

The market value of real estate assets is one of the major determinants influencing real estate investment decisions in the property market, and it can only be accurately ascertained through a property valuation exercise. The correctness of the valuation reports is often informed by a number of factors which often affect the valuation accuracy, if not properly managed. However, given investors increasing sophistication, the demand for high level valuation accuracy, and the potential of artificial intelligence (AI) in achieving high level valuation accuracy, the need to integrate AI into property valuation practice comes to the fore. While many professions have embraced AI, it seems that real estate sector, especially in most emerging markets, has been slow to integrate AI into property valuation practice. This study evaluated the real estate professionals' profiles, their knowledge of and willingness to use AI valuation tools, as well as the level of adoption of AI in the property valuation practice in Lagos, Nigeria. Interviews with registered estate surveyors and valuers working in Lagos real estate market—the country's commercial hub—were used to analyze the study qualitatively. It was discovered that real estate professionals have generally low levels of awareness, which means that adoption of the AI valuation model is below average. However, the readiness to embrace AI in valuation is above average. The study suggests that professional regulatory bodies and other stakeholders at all levels should establish supportive framework towards integrating AI into valuation practice. Also, real estate professional bodies should regularly conduct adequate sensitization on the accruable benefits of integrating AI valuation tools into real estate valuation practice. This will minimize valuation inaccuracy and provide easy access to market data when carrying out valuation exercises. Finally, government should provide a framework that is conducive for appropriate execution and promote sustainable smart cities in Nigeria.

Building Resilient Societies: Strategies for Climate Adaptation and Mitigation

#559 - The Emerging Role of Built Environment Education in Facilitating Resilience to External Impacts through Natural Disasters

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Keywords: Construction, Built Environment, Resilience, Education

Abstract

Over the past several years, the world has seen a significant number of natural disasters. Managing the impact of such disasters will require ongoing disaster management and improving the resilience of settled areas, including buildings and the infrastructure that serves them. Critical to this process will be the education of built environment professionals such as engineers, construction managers and asset managers; and the systems, including advanced information systems, which support them. Components of such education include not only an understanding of resilience and its management, but also related topics such as sustainability and its management, sound design, an understanding of asset management, and the use of advanced materials. Built environment professionals will also require an understanding of current issues in assessing and managing risk management in planning, design, construction and disaster management, and their role in managing such risk, along with associated tasks such as understanding the life cycle management of such events and using advanced information systems to assist in their decision-making process. Current education approaches used in teaching sustainable and resilient design, development and management of the built environment are discussed. Such teaching ranges from technical to postgraduate levels and includes research supervision. The authors further discuss how the emerging role of such education can be enhanced through the consideration of emerging developments such as the fourth industrial revolution and artificial intelligence in this process into the role of the built environment professional. An integrated approach that combines sustainability and resilience teaching, and which is taught across a range of disciplines, is considered a useful approach for undertaking the educational process.

#523 - Identifying the driving factors for the future hospital in a climate change scenario

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Keywords: Hospital estate, future-proofing, sustainability, resilience to extreme weather events.

Abstract

Climate change, a severe and urgent problem, is causing an increase in the frequency and intensity of climate-related disasters. The healthcare sector, responsible for safeguarding people's health, is also a significant contributor to carbon emissions, accounting for a staggering 4.4% of global net emissions. Given the critical role of climate change in health and health inequalities, this statistic is not just concerning but alarming, demanding immediate attention. Healthcare services, too, can be affected by climate change-induced disruptions. The healthcare industry has identified estate and facilities as a significant area with the potential to achieve a net-zero healthcare system. However, the environment in which hospitals operate is evolving rapidly, and they must keep pace with future requirements. Therefore, it is crucial to identify the driving factors for change and integrate them into a future-proof approach for maintaining and upgrading the healthcare estate.

This paper presents the results of a one-day workshop in which participants were asked to identify current drivers of hospital change and potential trends that may follow. The research reported in this paper is part of a larger project that aims to develop a framework to provide integrated mitigation strategies to transition to a zero-carbon future and adaptation strategies to address existing climate change through better-informed facilities and built asset management planning.

To shape a future hospital that is both sustainable and resilient, it is imperative, at a strategic level, to consider the interplay between evolving healthcare delivery, shifting user expectations, emerging technologies, and the hospitals' impact on the environment and their resilience to climate change. A future-proof approach is not just a choice but necessary in the face of the changing climate and evolving healthcare landscape.

#574 - Effects of Occupant Behaviour and Air Filtration on Indoor Air Quality in Social Housing

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Keywords: Indoor Air Quality, Health and Wellbeing, Occupant Behaviour, Social Housing.

Abstract

Indoor air pollution poses a significant threat to human health, making it crucial to identify sources, assess levels, and develop strategies to enhance indoor air quality. The main objective of this paper is to assess Indoor Air Quality (IAQ) and the effectiveness of air purifiers and tailored behavioural interventions in improving IAQ in social housing properties in London. The methodology involved monitoring key pollutants, including Carbon Monoxide (CO), Particulate Matter (PM_{10} and $PM_{2.5}$), Total Volatile Organic Compounds (TVOCs), and humidity levels using data loggers during three distinct phases: a) pre-intervention, b) with air purifiers, and c) after the behavioural intervention. The installation of air purifiers significantly reduced CO and PM_{10} levels, consistently maintaining them near or below recommended guidelines across all CSBs; however, the impact on TVOC levels was less pronounced, with levels often remaining above the recommended guideline. Subsequent behavioural interventions aimed at educating occupants on best practices for reducing pollutant generation yielded variable results across CSBs and pollutants. The study demonstrated the potential benefits of combining air purifier installation with tailored behavioural interventions, effectively reducing CO, PM_{10}, and $PM_{2.5}$ levels. However, the persistent issue of elevated TVOC levels across all case study buildings underscores the need for further research and more comprehensive strategies, including source control measures.

#517 - As global temperatures continue to rise as a result of continued climate change – How will varying future weather data impact the energy consumption within Leeds city centre with reference to the Urban Heat Island effect (UHIE).

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Keywords: Urban Heat Island, Thermal modelling, Simulation Weather data, Energy Usage Intensity.

Abstract

Climate change is having an exponential impact on global temperatures, causing temperature increases and variations. This paper will model what the impact of future weather data from urbanised areas has on the energy consumption of a city centre office building in Leeds, UK. Selecting appropriate weather data for building simulation is crucial for predicting future energy consumption. London, UK provides an optimum example case scenario to portray potential weather data that Leeds may experience in the future due to its larger area and increased urbanisation. In addition to its warmer climate and marginally closer proximity to the equator. This data will aid construction professionals to use potential future scenarios to simulate building characteristics against, accurately determine the optimum passive characteristics of construction projects to reduce energy consumption. Using the Meteorological office UKCP18 future predictions of weather, CIBSE have created the DSY and TRY files which can be used to simulate the future years for 2020, 2050 & 2080. Future weather data shows an increase in maximum mean temperatures in summer which will result in increased cooling demand. However minimum mean temperatures in winter are not increasing to caveat maximums and are remaining constant. Therefore, the temperature range for these future weather files are increasing adding more passive design consideration for consultants. This results in the energy consumption of the heating loads remaining constant while cooling loads steadily increase. Overall, the energy consumption will see an exponential increase.

#532 - Life Cycle Assessment (LCA) for a School Building Retrofit Regarding Embodied and Operational Carbon Emissions

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Keywords: Life cycle assessment (LCA), carbon emissions, building retrofits, energy efficiency.

Abstract

Retrofits are applied to buildings as climate mitigation and adaptation measures in the built environment. Passive retrofit measures can contribute to decreased operational energy consumption and carbon emissions. In addition, passive cooling measures can become more significant since they can perform without a power supply. However, the embodied carbon emissions from the retrofitted building components and materials should also be taken into consideration due to their impact on total carbon emissions. Moreover, retrofit measures are vital for educational buildings since school buildings host vulnerable people, such as children. This study aims to conduct a life cycle assessment (LCA) for school building retrofits, including different shading elements, to provide an optimized retrofit solution. The building is modeled in Revit to extract material quantities used in LCA calculations. This extracted information is embedded into the One Click LCA tool to calculate embodied carbon emissions, while DesignBuilder is used to calculate operational carbon emissions with energy consumption. The results show that operational carbon emissions are remarkable contributors to total carbon emissions, while embodied carbon emissions from the product stage are the second. In the meantime, medium-II retrofit scenarios, especially the Medium-II R03, are the most efficient LCA scenarios.

#541 - Evaluation of carbon calculators in construction industry: A parametric study

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Keywords: carbon calculator, construction industry, climate change, life cycle assessment.

Abstract

The construction industry has high energy demand and emissions, and its devasting impact negatively contributes to climate emergency and climate change. A review of government, professional and scientific literature has recommended multiple strategies, including renewable energy adoptions, alternative non-carbon energy sources, circular economy, net zero carbon policies and calculators. The use of carbon calculators as a tool to estimate carbon emissions has become instrumental in guiding construction professionals in selecting appropriate 'low carbon' materials for projects. However, the influx of carbon calculators is very important but creates problems for professionals regarding their effectiveness. Therefore, this study compares two popular carbon calculators (One Click LCA Planetary and IStructE) on a building design to ascertain their efficacy. The criteria for the comparison included formats of calculators, commercialisation of calculators, customisation of data, sustainability certifications, data sources, data entry parameters and results/outputs. The findings show a 'mixed' outcome regarding the strengths and weaknesses of the calculators. These criteria are key for becoming the basis of selecting an appropriate carbon calculator for analysis. The discussion shows that data for the carbon calculators from countries considered upper-middle-income and/or below are lacking; carbon calculators should be easier to use; the interoperability of carbon calculators with other digital tools is key for not just making the use of the tools attractive but makes it easier to reduce non-value activities in the construction project.

#561 - Integrating Data into Community Resilience: A Bayesian Approach to Assessing Flood Resilience in Built Environments

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Keywords: Bayesian Model, Built Environment, Data and Flood Resilience.

Abstract

In the face of escalating environmental challenges, fostering resilient communities requires innovative approaches to understanding and mitigating the impacts of natural disasters. This research introduces a novel Bayesian network model specifically designed to quantify flood resilience within built environments. This model integrates empirical data and expert insights to assess the influence of various structural and environmental factors on the capacity of communities to withstand and rapidly recover from flood events. The study commenced with an extensive survey aimed at collecting critical resilience-related data variables, broadly categorized into building-specific and flood-specific groups. The Manchester and Cumbria, recognized as high-level flood risk regions, were selected for data collection across twelve community zones with varying risk-levels. Through the application of Principal Component Analysis and Pearson Correlation Analysis, significant resilience factors were identified, and dynamic patterns and interrelationships were determined, laying the foundation for model development. By categorizing the influential key variables into actionable states of risk and analyzing their influence on key resilience parameters at gradated resilience-levels, the model quantified the resilience levels in Manchester and Cumbria offering a granular perspective on flood resilience. The model dynamically refines its predictions, enhancing its relevance and applicability to real-world flood scenarios. It further signifies the interconnectedness of built asset resilience and community well-being, highlighting the role of informed decision-making in strengthening societal resilience against floods. Utilizing actual datasets, the Bayesian model not only sheds light on the determinants of structural resilience but also serves as a crucial decision-support tool for urban planners, policymakers, and community leaders.

Case Studies in Sustainable Development: Finding Harmony between Old and New

#577 - Investigating Attitudes Towards the use of Electrical Prefabrication in Relation to Time, Cost, And Quality in the Electrical Industry in Ireland

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Keywords: Cost, Electrical, Prefabrication and Quality.

