Guest editorial: Climate change adaptation in the built environment

According to the State of the Global Climate Report, 2023 is a year that has broken the record for all climate change indicators (World Meteorological Organization, 2024). The global mean sea level rise rate has more than doubled during the past decade, indicating the significant threat of climate change to coastal regions. The impact of climate change is particularly pertinent to the built environment, given the relatively long lifespan of buildings and the fact that it is essential to adapt the existing built environment to deal with a climate significantly different from that in which it evolved. On the contrary, as the most significant contributor to climate change drivers through greenhouse gas emissions, the built environment has been recognised as the key agent of change in addressing the climate change predicament. Stakeholders in the built environment are responsible for leading climate-resilient developments that integrate mitigation and adaptation measures. The challenge lies in effectively achieving deep emission reductions throughout the various stages of the building life cycle: design, construction, retrofitting and maintenance. A fundamental understanding and the development of tangible climate adaptation measures for the built environment are vital to addressing such challenges.

In recognition of these challenges, an EU-funded project entitled Built Environment leArning for Climate Adaptation (BEACON) was launched in 2020 with the aim to develop trans-disciplinary and innovative research-based learning in the built environment to tackle climate change in coastal regions (Nissanka *et al.*, 2022). The BEACON project brought together experts from the University of Huddersfield, UK; the Lund University, Sweden; the University of Cantabria, Spain; the University of Malta, Malta; the University of Moratuwa, Sri Lanka; and the University of Colombo, Sri Lanka, to investigate these mechanisms. As part of the BEACON initiative, a special journal issue on Climate Change Adaptation in the Built Environment was launched to share experiences and encourage dialogue.

This special issue consists of two volumes. The first volume includes nine articles, which are published in Volume 15, Issue 3. The first two articles address detailed insights into retrofitting for climate resilience in residential buildings and the assessment of flash flood susceptibility. The next four articles offer contextual issues regarding climate change from the perspectives of knowledge, job attributes, attitudes and learning. The last three articles offer further insights into performance indicators for public evaluation of environmental management plan implementation in highway construction projects, policy coherence for resilience and climate change adaptation through nature-based solutions.

Retrofitting has become a key focus area with limited resources and competing demands in the current era. The first article sets the context for climate change adaptation in the built

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environment by assessing passive, active and renewable retrofit measures for achieving climate-resilient houses across four climate zones: tropical, arid, temperate and cold. Hulathdoowage *et al.* recommend appropriately adopting all three retrofit strategies to enhance the housing sector's climate resilience.

In the second article, Hosseini Sabzevari *et al.* assess the susceptibility of the Golestan province in the northern part of Iran to flash floods in cases of heavy downpours. It evaluates flash flood risks and predicts flood-prone areas in the northern part of Iran. Furthermore, interventions such as remapping land use and urban zoning are provided based on the socioeconomic characteristics of the region to reduce flood risk.

The next four articles offer detailed insights into climate change from the perspectives of knowledge, job attributes, attitudes and learning. Unuigbe and Zulu investigate the knowledge level of UK-built environment students in higher education institutions specific to the term "low-carbon future" (LCF). The findings reveal that LCF remains emerging, with no study specifically addressing it. It indicates a knowledge gap that could impact the grounding students require to address current and future sustainability challenges. In a related research, Janardana *et al.* identified key Sri Lankan construction professionals' job attributes in addressing climate change challenges. The findings highlight that, regardless of the knowledge of the professional category on green rating tools, carbon footprint, adaptation of renewable energies for the reduction of energy consumption, building information modelling-related applications and waste management concepts/practices, these are the foremost job attributes required for the key Sri Lankan construction professionals in addressing challenges associated with climate change.

Climate change education and awareness have become a global concern in addressing the challenges of the 21st century. Rupasinghe and Weliange explore knowledge and attitudes among schoolteachers on climate change adaptation and mitigation. The study highlights the need for and importance of changing the knowledge and attitude of primary educators, as they are the pioneers of education for the younger generation.

Ignacio *et al.* proposes a system thinking approach to e-learning on climate change in relation to capacity-building for junior high school teachers in the Philippines. It aims to assess how a system thinking approach to pedagogy compares to a conventional approach in terms of contribution to the participants' global climate change content knowledge, holistic thinking and depth and accuracy of knowledge and reasoning. The results from the statistical analysis indicated that the system thinking group obtained a significant increase in assessment scores compared with the non-system thinking group, according to predetermined criteria.

In the seventh article, Dahalan *et al.* investigate performance indicators (PIs) to assess environmental management plans implementation in highway construction projects. The analyses revealed 21 critical PIs for assessing EMP implementation in highway construction projects, grouped into four components: ecological, pollution, public safety and ecological.

In the next article, Halwatura and Amaratunga investigate the coherent approach of climate change adaptation (CCA), disaster risk reduction (DRR) and sustainable development goals (SDG) to identify concerns in policy documents addressing the coherence of CCA, DRR and SDG in the local context and propose policy coherence suggestions for resilience in Sri Lanka. The authors recommend increasing community and professional involvement, conducting more research, developing a national strategy, increasing capacity building, strengthening international collaboration and fostering multisectoral collaboration to improve policy coherence between CCA, DRR and SDGs, aligning policies with national goals and priorities and improving implementation effectiveness.

The concept of nature-based solutions, which address societal challenges through actions to protect, sustainably manage and restore natural and modified ecosystems, benefiting people and nature at the same time, is an emerging area in addressing natural hazards and the associated disaster risk. The final article by Chowdhooree *et al.* presents a study based in a coastal and seaport town in Bangladesh and explores the need for using nature-based solutions in addressing vulnerabilities to natural hazards. The research shows how human-induced activities as well as climate change-induced events have jointly contributed to hazardous situations and suggests reinstating natural environmental processes through nature-based solutions.

This collection of papers reinforces the importance of a wide appreciation and understanding of climate impacts towards the development and implementation of tangible climate adaptation measures for the built environment. This understanding requires trans-disciplinary and innovative research-based learning to tackle climate change in the built environment.

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