Guest editorial: Disruptive and innovative technologies for sustainable development in the built environment

The built environment entered the digital realm over the past decades, and it is now time for a true digital revolution. Assessment of its challenges and readiness towards digital transformations, both disruptive and innovative, presents potential competitive advantage over the competition, economic and environmental benefits and strategic vision. Future growth and economic capacity rely on human resource capacity, international competitiveness and incorporating sustainable standards (Fan *et al.*, 2021). This comes with significant risks while disruptive technology, such as 3D printing technology, continues to impact the global supply chain and logistics industry (Beltagui *et al.*, 2020). By incorporating specifically required skill sets in disruptive technology and using modern educational practices, a new mindset where disruptive technology is approached with rigour and ambition, and both hard/soft skills can be developed as specific assets to improve organisational and individual capabilities.

The Brookings Institute has indicated that America will require 100 million jobs with significant digital skills. Two-thirds of the jobs created in the last decade require either high or moderate digital skills (Muro *et al.*, 2017). The lack of enough qualified workers has been highlighted as a cause of limiting tech job growth in America (TechServe Alliance, 2018). A lack of "soft skills" will severely hamper the effort to reduce the digital skill gap. Other studies, mostly using developed country data, recognise that machines may transform the tasks underlying jobs, leaving 95% of jobs intact, but with a different profile (Arntz, 2016) and that automation will require a broad range of knowledge; most of which is less about computer programming and more about digital literacy (technical knowledge) and human skills (Cunningham and Pimhidzai, 2018).

Papers in this Special Issue

The first paper in this Special Issue, innovation in building designs to improve energy performance, reducing CO_2 emissions and minimising life cycle cost was the driver for the paper. Le Gia *et al.* researched into the design performance in the early design stages of cooling dominated buildings in hot and human climates. The case studies were conducted in Vietnam, which witnessed an exponential demand for high-rise buildings in urban areas. With high demand, came haste and complacency. Therefore, the importance and disruption of design process in its early stages. This paper exploited the NSGA-II optimisation algorithm to simulate and optimise investment cost and energy consumption, focusing on the thermal

This Special Issue is part of the research study in Engineering Skills Where they are Most Needed (No. ESMN1921\1\129), and it is supported by the Royal Academy of Engineering and the Lloyd's Register Foundation UK.

International Journal of Building Pathology and Adaptation
Vol. 40 No. 3, 2022
pp. 301-304

2398-4708
DOI 10.1108/IJBPA-06-2022-173

envelope, glazing and energy systems from preliminary design phases. Results demonstrated optimal solutions present the trade-off between energy consumption and capital cost compared to existing building design.

While Le Gia *et al.* looked into design optimisation, the second paper explores the mobile ICT in capturing and managing construction quality assurance information during the construction phase of the project, in the context of passive fire protection. Atkinson *et al.* argue that the migration from the traditional hardcopy approach into the digital space and its availably during emergency sessions were the disruptive process. Main challenges include existing and sharing of technology; people, social and user competency; technical compliance and evidence; and conventional process improvement.

Continuing the theme of disruptive technologies, the third paper by Truong-Hong *et al.* proposed terrestrial laser scanning point clouds to measure deformation for structural assessment. Laser scanning technology has the ability to provide high accuracy datasets of entire surfaces of deformation, instead of discrete locations on surfaces from traditional surveys. This process could also be deployed in sensitive, dangerous and emergency situations. Truong-Hong *et al.* demonstrated the procedure of using laser scanning data, use of segmentation for extracting data points, selection of reference surface and eliminating outlier/noisy data on deformative analysis.

The fourth paper in this Special Issue focussed on the development of an urban sustainability tool for developing countries, with specific Case Studies from Nigeria. Developing countries are experiencing drastic increase in urban growth that is not addressed by sustainability principles. Momoh *et al.* argues that to better understand how this can be achieved, there is a bespoke urban assessment tool that work within its context that can inform how developing countries could benefit not only to be sustainable today but also for the future. This paper proposes new social, environmental, economic and planning sustainability dimensions with 21 core indicators and 105 indicators of sustainability.

Jalali *et al.* explore the possibilities of learning from plants. The paper looks into biological-inspired design by exploring plant mechanisms and features to develop a new framework to approach water-harvesting design concepts. The first step defines the water harvesting mechanisms; the water problem; extraction and plant-to-design abstraction; and its application. Learning from plants' water harvesting strategies will contribute to efficiency in different disciplines in the built environment.