Abstract

In the construction sector, industry professionals and clients are trying to save costs, cut time, and produce an output with the best quality. This is no different in the electrical industry and can be impacted through the use of electrical prefabrication. This study aims to explore the use of electrical prefabrication in Ireland and the attitudes towards such in relation to time, cost, and quality, as there is little research in this area. This is achieved by conducting a thorough literature review and the generation of first-hand data through mixed research methods of surveys and semi-structured interviews. Six industry professionals were interviewed with an average experience of 25 years in the industry working for companies that generate €100-€550 million annual turnover. The data generated resulted in confirmation of some literature review findings such as the cost of implementation and the transport and storage requirements associated with electrical prefabricated assemblies. However, contradictions to previous research were also generated, such as a lack of data to show there is sufficient time benefits in the early stages of a project but proves electrical prefabrication could ultimately result in significant schedule reduction, and that experience is more favoured than training. The research has addressed the gap in knowledge on this topic in Ireland. Recommendations have been drawn from this study but is still limited and could be used in further research on this topic.

#581 - LIFE EXPECTANCY OF RAAC BUILDING STRUCTURES: A REVIEW OF LITERATURE

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Keywords: Building Safety, Building Survey, Concrete Panels, Condition Survey, RAAC, Risk Management

Abstract

The life of a building often extends well beyond its designed life. However, where the integrity of structural components is questioned, investigations are necessary to assure a safe continued operation. In this study, a comprehensive review of literature is performed to conceptualise the structural integrity of buildings constructed from Reinforced Aerated Autoclaved Concrete (RAAC). In the UK, such a topic has seen immense controversy and concern relating to the use of RAAC in buildings, which is now being considered high risk following the sudden collapse of a school's concrete roof. Such concerns have driven significant investments and efforts to explore the status of RAAC nationwide, particularly in public buildings, where it was commonly used during the 1970s. The emerging argument claims that all RAAC might have degraded and are having inherent structural limitations. To conceptualise this, a multidisciplinary team undertook a comprehensive review of literature to investigate the academic knowledge base relating to RAAC in existing buildings. The team systematically reviewed hundreds of papers relating to the use of Aerated Autoclaved Concrete in buildings. Subsequently, a carefully developed inclusion and exclusion criteria has been developed to filter extant literature to the most relevant academic contributions. This has led to the inclusion of 92 academic papers. The construction management research community would benefit from this review, which highlights scope for future research, and a research agenda to addressing the key questions that are yet to be answered.

#476 - On the Shore of the Lough: navigating sustainability in the rural context

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Keywords: embeddedness, localised learning, SMEs, sustainable development.

Abstract

The narrative around sustainable projects often follows considerations of acontextual best practice, standards, and inter disciplinary integration. Such formalised approaches may be appropriate for large projects often with repeat clients, however smaller independent builds may not reflect these contextual norms. In these cases localised independent suppliers, builders, architects and trades are dependent on each other for ongoing work and each is very focused on maintaining good working relationships. As actors navigate the terrain of builds which incorporate unfamiliar technologies, these sensitivities can make contractual and day-day conflict management a key determinant of how projects unfold and how sustainable practices are realised. New building techniques updated best practice and modern methods of construction (MMC) further test team dynamics and the old legitimacy of pathways and people. This research focuses on understanding how day-day issues are experienced in practice on smaller independent builds and draws upon concepts of localised learning and embeddedness. Using ethnographic methods in a single case study of a new-build residential project in rural Northern Ireland, the research takes three episodes during the build to explore these concepts. The build uses MMC and traditional procurement centring on a local supply chain. Findings indicate that subtle informal practices around the concept of embeddedness, coupled with active strategies of conflict avoidance were mobilised to navigate uncertainties of technology inclusion and associated challenges. These informal practices centred on protecting and nurturing relationships between project actors and became major barriers to adoption of new technologies, decision making, client satisfaction and sustainable outcomes. These findings prompt further examination of the issues surrounding this particular context and open new ways to explore how harmony between old and new methods of construction and sustainability standards can be achieved.

CIB TG96- Accelerating Innovation in Construction

#488 - Internet of Things (IoT) Implementation in the Malaysian Construction Industry

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Keywords: Internet of Things, construction, Malaysian construction industry.

Abstract

The adoption of Internet of Things (IoT) technology in the construction industry holds significant potential for improving project efficiency, safety, and management. This research investigates the implementation of Internet of Things (IoT) in the Malaysian Construction Industry (MCI) by exploring the awareness, benefits and challenges. The research adopted a quantitative research strategy using a questionnaire survey to collect data from professionals in MCI. Purposive random sampling technique was used to select the respondents for the survey. The study revealed that despite the majority being aware of IoT in the MCI, its implementation is still lacking. Construction progress monitoring, health and Safety and security control were revealed as the key benefits of IoT by MCI professionals. Despite the benefits, Implementation costs, lack of expertise, and security issues were realised as the key challenges in implementing IoT technology in MCI. To overcome the barriers government initiatives in creating policies for IoT implementation are suggested. Additionally, investing in technological advancements and providing subsidies or tax incentives were also suggested as potential strategies to facilitate IoT adoption in the MCI. Overall, this study provides valuable insights into the current state of IoT implementation in the MCI and other developing countries, it also sets a path for further research on fostering its widespread adoption. Further study is recommended to investigate the causes of MCI professionals' reluctance to adopt IoT technologies and provide mitigations on encouragement of its implementation.

#474 -Sustainable 3D Printing for Construction: Cement Choices, Structural Components, and Real-World Insights

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Keywords: 3D Concrete Printing, Sustainable Cement, Embodied Carbon and Energy, Structural specifications.

Abstract:

By providing quicker, more affordable, and ecologically friendly ways to construct buildings than traditional construction methods, 3D printed concrete structures not only revolutionises the construction industry but also drastically lowers carbon emissions, aiding in the worldwide fight against climate change. This research focuses on the material aspects of 3D printed concrete, concentrating primarily on cement as a key component. Using the sources from the cement-focused material research, it will not only look at the selection of suitable materials but also examine the structural specifications and the components (Foundation, Wall & Roof) that are printable. Cement, being the primary source of embodied carbon and energy in the construction industry, this study includes the various types of 3D Printing cements such as Geo polymer, Limestone-Calcined Clay Cement (LC3), Calcium Sulpho Aluminate cement and Reactive magnesium oxide cement. Utilising a mixed-methods approach, this research thoroughly examines the present status and potential applications of robotic construction and 3D printing in the construction sector by fusing qualitative literature review and case studies with quantitative material inspections. After analysing embodied carbon and embodied energy in each cement the best option available in UK is suggested. The findings highlight Geo Polymer and Limestone-Calcined Clay Cement (LC3) as the preferred option for 3D Printed Concrete in this research. In addition, this research delves into real-time case studies centered around 3D Printed Concrete Structure, providing practical insights into their applications and performance in diverse construction scenarios. Also, the load-bearing capacities of the wall that are 3D printed are examined closely, acknowledging from real-world application. The combinations of these components in a small-scale design act as a test run, providing insights for a smooth transition into more sustainable 3D Printed Concrete Structure using these sustainable cements such as Geo Polymer and Limestone-Calcined Clay Cement (LC3).

#543 - Accelerate or Deaccelerate Innovation through emergent AI technologies: a scoping study

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Keywords: OpenAI, GenAI, ChatGPT, prompting, ethics, digital creativity

Abstract

This paper investigates the impact of Generated Artificial Intelligence (GenAI) on education, emphasising the interplay between technology, creativity, and ethics. Previous studies have highlighted the ethical dilemmas of digitisation, noting the dual potential of technology to affect education and society both positively and negatively. The research aims to understand how GenAI can accelerate innovation strategies in education, contribute to creativity, and benefit students. This scoping review aims to map the existing literature on GenAI and identify key factors and challenges associated with this emerging technology. Through a systematic search of publications from 2022 to 2024, we have gathered and analysed 36 sources, including conference papers, journals, and reports. Our findings highlight the significant impact of GenAI on creative processes and achievements, emphasising its potential to enhance learning, support creative pedagogies, and facilitate interactive and personalised educational experiences. However, the review also uncovers several critical challenges, such as the risk of generating incorrect information, issues of data privacy and ownership, and the potential for reinforcing existing biases. Furthermore, ethical concerns related to academic integrity, including plagiarism and misuse of AI, are prevalent. The review underscores the necessity for transparency, accountability, and ethical guidelines in the deployment of GenAI tools in education. By systematically identifying these factors and challenges, this scoping review provides a comprehensive overview of the current state of research on GenAI, offering valuable insights for future studies and practical applications in the educational sector.

#558 - Exploring The Applications of Drones for Health and Safety Management in Malaysian Construction Projects

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Keywords: Drones, Construction site, Health and Safety (H&S) Management, Technological Innovation.

Abstract

Construction sites, which present inherent risks to worker safety, have urged the exploration of innovative technologies to mitigate these dangers. This research investigates the level of adoption of drone applications and explores the barriers to their adoption for health and safety management in Malaysian construction projects. Previous research acknowledges the potential of drones in construction but lacks a comprehensive understanding of their specific impact on health and safety management in Malaysian contexts. Addressing this gap is crucial to revolutionize safety practices within Malaysian construction, aligning them with technological advancements. The study employs a structured questionnaire survey among construction professionals and a thorough literature review. Findings reveal a high overall adoption rate of drones, with significant correlations between project types, sizes, and drone adoption. Despite substantial adoption, barriers such as weather constraints, technology familiarity, and permit processes hinder broader utilization. The study advocates for streamlined regulatory processes and training programs for professionals. These findings highlight the potential for drone technology to revolutionize safety practices in Malaysian construction and provide a roadmap for stakeholders to leverage drones effectively for health and safety management.

#576 - The Complexities of Mega Project execution in Nigeria

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Keywords: Mega Projects, risks, complexities, sustainability factors

Abstract

Mega-projects are large scale construction projects that involve significant financial resources. Despite increased investment in African mega-projects over recent years, several factors have resulted in a series of mega-project failures. This is often due to the complex nature of mega-projects with factors such as workforce shortages, skills gaps, and funding issues all resulting in project failure. The impact of such failures often prolong and exacerbate issues for Africa's population such as poor access to potable water supplies, a lack of decent and affordable housing and health care, poor transportation, and worsening educational disparity. However, to date there exists a gap in research pertaining to the relationship between the complexities of mega-projects and their failure. This paper seeks to address this gap and help improve the performance of mega-project execution in Africa. A large-scale questionnaire is utilised that is completed by multiple Nigerian mega project stakeholders. Analysis of the results reveals sustainability factors such as environmental and community considerations, are often responsible for poor mega project performance. Additional factors include economic, financial, social, and cultural, and political. This supports and broadens current understanding.

Community-Centred Resilience: Engaging and Empowering Local Populations

#473 – A Community-Scale Framework for Evaluating Flood Resilience Across Socially Diverse Communities

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Keywords: Flood Resilience, Social Capital, Framework, synthesis.

Abstract

Climate change and rapid urbanization have increased the risk of flooding in many parts of the world and consequently, flooding has become the most frequent natural disaster with major impacts on communities, causing physical and intangible damages. As the risk of flooding continues to increase, integrated approaches to Flood Risk Management (FRM) have emerged placing greater emphasis on routes to adaptation and resilience. Community flood resilience is a multidimensional concept which focuses on keeping communities functioning before, during, and after the occurrence of flood events. Despite many attempts to quantify community flood resilience, there lacks a consensus among researchers and professional stakeholders due to diverse perspectives and cultural considerations.

This research presents a critical review of the existing literature on community flood resilience, through a synthesis of previous studies, to present the case for a new community-scale framework for quantifying and evaluating flood resilience. This framework is designed to help multisectoral stakeholders including local authorities, flood risk managers, engineers, surveyors, and property owners to make more informed decisions on how to improve the resilience of their communities to the risk of flooding. Significantly, this new practicable framework argues the need for a deeper understanding of the role of social considerations in overall community flood resilience thereby enabling cross-comparisons across socially diverse communities.

Data-Driven Ecological Engineering: Enhancing Sustainability through Digitalization

#521 - The role of digital workflows for lowering the climate impact of residential buildings: a case study in Northern Sweden

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Keywords: Structural engineers, Residential buildings, Climate impact, Digitalisation.

Abstract

The Swedish government has introduced a requirement to conduct a climate declaration for new buildings, and climate impact limit levels are set to be implemented by 2025. This has put pressure on structural engineers, who are an important part of the decision-making process regarding materials for and design of the superstructure of buildings. Since climate calculations usually occur towards the end of the project and are a time-consuming and manual effort, structural engineers seldom evaluate the climate impact of their designs daily. The literature also suggests that while integrations of building information modelling software for structural engineering with climate calculation software exist, there is still a long way to go before this becomes fully automated. Moreover, even if automated, does this really help the housing companies and consultants where they are today? The aim is, therefore, to discuss the role of digital workflows in lowering the climate impact of residential buildings.

This paper presents a case study examining a recently built apartment building in Northern Sweden in collaboration with the structural engineers and the housing company. The digital workflow used during the design phase was mapped, and several redesign ideas (e.g., climate-improved concrete, timber instead of concrete, innovative foundation design) were evaluated for their climate impact, cost, and feasibility from the perspectives of the architect, the client, and the contractor. The connection between the redesign ideas and the digital workflow is discussed.

The results show that while there is potential for enhancing the building information models and tools used in the project, the digital workflow is not the primary challenge to reducing the climate impact. Instead, other factors, such as limited access to climate-improved concrete and a lack of early discussion of the climate impact of the design ideas between the different actors involved, present more significant challenges.

#531 - Seasonal variations in exposure to indoor air quality in existing UK social housing dwellings

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Keywords: Seasonal variations, Indoor air quality, Social housing dwellings.

Abstract

Strategies for protecting the UK population against the health effects of indoor air pollution are constrained by the lack of empirical data on the impact of dwelling characteristics on exposure to air pollutants inside homes. Evidence is particularly limited over different seasons and by different housing typologies. This paper undertakes empirical measurements of indoor temperature, relative humidity (RH), carbon dioxide (CO_2), particulate matter $(PM)_{2.5}$, PM_{10} and volatile organic compounds (VOCs) (Isobutylene and EtOH) in the living rooms of 34 social housing dwellings located in Warwickshire (UK) during 2021-2022. Contextual data about the physical and household characteristics of the dwellings were gathered using in-person surveys. Results revealed that the effect of seasonality was apparent, with indoor air quality (IAQ) being particularly poor in winter. The seasonal discrepancy in ventilation practices was significant. Strong seasonal variations were observed in indoor temperature (ranging from 9°C to 37°C), with widespread overheating in summer and under heating prevalent in winter across the dwelling sample. The lowest mean wintertime indoor temperatures (17.7°C) and the highest mean summer indoor temperatures (25.7°C) were recorded in bungalows. RH levels remained stable across seasons and building typologies, averaging between 45% and 54%. Regardless of seasons or typologies, the concentration of CO_2 levels stayed above 900 ppm, indicating inadequate ventilation. CO_2 concentrations were found to be particularly higher across bungalows inhabited continuously by elderly residents, while high PM concentrations of 100 µg/m^3 and above were experienced in terraced dwellings, exceeding the WHO limits of 15 µg/m^3 for $PM_{2.5}$ and 45 µg/m^3 for PM_{10}. This was possibly due to residents' indoor activities such as smoking and cooking, confounded by poor ventilation. About 12 out of 34 dwellings experienced mean VOCs levels higher than the sample means of 0.95 ppm (EtOH) and 0.11 ppm (Isobutylene). Given that these dwellings are likely to be energy retrofitted in the near future, it is vital that trends in IAQ are used to inform the retrofit measures, especially regarding adequate ventilation alongside insulation.

#520 - Analysis of monitoring systems through the study of measurement uncertainty to improve the estimation of the Key Performance Indicators of the energy behaviour of the building´s thermal envelope

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Keywords: Energy Monitoring System (EMS), Heat Transfer Coefficient (HTC), Energy Performances Certification (EPC), Measurement Uncertainty (UM).

Abstract

*The Energy Performance of Building Directive 2010/31/EU notes the importance of implementing an **MCS** to achieve quality assurance (*(*10288/17*, 2017)*,* (Brajterman et al., 2018)*) and the importance of comparing **EPC** issued before and after the renewal of buildings. The Heat Transfer Coefficient (**HTC**) is a potential Key Performance Indicator (**KPI**) to be used [4] in the future Energy Performance Certification (**EPC**) of buildings, making it necessary to improve the technologies of Monitoring and Control Systems (**MCS)** integrated into Automated Building (**AB**), as well as having experimental tests for reliable **HTC** estimation.*

*To estimate reliable **HTC,** it is necessary to assess its uncertainty through the measurement uncertainty propagation of the physical variables involved in the **HTC** estimation. Where decreasing **HTC** uncertainty involves collecting reliable **MCS** data to estimate measurement uncertainties as low as possible. In turn, knowing the best technology allows the **MCS** to be optimized, providing the best sensor layout and technological accuracy, among others aspects.*

*Considering all of the above, in order to estimate a more reliable **HTC** for use in future **EPC** and to advance to an optimized **MCS**, this research study performed a 3D **MCS** in a tertiary building to identify the best location, precision and accuracy of the sensors through the uncertainty analysis of indoor air temperature. The results show the importance of sensor accuracy, in which there is a discrepancy between the manufacturer`s accuracy and the sensors' experimental accuracy, showing how it can impact the **HTC** uncertainty. The main conclusion of this study is that the overall Temperature Uncertainty (U_T) of the monitored thermal zones is 2.4 to 10.7 times bigger than the manufacturer's sensor accuracy. Thus, using the manufacturer's accuracy as the overall temperature uncertainty value could greatly underestimate the measurement uncertainty. Underestimating the measurement uncertainties of the **HTC** variables implies underestimating the **HTC** uncertainty, resulting in unreliable **HTC** estimations.*

Digital Twins and Sustainability: Leveraging Industry 4.0 for Ecological Engineering

#578 - The impact of attitudinal engagement when implementing digitalisation in construction projects.

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Keywords: Digitalisation, attitudinal factors, change resistance, digital transition.

Abstract

Digitalisation is a revolutionary force in many sectors that may lead to cost reduction, enhanced efficiency, improved data utilisation and therefore delivery of projects with increased sustainability. Despite an awareness of how crucial it is to implement digital technologies to increase both commercial success and improved sustainability credentials, so called Triple Bottom Line, the construction industry trails behind other sectors. The construction industry's slow digital adoption due to technological, cultural, and attitudinal barriers is well known and is possibly due to the lack of industry-specific research. This multi-case study was unique in that it focused on investigating the impact of attitudinal factors affecting the adoption of digitalisation in construction companies in Ireland and as a comparison a company the US which could be considered as a more sophisticated market. A mixed-method research approach informed by a literature review, involved using 18 semi-structured interviews and 50 confirmatory questionnaire-based surveys. Data were thematically analysed and despite the geographical, cultural and size differences between the two jurisdictions, the initial findings showed a commonality of factors such as training and leadership that positively influence attitudinal change potentially facilitating the successful adoption of digitalisation, and subsequent benefits derived by stakeholders within the construction sector.

#582 - Digital Twins in The Net-Zero Carbon Transition for the Built Environment

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Keywords: Digital Twins, Net-Zero Carbon, Built Environment, Construction

Abstract

In recent years, there has been much focus on the role of digital twins (DT) in the areas of construction productivity, quality and indoor air quality. However, attention on promoting net-zero with DT is limited in the emerging construction literature. This highlights a significant research gap on the role of DT in net-zero research. Therefore, this study aims to explore the nexus between DT and net-zero research to identify prominent research topics and uncover under-researched areas that would improve the application of DT in the net-zero transition. A two-step review process involving scientometric and a critical review was conducted. The findings reveal that building energy, emissions assessment, artificial intelligence and solar energy are gaining traction in the DT-net-zero research nexus. However, the under-research net-zero areas that could be improved in future research are DT's relationship with blockchain, other renewable energies and cost effectiveness. This study would aid researchers and practitioners with knowledge on effective ways to promote DT in the net-zero transition for a more sustainable industry.

Environmental Justice in Ecological Engineering: Ethical Dimensions of Community Impact

#571 - Navigating Environmental Disputes in the UK: Lawyers' insights into ADR attitudes and experiences

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Keywords: Attitudes, Legal System, Dispute resolution, sustainability, Environmental law, Policy Implications

Abstract

There is a dearth of empirical data on lawyers' attitudes toward alternative dispute resolution (ADR) in the specific context of environmental disputes, which are often characterised by complexity and prolonged litigation. This lack of comprehensive insight into lawyers' perspectives may pose challenges to the effective integration of ADR into the legal landscape. Addressing this gap through targeted initiatives and research could enhance awareness and knowledge, fostering a more informed and adaptive approach to utilising ADR in resolving environmental disputes. Utilising a structured questionnaire distributed among a targeted sample, this research employs statistical analysis to quantitatively assess lawyers' awareness, attitudes towards the use of ADR methods to resolve disputes in the environmental arena. This study contributes to filling a significant research gap by providing empirical insights into lawyers' attitudes towards ADR specifically within the context of environmental sphere in the United Kingdom. The survey findings indicate a spectrum of perspectives and while the sample of legal professionals expressed confidence explaining ADR and some had undergone training, concerns about enforceability, familiarity, and delays hampered its usage. Negotiation and mediation were identified as preferred methods, especially for lower-value environmental disputes. The implications for practice underscore the necessity for targeted educational initiatives to enhance awareness and familiarity with ADR, potentially fostering its greater integration into legal strategies for environmental dispute resolution. The findings also hold significance for policymakers and legal practitioners, informing strategies that could expedite and streamline dispute resolutions in the realm of environmental law, ultimately contributing to a more effective and adaptive legal landscape

Ethical Dilemmas in Ecological Engineering: Navigating Sustainability's Moral Landscape

#545 - Under the Concrete Cloak: Exposing the Construction Mafia's Hold in South Africa's Eastern Cape Industry

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Keywords: Construction Mafia, Unethical Practices, Regulatory Measures, Eastern Cape.

Abstract

The purpose of this paper is to investigate the threat posed by the construction mafia in the Eastern Cape construction industry, focusing on its unethical behaviour, impact, and effectiveness of existing regulatory measures. The research aims to provide an in-depth understanding of the construction mafia's operations, identify unethical practices, and evaluate the current regulatory framework's effectiveness. A qualitative research approach within the interpretivism paradigm was employed, utilising semi-structured interviews with construction managers in Mtata, East London, and Gqeberha, South Africa. Purposive and snowball sampling techniques were used to select participants, and the data were analysed using thematic narrative analysis. The study identified the construction mafia as a well-organised, profit-driven entity engaging in illicit practices, including resource demands, employment manipulation, and contract interference. Unethical behaviours documented include intimidation, financial misconduct, exploitation of workers, and compromised work quality, contributing to systemic corruption. Regulatory measures such as the Preferential Procurement Regulation (PPR), the Preferential Procurement Policy Framework Act (PPFA), and Construction Industry Development Board (CIDB) regulations, while essential, are often hindered by lack of clarity, political interference, and external influences. Limitations include focusing on a single province and a specific subset of participants, which may not capture the full scope of the issue across South Africa. Future research should explore similar regional dynamics and investigate different regulatory approaches. The research highlights the necessity for proactive measures, enhanced collaboration, and robust regulatory frameworks. It calls for stricter enforcement of existing regulations, improved transparency, and stronger community engagement to mitigate the influence of the construction mafia, potentially leading to a more ethical and stable construction environment.