Last but not least, the final paper emphasised on the topological geometry to the architectural concept design process in the flow of digitalisation to explore novel architectural spaces and forms dynamic, easily adaptable to the context and surroundings. Nguyen and Nguyen explored design thinking, architectural design methods and architectural compositions to be compared with current practices. Topological design thinking and exploring architectural ideas in the digital realm presents endless possibilities as we embrace Industry 4.0 for the built environment. This paper contributes a novel design thinking based on topological geometry to be combined with modern digital technologies (e.g. BIM) in architectural design theory.

Closing reflections

The myriad of disruptive and innovative technologies aimed towards a more sustainable future for the built environment are very being encouraged and challenging. From the advancements in new technologies and borrowing technologies from other sectors to fit; new frameworks for a more sustainable building design and urban development at different points of the construction process and changing the way we fundamentally provide solutions by learning from plants and topological geometry, this Special Issue provides a snapshot on the current state of the art in a timely manner.

Eric C.W. Lou
School of Engineering, Manchester Metropolitan University, Manchester, UK
Nguyen The Quan
National University of Civil Engineering, Hanoi, Vietnam, and
Kenneth Park
Department of ESM/EAS, Aston University, Birmingham, UK

References

Arntz, M. (2016), "The risk of automation for jobs in OECD countries: a comparative analysis", OECD Social, Employment, and Migration Working Papers.

Beltagui, A., Kunz, N. and Gold, S. (2020), "The role of 3D printing and open design on adoption of socially sustainable supply chain innovation", *International Journal of Production Economics*, Vol. 221, 107462.

Cunningham, W. and Pimhidzai, O. (2018), *Vietnam's Future Jobs Leveraging Mega-Trends for Greater Prosperity*, The World Bank, Washington, DC.

Fan, D., Zhu, C.J., Huang, X. and Kumar, V. (2021), "Mapping the terrain of international human resource management research over the past fifty years: a bibliographic analysis", *Journal of World Business*, Vol. 56 No. 2, 101185.

Muro, M., Liu, S., Whiton, J. and Kulkarni, S. (2017), *Digitalization of the American Workforce*, Metropolitan Policy Program, Brookings, Washington, DC.

TechsServe Alliance (2018), *IT Job Growth Completely Stalled*, TechsServe Alliance, Virginia.

About the authors

Eric C.W. Lou joined Manchester Metropolitan University in March 2018 as a Reader in Project Management, and currently serves as the Head of International with the Faculty of Science and Engineering. Dr Lou's research is internationally recognised though his success in Newton Fund, British Council and Royal Academy of Engineering grants and journal publications with partners globally. He also served his community as a Primary School Governor. Dr Lou spent a decade in construction, higher education, information technology and environmental industries and completed over £60 m in building refurbishment and new build projects before joining academia. Eric leads the MSc Engineering Project Management programme and acts as an External Examiner at the University of Cumbria, UK and previously with the University of Salford, UK.

Nguyen The Quan joined the Hanoi University of Civil Engineering (HUCE, former name: the National University of Civil Engineering) in 1998 and was appointed as the Head of the Department of Project Management and Law in in 2012, then the Director of Institute of Investment and Construction Management in 2015. He is also an active member of the Vietnam Association of Construction Economics and was elected as the Chairman of the Vietnam BIM Academic Forum since 2019. Dr Nguyen The Quan has conducted nearly 20 research projects funded with by local and international grants, such as the Newton Fund, Royal Academy of Engineering and British Council. His research interests include sustainable construction and construction digitalisation, among others. He has published over 60 journal and conference papers. He is an active reviewer of local and international journals, namely the Journal of Financial Management of Property and Construction, International Journal of Construction Management and International Journal of Building Pathology and Adaptation.

Kenneth Park is currently Reader in Construction Management and Engineering at Aston University, UK and has 27+ years construction research and industrial experience internationally. His research and expertise lie in the areas of construction management, whole-life management, sustainable housing refurbishment, smart construction and process improvement. He is a Fellow Member of Royal Institution of Chartered Surveyors (FRICS), a Chartered Fellow Member of Chartered Institute of Building, UK (FCIOB), Senior Fellow (SFHEA) Advance HE, Fellow of Association for Project

Management (FAPM), PMP (Project Management Professional, PMI, USA) and a CCM (Chartered Construction Manager). Kenneth's research interests include construction and engineering economics, integration of design and construction, house refurbishment, BIM integration, process improvement and innovation, integrated procurement system, project management, whole life performance and sustainability.