Future-Proofing Cities: Sustainable Infrastructure for Growing Urban Populations

#513 - Integrating DfMA and BIM for Sustainable Infrastructure: Industry Perspective

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Abstract

Modular Construction (MC) has been globally recognised as a sustainable solution to the higher material consumption and wastes of infrastructure projects accounting for 70% of carbon emissions in the construction industry. However, it suffers difficulties in design coordination among components and post-design changes during manufacturing and construction, causing additional costs and delays. To tackle these issues, vertical and cross-stage integration to consolidate and coordinate design, manufacturing, and assembly processes has become essential. Consequently, the integration of Design for Manufacture and Assembly (DfMA) and Building Information Modelling (BIM) have been recognised as solutions since DfMA facilitates process coordination and management while BIM provides an information and design collaboration platform. Despite several global DfMA-BIM guidelines, they mainly focus on the design stage, while none adequately connect the DfMA process with BIM tasks and their implementation throughout the project lifecycle. Hence, this study aims to explore the current status and required procedural support for integrating DfMA and BIM in projects. The research articulates the prevailing challenges in DfMA-BIM implementation and suggestions to improve their synergy to address them through interviews with construction professionals with around 9 years of experience in MC and infrastructure. The identified critical challenges include deciding to use DfMA after concept design, early collaboration and overlooking health and safety, logistics and installation requirements. The study suggests implementing DfMA early, pushing all the decision-making upstream, and using Early Contractor Involvement contracts for early collaboration. It reveals the role of 4D BIM in developing a logistic plan aligned with the construction strategy. Findings highlight the BIM use in visualising, compliance checking, scenario planning, and training to improve health and safety, identify forces on components during transportation and lifting (tight bends, swing, etc) and reduce risks. These findings will contribute to developing a comprehensive procedural guideline for the DfMA-BIM approach in infrastructure projects.

#542 - Application areas and potential benefits of blockchain-smart contract in infrastructure Public-private partnership (PPP) projects

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Keywords: Blockchain technology, Smart contract, infrastructure projects, Public-private partnerships.

Abstract

Public-private partnerships (PPP) have gained increased patronage by governments in both developed and developing nations. Governments leverage PPP to utilise the private sector's technical strength and capital to improve value for money (VfM) delivery to their citizenry through the provision of mega, long-term infrastructure projects. However, PPP projects have continued to suffer from failures, early termination, and re-municipalisation due to failure to meet projects and stakeholders' performance expectations. Poor quality, lack of trust and transparency by the parties, skewed risk allocation, fraud in contractor selection, poor contract compliance, and inability to enforce bill payment by end-users have led to strained relationships between the public and private sectors and the ultimate termination of contracts. Blockchain and smart contracts possess unique features that can mitigate some of these problems and lead to improved and sustainable performance of PPP projects. While studies on the digitalisation of PPP contracts in the built environment are limited to BIM technology, adopting Blockchain and smart contracts in PPP projects is a scanty and underexplored domain. This study, via a questionnaire survey, examined the application areas and potential benefits of blockchain-smart contracts in infrastructure PPP projects. Relevant data were collected from experienced built environment experts using the snowball sampling technique, and the data were analysed using appropriate descriptive statistical tools. The leading application areas of blockchain-smart contracts are (1) Payment and financial administration, (2) Data and Information management, (3) supply chain management, and (4) dispute resolution and management. Prominent potential benefits of blockchain-smart contracts are (i) Decentralisation of payments and other transactions, (ii) prevent misapplication of contractual provisions, (iii) improved interoperability in data exchange, and (iv) better project resources management. This report is part of an ongoing PhD research that would provide a framework for the digitalisation of infrastructure PPP contracts.

#584 - Exploration of Healthy Building Concepts within Green and Sustainable Building Practises

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Keywords: Comparative Analysis, Green Building, Healthy Buildings, Sustainable Buildings.

Abstract

The overall influence of building on its occupants and environment is immeasurable and as such has been a major point of revolution throughout human history. Within the built environment sector, the design and construction of buildings are constantly evolving and in recent times have led to the emergence of terminologies such as Green, Healthy and Sustainable building practises. These terminologies are used interchangeably by researchers and practitioners within the built environment even though, they are technically different. As such, this study presents an exploratory literature review of the three terminologies to identify the similarities and differences between them.

The result of the analysis shows that Green, Healthy, and Sustainable building concepts are the same in their approach to materials selection, with all three prioritising the adoption of materials with low embodied energy, consumed less energy and have fewer negative impacts on the environment and human health. Meanwhile, the distinct features are in their focus, metric tools, and philosophy. Green building is solely about the environment while Healthy building is about occupants' well-being and health. Sustainable building is more holistic comprising green building and part of healthy building concepts in addition to other social and economic responsibilities. This study has contributed to the wider discussion of these three key concepts and will enable key stakeholders in the academia and construction sector to understand properly the main features of Green, Healthy and Sustainable Building practises. This will facilitate proper adoption of the strategies to provide the needed sustainable healthy built environment.

Industry 4.0 and Environmental Monitoring: A Path to Greener Futures

#512 - Embodied Water Monitoring for Sustainable Construction: A Case of India

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Keywords: Embodied Water, Internet of Things, Smart Water Meters and Water Efficiency.

Abstract

Growing concerns surrounding water scarcity have spiked an interest in Embodied Water (EW) studies globally. The EW of a building is the amount of water needed to manufacture all the materials that constitute the building (Indirect EW) plus the amount of water needed to construct that building (Direct EW). Regular monitoring of EW can help identify possibilities for water conservation and enhance water efficiency.

This paper will present an analysis of the application of Water Metering (WM) for EW monitoring in India along with analysing the benefits of upgrading it to Internet of Things (IoT) Smart WM. A qualitative approach is adopted in which semi-structured interviews with seven construction professionals and eight construction material manufacturers were conducted to determine the extent of WM on construction sites and manufacturing plants in India, along with the challenges faced, and the drivers for its adoption.

The interview analysis revealed that the large number of consumption points along the EW supply chain, makes it economically challenging to monitor water consumption at each point. As a result, using a single water meter at the point of water withdrawal is the most common methodology adopted for EW metering. WM is more prominent in material manufacturing plants as opposed to construction sites due to the presence of stringent regulations set up by governing bodies such as the Global Cement and Concrete Association (GCCA). These governing bodies have set benchmarks to regulate the water footprint at manufacturing plants. The high cost of an IoT Smart WM and the lack of knowledge among people regarding its benefits limits its adoption for EW monitoring in India.

#551 - Digitalization of the Offshore Wind Sectors Supply Chain

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Keywords: Digitalization, Digital Maturity, Offshore wind, Supply chain, Technology

Abstract

Climate change has prompted a consensus change to approaches used in electricity generation globally from fossil fuel to sustainable energy sources. In lieu of this, a target was set by International Renewable Energy Agency (IRNEA) in conjunction with Global wind energy council (GWEC), to produce 380 GW of energy from offshore wind in 2030 and 2500 GW in 2050. Today only 63.2GW is produced by offshore wind farms globally.
Meeting the set target by 2050 requires taking measures that will enhance greater efficiency.

Digitalizing the offshore wind supply chain is one measure that will encourage greater collaboration amongst supply chain participants which will lead to reduced costs of electricity generation, leading to increased sector investment. This paper is aimed at identifying the current digital maturity of the offshore wind supply chain based on a digital maturity model by Agca et al. (2022).

The objective is to evaluate the rate of deployment of digital technologies, measure the current level of digital maturity and suggest suitable digitalization technologies that can be deployed to enable the supply chain to reach its highest level of maturity. The survey was quantitative in nature using structured questionnaire constituting 93 respondents from 30 countries. The data fetched from across supply chain practitioners in the offshore wind sector was analysed using relative importance index and statistical analysis.

The result revealed the offshore wind supply chain is at developing stage (stage 2) of digital maturity based on digital maturity model by Agca et al. (2022). This research also proposes that although some digital technologies have been fully integrated into the offshore wind supply chain, several technologies are not used to their full potential.

Innovation and Tradition in Sustainable Organisation: A Holistic Approach

#572 - Determinants and the Barriers of Facilities Management Innovation.

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Keywords: Facilities Management, Innovation, Barriers, Determinants.

Abstract

This paper investigates the determinants of facilities management innovations and the barriers of facilities management innovation, aiming to examine the primary barriers to innovation and in the FM sector. Employing the qualitative method. The qualitative approach adopted here involved reading and interpreting the material in a progressive and systematic way so that an inductive, constructive output emerges. The findings reveal the determinants of FM innovations as: market observations, external best practices and a network of FM practitioners and organizations. The main barriers that constrain FM innovation is poor communication and cooperation, budgetary constraints as well as insufficient value creation and a lack of managerial or business administration knowledge. The study underscores the importance of addressing the identified barriers to earnestly to realize the anticipated benefits of FM innovations.

#573 - Value for Money Assessment Approaches in Public-private-partnerships: A Systematic Literature Review

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Keywords: Public Private Partnership, Value-for-Money, Infrastructure, Systematic Literature Review.

Abstract

Value for Money (VfM), a major criterion for assessing Public Private Partnerships (PPPs), has created debate among researchers as to whether PPPs offer more opportunities as opposed to traditional methods in the delivery and operation of public infrastructure projects. PPP is an effective procurement method for delivery of infrastructure projects worldwide, however, their ability to provide taxpayers, users, and society with VfM remain controversial. While studies on VfM assessment in PPP arrangement exist, there is limited literature that comprehensively evaluates the VfM assessment approaches. Therefore, this study aims to conduct a systematic review on VfM assessment approaches in PPP infrastructure projects. A five-step PRISMA approach was used to search, select, and analyse twenty-eight relevant articles. The findings revealed that cost benefit analysis, competitive bidding method, outline business case and public sector comparator are the main methods used to assess VfM in PPPs. Prevailing VfM techniques such as the public sector comparator, tend to focus on achieving cost saving rather than value itself. As a result, the public sector has struggled to ensure and deliver VfM, leading to the combined use of the public sector comparator and cost-benefit analysis in developed countries. In addition, it was noted that, governments have created country specific and project specific frameworks to guide VfM assessment process in PPP infrastructure projects. Although the research used 29 articles, the results reveal significant gaps for further research in PPP infrastructure projects.

#504 - Systematic Analysis of Capability Maturity Models for Enhancing Circular Economy Adoption in the Construction Supply Chain

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Keywords: Capability Maturity Model, Circular Economy, Construction Supply Chain, Stakeholder Engagement

Abstract

The global climate crisis requires bold steps to decrease greenhouse gas emissions by 50% by 2050, to keep global warming below 2°C, and to reduce it to 1.5°C by increasing international cooperation. Therefore, the current business models should transform their organizational capabilities to tackle the negative impacts of everyday activities. The construction industry, known for its significant environmental impact and as an essential contributor to resource depletion and waste generation, is increasingly pressured to transition towards sustainable practices. This pressure promoted the exploration of new methods that facilitate the integration of circular economy (CE) practices within industrial activities. Accordingly, individuals, organizations, and governments seek solutions to set the objectives for a successful transition. Capability maturity models (CMM) are used to develop comprehensive decisions for a successful transition. Thus, individuals, organizations, and governments can define, manage, control, and monitor the organizational capabilities and objectives for an achieved transition. However, there is a need to explore CMM, which facilitates the integration of CE practices within the construction supply chain. Therefore, this paper conducts a systematic literature review to examine existing CMM critically and compares the strengths and limitations of the results. The research results are twelve journal articles that do not consider the construction industry. The CMM focuses on CE from resource, waste, culture, stakeholder, and value and supply chain perspectives. Thus, the study highlights the emergence of hybrid models that combine CMM and CE to address construction supply chain challenges. In conclusion, it proposes a process-based view to define new avenues for stakeholder engagement, innovation diffusion, resource optimization, organizational culture, regulatory frameworks, and market dynamics for CE-CMM. This paper contributes to the ongoing discourse on circular organizations in construction by synthesizing these findings, and it guides individuals, organizations, and governments to navigate the complexities of implementing CE in construction supply chains.

Lessons from the Wild: Nature-Inspired Materials and Structures

#555 - Local resources inform design: mid-point results from the Building from England's Woodlands project

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Keywords: Homegrown hardwood, engineering wood products, biogenic manufacturing, UK construction industry.

Abstract

Considering the energy consumption and carbon equivalent emission of the construction industry, a massive shift towards more sustainable and less carbon intensive materials and building techniques is desirable. In this regard, wood and timber products will be more utilised within the built environment, posing the question of what can be done to prevent resources from being overused and to ensure it is properly managed. To try to address the issue within the UK, the Woods into Management Forestry Innovation funded project "Building from England's Woodlands" aims at bringing together England's sustainable forests, manufacturing sector, and construction industry to encourage wider use of homegrown timber and demonstrate that engineered components made from English wood are reliable and feasible, paving the way for innovative and large-scale wood products in the UK construction market. The project is targeting suitable hardwood species for construction and assessing their relative characteristics to inform future strategies for sustainable forest management and creation in England. The paper introduces some of the findings so far, whilst showing the plans for the prototypes to be created within the last part of the project. The prototypes aim to showcase what is feasible when the understanding of the resource informs the design process, as opposed to designing a system and then trying to determine how it can be realised from the available resource.

#459 - A Solution is Growing: Are Mycelium-based materials the answer for a sustainable future in the built environment?

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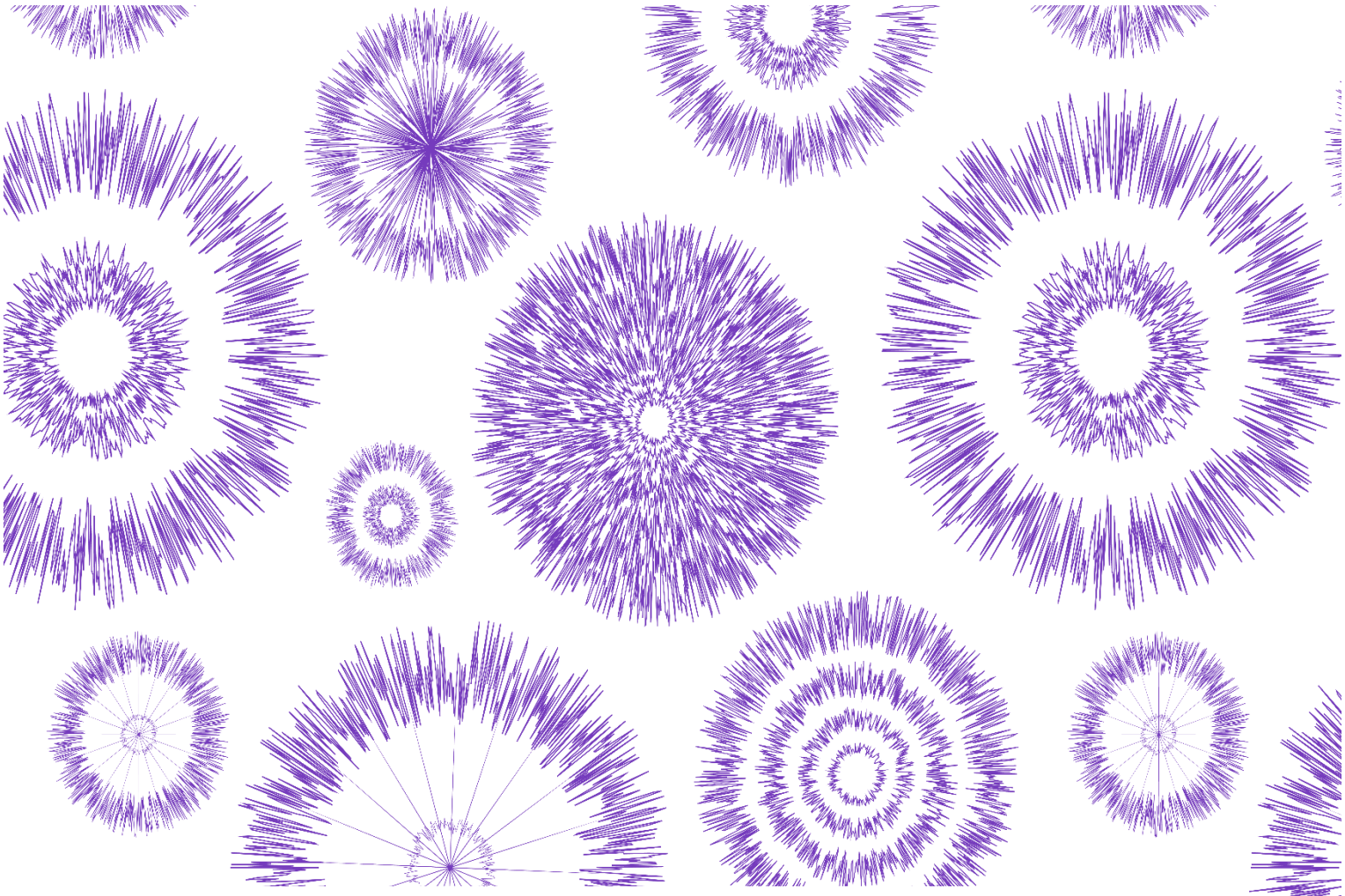
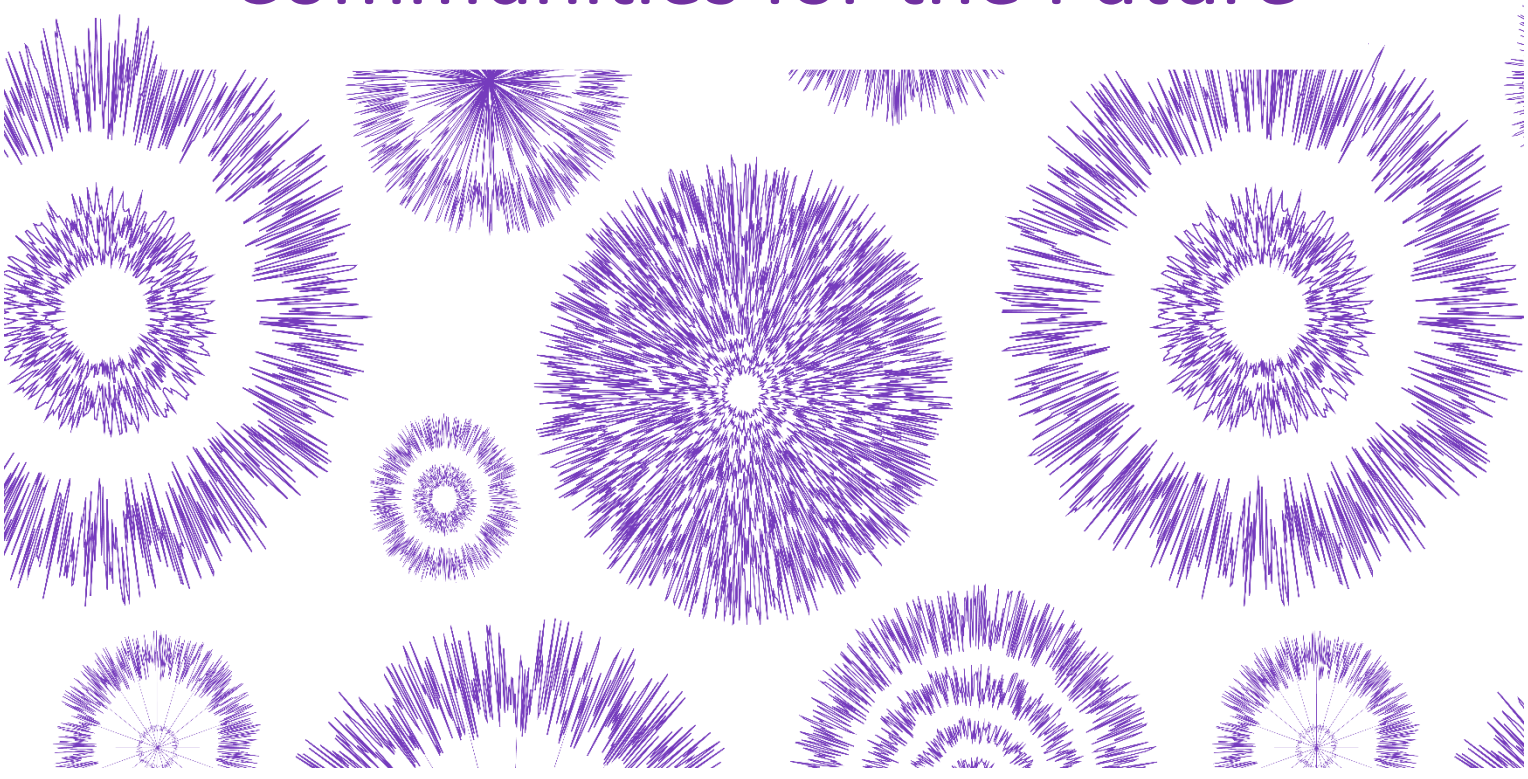
Keywords: Circular Economy, Natural and Sustainable Materials.

Abstract

Rising global temperatures and environmental pollution have put into question traditional construction materials in search of sustainable solutions. An alternative lies in the utilisation of biological materials through growing mycelium-forming microorganisms on various organic feedstocks. Newly developing research questions the possibility of utilising this organism's naturally occurring recycling properties to incorporate it within the construction industry. The root-like network of hyphae (mycelium) is an organism responsible for nutrient sourcing and transportation for the growth, and reproduction of fungi. Growth requires access to an organic substrate to decompose and subtract nutrients from (Biala and Ostermann 2024). This naturally occurring process has been developed within lab environments to create naturally formed structures, (Agraviador, 2024) and combined with various feedstocks to create mycelium-based composites (MBCs). Due to their porous structure, these materials have similar acoustic and thermal performance to their synthetically produced counterparts and derive from organic materials (Elsacker et al. 2019). This paper discusses the suitability of mycelium-based materials in relation to; resource sustainability, durability, recyclability, feasibility, and pollution through investigating existing case studies and analysing current research. An analysis of companies currently developing these products regarding the costs, scalability, and limitations alongside a comparison to traditional construction materials regarding key factors such as acoustic, and thermal insulating capabilities has been explored, alongside a prediction of future projection. The research was conducted with a pragmatic and postpositivist mixed-method approach with primary data collected through a survey design. This provides a comprehensive insight into the use of mycelium as a potentially sustainable and innovative building material, alongside the necessary development for its implementation in the construction industry.



Resilient Infrastructure Design: Safeguarding Communities for the Future



#486 - Examining the Challenges of Cloud Data Management Usage in the South African Construction Industry

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Keywords: Challenges, Cloud Data Management, Efficiency, South African Construction Industry

Abstract

The construction industry globally is undergoing a significant digital transformation driven by innovative technologies such as cloud computing. Despite the numerous benefits of using cloud computing services, there are still some notable barriers to its full-scale adoption in the construction industry. Hence, the paper aims to examine the barriers of cloud data management (CDM) usage within the South African construction industry (SACI). The study adopted a quantitative research methodology using a closed-ended questionnaire that was distributed to construction professionals and IT experts with construction experience based in the Gauteng province in South Africa, and 104 responses were recorded. Principal component analysis (PCA) and descriptive statistical procedures were used to analyse the data as part of the exploratory factor analysis (EFA) using the computer program SPSS. The study revealed the diverse range of barriers that significantly affect the effective adoption of CDM to be privacy concerns, lack of awareness, data security, and risk of data breaches in data centers of cloud service providers categorized into clusters like 'Operational and regulatory', 'Data security and privacy', 'Technological proficiency', 'Standardization and reliability', 'Infrastructural and Organizational' and 'Economic, Trust and Compliance' from the EFA analysis. To address the obstacles, CDM service providers can drive the usage of these services through establishing targeted awareness educational programs working closely with construction professionals, and the collaborative approach between built environment stakeholders and cloud providers can help tailor improved regulatory framework to the SACI's needs.

#586 - Community resilience; people, place, and practice

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Keywords: Resilient Community, Housing, Built Environment and Older People

Abstract

This paper explores the outputs from the Almshouse Resilient Communities (ARC) for the Future project. Increasingly global challenges require us to look at ways to increase resilience in our communities. Research on resilience has examined topics such as infrastructures and planning, in social science resilience research has typically been with disaster-struck communities. Little research on resilience has combined both built environment and community and we sought to address this gap. We conducted our research with almshouse communities in the UK, almshouses offer long-term, independent living to typically older, poorer residents. Almshouse communities include both the built estate and the human community within a specific geographic location. We applied qualitative methods through interviews and focus groups with 102 residents, staff and trustees of almshouse charities, and conducted site visits and document reviews. From our abductive thematic analysis, we identified four overarching clusters of factors contributing to resilience; this paper focuses on themes contained in two of those clusters: 'Enhancing the built environment' and 'Valuing and supporting people'. The two clusters are closely linked: good design can provide spaces for community relationships to develop; a robust maintenance regime protects current assets and strengthens personal resilience by removing worries. Analysis of the role communal space plays in the daily lives of older people in almshouses, enables speculation on the importance of providing opportunities for social interaction when designing and adapting housing for society more generally, reinforcing the connection between physical and mental health and housing for designers and housing professionals. We can conclude that resilient communities need to consider the built environment and the people within it and the reciprocal interactions between them. The research is presented through a Knowledge Hub for residents, almshouse charities and housing providers.

#587 - Behaviours, Attitudes and Opinions of Micro-mobility and Vulnerable Road Users: A European Study

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Keywords: Road Traffic Accidents, Road Safety, Living Labs, SOTERIA Project.

Abstract

If many national road safety policies are to be achieved, especially those aligned to the EU's Vision Zero goal of zero fatalities on European roads by 2050, they require a much deeper and wider understanding of micro-mobility (e.g. motorcycles, mopeds, bicycles, scooters, etc.) and VRU (e.g. pedestrians, horse/pony riders, wheelchair users, etc.) behaviours, attitudes and opinions. As part of the EC/UKRI-funded SOTERIA Project (2022-2026), this study presents some of the insights from a Europe-wide online questionnaire. This was available in English, German, Greek and Spanish languages and received >700 responses. Some of the headline observations from the analyses are: (i) Nearly all participants from the motorcycle and bicycle groups stated that personal safety is always a consideration when travelling; (ii) Many participants indicated that the safety, length and familiarity of their route are the most important considerations influencing their travel decision-making; (iii) Almost three quarters of participants indicated they are uncomfortable sharing space (roads or pavements) with other VRUs; (iv) Nearly all micro-mobility participants claim to obey road signs and stop when traffic lights turn red but almost half of them acknowledged that they deliberately take risks (e.g. swapping lanes to avoid slowing or stopping, kerb-jump on to pavements to avoid slowing or stopping, weave between motor vehicles, other micro-mobility users and/or pedestrians to avoid slowing or stopping); (vi) Whilst there are no statistically identifiable differences in the psychological traits of the different participant micro-mobility and VRU groups, there are statistical differences being the male and female participants. All these findings will now be used to inform the functions and features of a safe/clean routing mobile phone app being developed by the project partners. You can follow the project on social media or find out more at https://soteriaproject.eu/.

Responsible Innovation in Sustainable Design: Ethical Considerations and Best Practices

#505 - Do Built Environment Students Want Feedback?

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Keywords: Feedback, Built Environment, Pedagogy, Innovation.

Abstract

Feedback is a fundamental building block of Built Environment education For undergraduates, it is often the first-time students have transitioned from a more supervised and directed style of learning to becoming independent self-directed learners. As independent learners, feedback is arguably of key importance as it offers reassurance and guidance. Therefore, a failure to engage with feedback, could have detrimental impacts on the learning experience. Arguably, it is the students who achieve lower grades who are in most in need of feedback. However, there is a gap in current knowledge with regards to which students access the feedback available, and if this feedback is then actioned. This study aims to understand which students engage with feedback and what this engagement looks like. The grades and feedback engagement records of 494 students were analysed. This was then followed up with 12 student interviews. Analysis of student feedback requests reveals that interestingly, the higher a student's grades, the more likely they are to request and action feedback. It appears the students in most need of feedback are the ones least likely to request and action it. The impacts of this research can help inform Higher Educational feedback policy and help support Built Environment students who could benefit the most from feedback, but are often not aware of the benefits feedback provides to become more resilient learners.

Smart Cities and Environmental Sustainability: The Role of Digital Solutions

#557 - Investigating the Impact of BIM Implementation on Mitigating Construction Delays in Building Projects in Bangladesh

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Keywords: Building Information Modeling (BIM), Construction Delays, Project Management and Efficiency Enhancement.

Abstract

Construction delays are a persistent challenge in Bangladesh's construction industry, impacting project timelines, costs, and overall efficiency. This study investigates the potential of Building Information Modeling (BIM) to address these delays by enhancing communication, streamlining processes, and improving project management practices. Through a comprehensive examination of BIM's effectiveness, adoption levels, and implementation challenges, this research aims to deepen the understanding of construction delay factors and promote the effective application of BIM in Bangladesh. Using a mixed-methods approach, including literature review, survey analysis, and qualitative interviews, data were collected and analyzed to assess the role of BIM in mitigating construction delays. The findings reveal insights into the main factors contributing to delays, the current state of BIM adoption, and the challenges faced in its implementation within the Bangladeshi context. Results indicate a significant correlation between BIM adoption and reduced construction delays, highlighting the potential of BIM as a transformative tool in the construction industry. Key findings include highly significant factors contributing to delays such as owner decisions, design modifications, and poor site management, as well as the emerging adoption of BIM in Bangladesh, despite challenges like lack of expertise and resistance to technology. Despite these challenges, BIM has shown promise in reducing delays, particularly in areas such as design changes, shifting owner decisions, and poor site management. In conclusion, this research underscores the importance of embracing technological advancements like BIM to address the complex challenges faced by the construction industry in Bangladesh. By leveraging BIM's capabilities, stakeholders can improve project management practices, streamline processes, and ultimately achieve timely and cost-effective project delivery.

#484 - Unlocking brownfield project delays by leveraging on the nexus of digital technologies: A review

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Keywords: *Circular economy, Digitalisation, Sustainability, Urban revitalisation,*

Abstract

Inner cities are characterised by derelict, dangerous, high-rise buildings no longer fit for purpose. This review encompasses technological solutions, including Generative AI, Blockchain, Digital Twins, and Modular Integrated Construction. It aims to understand their roles, opportunities, and challenges in revitalising urban spaces whilst integrating sustainability practises through circular economy processes. Through an extensive analysis of recent research and practical applications, the paper highlights the transformative potential of these technologies in optimising circular economy processes and enhancing sustainability outcomes. However, it identifies critical challenges such as financial constraints, integration complexity, and data management. The paper recommends that stakeholders collaborate closely, navigate challenges effectively, and capitalise on technological innovations to create more inclusive, resilient, sustainable, and liveable urban environments.

#469 - An Evaluation of Regulatory Documents Towards Automated Compliance Checking in Green Building Design

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Keywords: Automated Compliance Checking, Green Building Design, Regulatory Documents and Requirements Taxonomy.

Abstract

Regulatory frameworks related to building design are typically complex, encompassing extensive sets of rules and regulations. In the case of green building projects, this includes both regulatory requirements and guidance documents. Previous studies have indicated that these documents often contain subjective criteria, which makes it challenging to implement automated compliance checking effectively. Most efforts to automate compliance checking are objective in nature. However, there is a lack of initiatives aimed at automating the compliance checking process specifically for green building designs, and there is insufficient documentation on the systematic evaluation of legal documents within the green building domain to ensure efficient automated compliance checking. Therefore, the aim of this research is to conduct a thorough evaluation of the legal documents pertaining to green buildings in order to propose requirements taxonomy for integrating automated compliance checking into the design process of green buildings. The study adopted a qualitative research approach. The LEED regulatory document was analysed to extract and categorise the design requirements. The semantic and syntactic information elements were employed to establish the requirements taxonomy. The study provides a taxonomy for the requirements and ambiguities contained in the regulatory document guiding green building designs.

Sustainability and Social Responsibility: Creating Equitable, Eco-Friendly Solutions

#518 - Exploring the Powerlessness of Pakistan Construction Professionals Towards Mainstreaming Sustainability

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Keywords: Sustainability, Construction Professionals, Behaviour and Controlling Beliefs.

Abstract

Many traditional barriers towards adopting sustainability in the built environment have been overcome over the past thirty years since 1994 when sustainable construction was conceptualised. For instance, there is increasing awareness about sustainability, and there are now multiple regulations, tools, strategies and assessment methodologies to guide its successful implementation. However, the current academic literature suggests that adopting sustainability in emerging economies like Pakistan could be more evident. Most research efforts have been made to give solutions for addressing sustainability issues in the construction sector through organizational change. However, there seems to be little understanding of the problems which construction professionals are facing in the form of socio-psychological controlling beliefs about sustainability. Using the theory of planned behaviour, this ongoing research attempts to fill this research gap by investigating the non-volitional controlling factors that might be influencing Pakistani construction professionals' actions. Semi-structured interviews were conducted with Pakistan construction professionals as part of a qualitative narrative inquiry. The research findings of ten interviewees indicate that construction professionals feel powerless as they cannot translate their behavioural intention towards adopting sustainable practices due to non-volitional contextual factors, which include lack of government reinforcement, unwillingness of clients, and limited budget. This research-in-progress will help policymakers to improve national policies and take initiatives in the form of incentives and subsidies to facilitate construction professionals towards embracing sustainability. There is also a need to conduct a nationwide campaign to encourage local clients to adopt sustainable construction. This research offers future research works to track changes over time to facilitate a deeper understanding of the behavioural change and evolving dynamics of sustainability adoption within the construction sector.

#481 - ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS OF OIL EXPLORATION: STRATEGIES FOR SUSTAINABLE REGENERATION OF THE NIGER DELTA

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Keywords: Environment, Niger Delta, Regeneration, Sustainable development.

Abstract

The Niger Delta has been immensely subjected to huge environmental, social and economic (ESE) challenges arising from oil exploration and production. Despite being blessed with abundant natural oil and gas resources, the region possesses some of the lowest developmental indices known in the modern world. To many, the negative outcomes rendered by crude oil exploration and production in the region have outweighed the positive contributions culminating in the absence of visible sustainable development. Therefore, the aim of this paper is to explore the impacts of the oil exploration activities with a view to recommending practical strategies for the regeneration of the region. The study adopted a mixed method research approach to gain an in-depth insight into the Niger Delta crisis and obtained primary data using 15 semi-structured interviews and 262 questionnaires which were administered to government ministries, departments, agencies, key leaders of the affected communities and representatives of oil producing companies operating in the area. Participant selection during both surveys was based on residency in the area, knowledge of the oil industry and experience of the impacts of industry-related operations. Findings from the study revealed that the Niger Delta is plagued by colossal environmental, social and economic challenges that must be addressed for any meaningful and sustainable development to occur. The degradation of the environment - which included pollution of lands, water systems and the air quality - has negatively impacted the biodiversity and caused irreversible damage to the built environment and sustainable development goals of the communities. Consequently, the paper recommended some notable solutions for the ESE regeneration of the area which included total environmental cleanup and remediation of the polluted water bodies and farmlands, economic empowerment, diversification of the local economy away from oil, accelerated energy transition to sustainable renewables, policy reforms, strict regulatory compliance and enforcement regimes.

#485 - Identifying Competencies for Procuring Equipment Facilities in Public Tertiary Institutions Towards a Sustainable Procurement

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Keywords: Equipment Facilities, Public Tertiary Institutions (PTIs), Procurement, Sustainable Procurement.

Abstract

Public tertiary institutions (PTI) often face challenges in the procurement of public educational facilities (i.e., buildings, equipment, roads, ICT, etc), leading to delays, cost overruns, and substandard infrastructure delivery. This in turn, affects the efficiency of the teaching and learning environment. Recently, requirements for procurement functions, competencies, and skills have become multi-disciplinary, cutting across several range of skill-sets to facilitate a more sustainable teaching and learning environment. However, a comprehensive understanding of the competencies required in the procurement of different types of equipment that support effective and sustainable teaching and learning in PTI is lacking. This study identifies the competencies required for the procurement of equipment in PTI. The study collected data from procurement personnel in public institutions within Kaduna, Nigeria through a questionnaire survey. A response rate of 40% was retrieved. The results show that all the competencies identified from the literature are critical in the procurement of equipment in PTI. However, the result shows that the 'application of national procurement law & procedures', 'tendering', 'communication (oral/written)', 'procurement planning', and 'quality management' are the top five with the highest importance in the procurement of equipment in PTI. The study therefore, recommends that procurement personnel within PTI should focus more on improving competencies in the areas of 'cultural awareness', 'business case development/business planning', 'entrepreneurship', 'application of corporate social responsibility procedures', 'stress management' and 'application of corporate social responsibility procedures.

#475 - Pioneering Large-Scale Construction through 3D Printing: A Critical Review

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Keywords: 3D printing, construction, large-scale, digital fabrication, sustainability.

Abstract

The integration of 3D printing technology in the construction industry presents a change in thinking in the conception, design, and construction of large-scale structures. This paper provides a critical review of pioneering endeavors in utilizing 3D printing for large-scale construction projects. Drawing from extensive literature and discussions, we examine the multifaceted aspects of 3D printing, including materials, methods, case studies, structural performance, sustainability, challenges, and future directions. The review begins with an exploration of the materials and methods employed in 3D printing for construction, highlighting advancements in materials such as concrete, fiber, and composites. Case studies of notable projects, ranging from houses to architectural pavilions, are analyzed to elucidate design, construction processes, challenges faced, and outcomes achieved. Structural performance and engineering considerations are critically assessed, evaluating the mechanical properties, durability, and safety of 3D-printed components and structures. Sustainability emerges as a key theme, with discussions centering on the environmental benefits and challenges of 3D printing in construction, including waste reduction, energy efficiency, and life cycle assessments. The review concludes with an examination of the challenges and future directions of 3D printing in construction, identifying scalability, regulatory constraints, and technological advancements as areas requiring further attention and research. Through a comprehensive analysis of the literature, this paper contributes to a deeper understanding of the transformative potential of 3D printing in pioneering large-scale construction projects. Insights gleaned from this review inform ongoing efforts to advance the field of 3D printing technology and its application to sustainable and innovative construction practices. Furthermore, the potential outcome of this research is to leverage the insights gained to develop an in-house 3D concrete printer. This endeavor aims to utilize the knowledge and understanding acquired to construct a bespoke 3D printer tailored to the specific needs and requirements of our organization, thereby enabling us to explore novel avenues in large-scale construction projects.

#455 - Assessing the Sustainability Potential of Using Hempcrete

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Keywords: Hempcrete, Sustainability, Life cycle assessment and Carbon sequestration.

Abstract

Hempcrete is a construction material construed of hemp and lime, its profile has begun to favour sustainable construction methods. The material is grown without chemicals and requires little water. Hempcrete removes carbon dioxide from the atmosphere through the process carbon sequestration. Hempcrete improves the energy efficiency of walls, flooring, and roofs. The use of the material however has had skilled labourers and contractors unsure of its use, it's clear that a future in hempcrete requires further education for those that are installing hempcrete.

The aim of this research was to review the sustainability benefits of hempcrete and how it can educate the construction industry in lowering carbon output through material selection. The objectives of this research were to investigate the properties of hempcrete when used as a building material contrasting with the barriers in practice when selecting materials. The second objective was to analyse hempcrete product data to reiterate its benefits against traditional materials.

The research was guided by a pragmatic worldview, with a quantitative phase assessed technical data supplied by manufactures of hempcrete worldwide; the materials thermal conductivity, compressive strength and carbon footprint was compared against concrete. As a result of the data a set of questions were developed for the qualitative phase. The survey was deployed to the architecture and construction industry (ACI) with the highest denominator being Architectural Technologists and establishing why these stakeholders do not currently use hempcrete. The pragmatic approach facilitated the integration of quantitative and qualitative data, with the technical data providing the justification for the survey questions. The conclusion of the survey is that the ACI lacks knowledge within the area of hempcrete and its comparison to traditional materials. To combat this gap, recommendations of cpd, further research into case studies where hempcrete has been used and attendance of workshops addressing different sustainable materials.

#534 - Cement Replacement in Concrete: A Review of Research Trends, Challenges, and Future Directions

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Keywords: Concrete mix, sustainability and cement replacements.

Abstract

In the field of sustainable concrete practices, this review paper focuses on the concerns of the high percentage of embodied carbon dioxide present in the earth's atmosphere by addressing the pivotal impact concrete has on this. Cement being a main ingredient in concrete has a great share in the amount of carbon dioxide embodied into the world. The substantial environmental impact of cement production on a regular basis underscores the urgency to explore alternatives and substitutions. Previous studies by scientists and engineers have successfully demonstrated the viability of partial cement replacement by percentages in concrete by enhancing its properties and reducing the environmental impact.

This review paper will focus on the idea of potentially complete cement replacement in concrete. This potential idea is build based on the foundation laid by previous engineering researchers and scientists that have explored and delved into the study of potential and possible cement replacements. By recognizing that cement is a major and a main component in concrete and is a major sustainable challenge to overcome, the analysis of previous results and research will be explored based on the feasibility and implication of eliminating cement entirely from the concrete mix. Numerous tests performed previously has been conducted and recorded on partial cement replacements have shown promising results indicating the suitability of cement-free concrete for low to medium structural applications.

This review goes beyond traditional studied that gradually replace cement, instead it highlights a paradigm shift towards complete replacement. A critical evaluation of existing research and findings with the aim of contributing to a more sustainable future for concrete applications. By conducting a critical evaluation and an inclusion and exclusion method to identify the gaps in the analysis, this review paper will not only highlight the successful partial replacements of cement but will also identify the gaps in literature, providing a guiding future investigation and prompting a more environmentally friendly and a conscious approach towards the concrete production in the engineering world. Being an informative resource for both industry experts and newcomers.

#472 - How architectural designs have been altered to accommodate global warming and the ever-changing environment.

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Keywords: Global Warming, Designs, Sustainability and Environment.

Abstract

Currently, our environment has been shaped in large by human activity (National Geographic Society, 2023). Following the industrial revolution's technological advancements, pollution introduced by those advancements has already caused a significant negative impact. The construction industry currently contributes to 38% of all greenhouse gasses (World Business Council for Sustainability Development). While there are measures in place to lessen greenhouse gas emissions and become more sustainable, are designs evolving so they can appropriately react to this ever-changing environment?

This issue is relevant because designers impact construction projects. Therefore, it is the duty of designers to modify standards, influence projects and adjust the construction sector. While new laws and regulations are being implemented to promote sustainability, what steps are designers adopting to address the harm that has occurred?

The purpose of this paper is to determine if construction designers are adapting plans to account for the extremes that are happening now and will happen in the future. The research papers main aim is to gather information and viewpoints from industry professionals to determine whether they comprehend the effects of global warming, whether the extremes that will occur are considered throughout the design stage, and whether this research paper will persuade other designers in the construction industry to take these issues into consideration.

To gather information and opinions from those in the construction industry, a mixed methods approach and the constructive worldview has been employed. Surveys, case studies, and interviews has been used to collect data to gather professional's opinions and whether the construction industry are aware and accommodating extremities in their designs.

In conclusion, designers are aware of the effects caused by the ever-changing environment but don't design to accommodate them. An increase in education based on the matter would be beneficial as well as developing standardised designs to accommodate the extremities.

#508 - Quantifying the Social Value of the UK Construction Industry

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Keywords: Communication. Reporting. Contractors, Social Value.

Abstract

Since the introduction of the Social Value Act in 2012, a focus on time, cost, and quality is no longer sufficient to guarantee procurement success. However, to only communicate social value achievements as part of tender submissions may be viewed suspiciously. Therefore, many construction contractors produce annual reports showcasing their social value. Despite this, the construction industry is often viewed negatively, with even positive benefits (such as those arising from social value action) often ignored when forming industry perceptions. However, construction has been a leading industry for creating social value. Yet, as an industry, it often fails to effectively illustrate and quantify the positive societal benefits it creates. This failure is a problem for the whole construction industry as it proliferates the negative perceptions amongst stakeholders and serves to obfuscate the benefits the industry brings to society. The aim of this research is to quantify the annual social value construction contractors create to illustrate the positive benefits that result from industry action. A qualitative content analysis of leading contractor annual reports is undertaken. The results reveal that contrary to some stakeholder perceptions, the social value created each year by the construction industry is substantive and impressive. This research contributes to addressing negative industry perceptions and illustrating the positive societal benefits the construction industry brings above and beyond those of designing, constructing, and maintaining the built environment itself.

#546 - Flexible Working in Construction Project Management - Sustaining Team Cohesiveness

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Keywords: flexible working, hybrid working, project teams, remote working, team cohesiveness.

Abstract

Flexible working appears to be in high demand. Many project organisations that habitually worked exclusively onsite, have begun embracing flexible working to suit the needs of their teams. For this study, flexibility cuts across working from different locations, which includes your employers' workplace, working remotely, or a hybrid of both. Coupled with its growing demand, the recent outburst of covid-19 had forced many teams into flexible working. The construction industry also had to adapt swiftly to the new requirements and work arrangements. Thus, this research aims to establish the challenges of cohesiveness among construction project teams working in flexible environments and propose solutions in the form of a framework to assist project managers and their teams. A sequential explanatory mixed-methods design is adopted to collect data. Based on the feedback analysed from a pilot survey, a revised version has been developed and analysed to subsequently inform questions for semi-structured interviews. nVivo and SPSS are used to identify links between data. It is expected that the research framework will have generic applicability in project management. Recommendations are noted for future research.

#554 - Assessment of Effectiveness of Health and Safety Management System used in Building Construction Sites in Lagos, Nigeria

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Keywords: Health and Safety, Construction sites, Lagos Nigeria, ANOVA, Safety awareness.

Abstract

Construction industry is known for its inherent risks and hazards, making it crucial to establish robust health and safety practices to protect workers' well-being and mitigate potential accidents. This paper aims to evaluate the effectiveness of health and safety management systems provided in construction sites in Lagos, Nigeria. The study focuses on assessing the effectiveness of health and safety management practices within the building construction sites in Lagos, one of the largest and fastest-growing cities in Nigeria with a booming construction sector.

The study used a quantitative approach by using a structured questionnaire for professionals in relation to health and safety management in building construction sites with a sample size of 140 respondents. Respondents including project managers, civil engineers, safety officers and artisans, to gather quantitative data on the effectiveness and implementation of health and safety management in building construction sites. A questionnaire containing 78 items developed by the researcher and validated by three professionals in the industry was used for data collection.

The data collected was analysed using mean and standard deviation, while the hypothesis was tested using one-way ANOVA based on the findings. The study revealed that building construction professionals in Nigeria often put temporary safety practices in place but the implementation and continuous learning for improvement have always been the main issue. The study recommended that client should use past record on health and safety performance to prequalify contractors. Construction managers should embrace strategic approach on site such as: creating safety awareness, safety briefing, include safety matters right from the planning phase, setting safety guidelines into conditions of contract, reward workers that exhibit excellent safety performances. The findings of this study contribute to a better understanding of the implementation and effectiveness of health and safety management systems in the construction industry in Lagos, Nigeria.

#454 - Assessing the Sustainability of European Forests as a Source for Glulam Timber Production

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Keywords: Glulam, Sustainability, Production, Timber

Abstract

Glulam Timber is used in the Construction Industry as a natural alternative to structural steel. It is produced by gluing laminates of accurately planed timber together, under pressure and heat, resulting in a stable, strong and corrosion resistant structural beam. A vast amount of the European timber is grown in forests facing rising demand for sustainable raw materials (Pramreiter, et al, 2023).

Due to elevated demand, different species of timber are being tested to understand if more prevalent species or younger saplings may be used rather than traditional Spruce, European Larch and Oak (Scholtzhauer et al, 2019). This could lead to the use of alternative faster growing species expanding the availability of raw materials throughout Europe. Expanding the varieties would embrace the three pillars of sustainability: social, economic, and environmental, by creating employment opportunities throughout the product lifecycle. There is significant research about Glulam but the rationale for this undertaking is to understand the awareness of the product within the industry.

The research approach will be a pragmatic quantitative undertaking using a research method of questionnaire and literature review (Creswell & Creswell, 2023). The aim is to assess the sustainability of European forests where the Glulam timber is grown. The objective is to understand if the awareness of glulam timber would influence a willingness to pay a premium for a sustainable product grown locally rather than a less expensive import with higher embodied carbon. The questionnaire will be issued to participants both within and outside the construction industry. This is to understand awareness of Glulam within the industry and the perception of it from the wider public. The literature review will research existing papers and the European standards which the Timber Industry and forests must comply with to be certified sustainable.

Sustainable Urban Planning: Balancing Growth with Ecological Preservation

#579 - Determining The Effectiveness of Risk Process Practice In Malaysia's Urban Landscape Planning Project Lifecycle

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Keywords: Risk Management, Risk Process, Project Lifecycle, Urban Landscape Planning

Abstract

Many urban landscape planning project risks become issues if not handled early. Risk management is necessary to control these undesirable risks through a project lifecycle risk process. Risk management is a well-established topic with global applications. However, research on integrating the risk process into the project lifecycle is uncommon. This study aims to examine how well the present risk process practice works throughout the project lifecycle. The aim of the study was achieved by conducting a thorough analysis of the risk process practice in the urban landscape planning project lifecycle. Within the project lifecycle phase, the practice effectiveness examined characteristics of risk process planning, process sequentialness, and completeness of each process stage. An investigative case study was used in the research technique. An expert interview with twelve landscape practitioners overseeing urban landscape planning projects in Malaysia was used to gather data. The content analysis approach is then applied to analyse it to create a topic and categorise, describe, and synthesise a thematic map. According to the study, the risk process is insufficiently integrated into the landscape architecture project lifecycle. The process is applied ad hoc and unplanned as risk process practice, beginning in the middle of the project lifecycle phase. Secondly, the risk process is applied intermittently since the risk is applied randomly and nonsequentially over the project lifecycle stage. Third, risk process techniques are incomplete because they only cover process steps. The practice restricted project performance risk management benefits. Infective integration causes project risk to be realised late in the lifecycle, managed poorly, and executed informally. The urban landscape risk management process should be elevated in urban landscape planning practice by integrating it into the project lifecycle framework.

Traditional Building Techniques Meet Modern Sustainability Standards

#480 - On the Origin of Methodology: A sustainable construction assessment framework for UK housing

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Keywords: Modern Methods of Construction, Sustainability, Decision Making Framework.

Abstract

This research sets out to produce a practical framework for the selection of appropriate construction methodology, based on sustainability criteria, for use in the UK residential construction sector. This tool is for industry professionals to assess their construction project and compare differing methods of construction. Professionals are then provided with the most suitable methods, based on their own sustainability criteria. This may aid in the adoption of more suitable MMC. This paper aims to determine the influential criteria on sustainability in the UK residential construction sector. The opinions of relevant stakeholders are assessed as a foundation for developing a new construction methodology assessment framework. Primary data has been collected to highlight the current assessment methods used in the residential sector, along with identifying the opinions of industry professionals on the importance of sustainability criterion. Secondary data is collected from existing literature on the frameworks, and methods currently utilised by industry professionals. A new framework is proposed – the Method Assessment in Construction (MAC) – which provides a comprehensive analysis of sustainability criteria and construction methodology. Proof of the efficacy is detailed with the example of a typical residential scheme. The MAC is proposed to be used during the initial design stages to provide a suitable method of construction.

#549 - Towards Energy Efficient Homes: A Review of Retrofitting Policies in the UK

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Keywords: Retrofitting, Climate Change, Supplier Obligations, Net Zero Target.

Abstract

The Climate Change Act committed the UK to reduce GHG emissions by at least 80 percent in 2050. This ambitious target requires millions of homes to be retrofitted and, in response, the Government has implemented multiple retrofit *policies and funding mechanisms, including supplier obligations. This study presents a review of retrofit policies and compares the objectives and the carbon/energy savings achieved. The review focusses specifically on the 4 iterations of the supplier obligations that have been implemented since 1994. It finds that the supplier obligations have had similar objectives and followed similar trends in the retrofit measures installed. The study further identified the benefits and challenges of the suppliers. Obligations. The paper concludes by discussing lessons learned for the design of future policies and implementation strategies to improve the energy efficiency of homes in the UK to achieve net zero by 2050.*

#580 - Work Breakdown Structures Within Data Centre Projects: Assessing Influence and Application Strategies

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Keywords: Project Scope, Construction Planning, Lifecycle, Schedule.

Abstract

In a period marked by a skilled workforce shortage, a dynamic and an escalating workload, the acceptance of schedule overruns in the construction industry and reluctance, or potential reservations, to analyse and correct for future projects appears commonplace. Amidst these challenges, the urgency to secure project completion milestones remains as an essential mandate for clients. Despite various efforts to improve schedule accuracy, many have fallen short of unearthing solutions to the core issues. The incorporation of the work breakdown structure, according to literature, is a critical component of the project schedule, however, it is noticeably omitted from discussions around schedule overruns. Therefore, this study aims evaluate the methods in which a work breakdown structure is applied and assessed in Data Centre projects. A literature review, coupled with semi-structured interviews, focuses on which constraints and performance measurement techniques, a work breakdown structure influence. Findings highlight a lack of understanding, a misconception on the level of effort required for WBS development, a lack of WBS performance measurement techniques, and minimal meaningful literature from which to develop a person's understanding of the complexities of a WBS. This study's originality becomes apparent in shedding light on the frequently underestimated influence of work breakdown structures on Data Centre construction projects. Its value lies in its potential to enhance collaboration and alignment between client and contractor in defining project scope to achieve a successful construction timeframe.

#465 - Establishing the impact of orientation on the thermal transmission values of solid wall properties in a coastal situation.

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Keywords: Sustainable construction, Hard to Treat Properties, Optimising Thermal Efficiency, Home Environment Health.

Abstract

This research aims to demonstrate that the orientation of a building can significantly affect it's thermal performance, in regard to the building's envelope.

This research has been completed from an experiment, focused on two solid monolithic stone constructions, both of which are in a coastal town in Cornwall. This proved that further insulation strategies should be considered within the design phase of a development/retrofit which are influenced by the individual building and its surroundings.

Data logging equipment has been utilised alongside a newly developed climate chamber to collect data based on the above research. The conclusion was that the orientation has a noticeable influence on the thermal performance of the envelope of the building. Thus, further exploration is required into better understanding how to achieve thermal optimisation within the Built Environment for period buildings.

#477 - Exploring the Effect of Fourth Industrial Revolution Technologies on Ghana's Employment Landscape of Construction Artisans.

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Keywords: Construction Artisans, Employment, Ghana, 4IR Technologies, Mitigation Strategies.

Abstract:

This study investigates the effect of 4IR technologies on employment opportunities and working conditions for construction artisans in Ghana. This research adopts a structured survey to collect qualitative data on employment trends, skill requirements, and technology adoption in the construction sector. This research reveals that introducing 4IR technologies has both positive and negative implications for construction artisans in Ghana. On the one hand, adopting technologies such as Building Information Modelling, robotics, and automation has increased productivity and efficiency, thus resulting in higher demand for skilled artisans. However, the study also highlights concerns regarding potential job displacement, as machines can now automate or perform some traditional artisanal tasks. It is concluded that construction artisans need to upgrade their skills to align with the changing technological landscape and emerging roles in the industry. The study recommends implementing upskilling and reskilling initiatives to ensure CAs remain relevant in an evolving industry. This research contributes to the existing literature by focusing on the employment landscape of construction artisans in Ghana within the context of 4IR technologies. It offers insights into artisans' challenges and opportunities faced in adapting to technological changes. Further, it provides recommendations to ensure a smooth transition to the new work environment.

#530 - Assessing and Mitigating Building Defects in the UK Construction Industry: Trends, Causes, and Sustainable Solutions

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Keywords: Building defects, Bibliometric analysis, Construction industry, Research trends, United Kingdom.

Abstract

Defects in new homes have become an issue of a significant concern, which highlights the need for an urgent review of quality control processes within the UK construction industry. Improving the industry's performance requires a thorough understanding of construction defect trends, causes, and viable solutions. Despite a broad range of research in this area, a detailed review of building defects in the UK construction industry, using bibliometric methods, is lacking. By analysing the current literature quantitatively and qualitatively, this study aims to fill the gap. Using Bibliometric analysis, the study analysed scholarly publications, identified research trends, and highlighted significant authors, journals, and countries using mathematical, statistical, and graphical methods. The study highlights the main causes as low-quality materials used to minimise costs, skilled labour shortages and fast-tracked construction timeframes resulting in substandard work, all of which could be addressed through enhanced quality control, advanced technology, thorough inspections and quality audits, stakeholder collaboration, and sustainable construction. The study established the need for further research into defect prevention frameworks, economic and environmental implications of building defects, and the need for application of emerging technologies (e.g., Building Information Modelling, Internet of Things) to defect mitigation. Comparative research across regions or countries may reveal best practices and creative ways to construction building defects management.

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