Editorial

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As someone who has utilised a range of methodologies across their career, I was pleased to receive and review the five papers in this issue of *Engineering Sustainability*. The papers showcase a diversity of methods and share a common strength: robust, duplicable methodologies explained in extensive detail. With this backdrop the papers also take us through the construction life-cycle across different scales and types of urban environments: design at site scale; materials selection and operation at building scale; and maintenance and use of non-building infrastructures. They also remember the people who benefit from these projects – whether informal settlement dwellers, hotel guests or urban cyclists.

Focusing on the representation of social sustainability in construction projects, Sodangi (2019) emphasises evaluation from the pre-construction phase, acknowledging a diversity of views on social sustainability. Prominence is given to enhancing education and well-being, multi-generational quality of life and, therefore, long-term efficacy of a project. Methodologically, the paper suggests previous approaches to social sustainability efficacy evaluation (SSEE) are too qualitative, which is seen as a weakness and therefore makes the case for the subsequent development of a quantitative methodology. This is achieved through a qualitative collaboration with experts on aspects of social sustainability – interviews with 25 professionals in Saudi Arabia and UAE – highlighting that there is value in qualitative underpinnings to quantitative approaches. Alongside the researcher, these experts identified 60 SSEE subfactors, which were narrowed to 49 across five primary categories and then rank-ordered to enable weighting by relative importance. While the research provides a comprehensive list of subfactors, it is not clear whether end-user views on intended outcomes of the project were also included, which could be an interesting area for future work. The work focuses on meeting the requirements of a project client and workforce and the construction industry at large, as well as the end users and local community. However, Sodangi takes a positivist approach, trying to make the social aspects of a project more tangible by quantifying them for evaluation. Does this place the work more in the consultation zone of Arnstein's ladder of participation (Arnstein, 1969) rather than the partnership zone that interpretive social science research is currently championing to improve interdisciplinarity (Sharp, 2017)?

As such, the work highlights a pressing issue: how social factors are included in construction (and other engineering/infrastructure) assessments. Do all criteria need to be turned into a number? Perhaps this is the expectation of those trained in the scientific method and more quantitative disciplines such as engineering, but in a world of diverse socio-cultural values, behaviours and preferences, is that appropriate? Or is a greater understanding of the value of qualitative techniques required in some industries/sectors? The research is conducted in Saudi Arabia and UAE; would different factors be highlighted by different experts (or other groups) in different contexts? We shall return to these questions after exploring the other papers.

Moving from quantitative evaluation of the project scale to building information modelling (BIM) at the housing scale, Gavali and Ralegaonkar (2019) focus on sustainable single-storey building design for the urban poor in Nagpur, India. Through the use of a relational database and a behavioural model comprising a three-dimensional (3D) model of a building, a time simulation (4D), cost analysis (5D) and sustainability (6D), BIM's value in optimising building orientation and sustainable brick walling material is demonstrated for peak cooling load and energy efficiency. The greatest reduction in embodied energy came from recycled paper mill waste (RPMW) bricks, which was also good for peak load cooling and cost reductions.

Shifting from embodied sustainability considerations in alternative house building fabrics to operational sustainability considerations for internal building services, Rotimi *et al.* (2019) examine how cavity extraction fans affected the thermal and energy performance for a hotel located near an airport in London, UK. Through their study on a double-skin façade (DSF) system for an actual hotel rather than a prototype or computational fluid dynamics (CFD) building model, which was totally sealed for noise abatement, they present a four-stage method focusing on building description, 3D model building, thermal simulation and plant/system modelling. Results highlight the value of comparing modelled data with real data for a monitored building, examined with occupant discomfort in mind. The work also demonstrates that DSF fans improve internal temperature for a marginal increase in energy (as long as

an annual operation schedule is optimised – the best profile is when the fan is only used in summer).

Leaving the building scale and operational sustainability behind, the next paper, by Brás and Faustino (2019), focuses on maintenance of an entirely different type of structure; a concrete quay in Portugal. Filling a gap in research on the life-cycle analysis of repair actions, they utilise a complex empirical methodology combining laboratory testing, well-established corrosion laws, design life calculations and Monte Carlo in a probabilistic approach. Examining the performance of three concrete types and two inhibitors (one additive, one surface) in four environmental exposure classes, they conclude that in some cases, increasing thickness of concrete cover at the outset was more effective in prolonging service life and reducing embodied carbon dioxide than adding inhibitors or repairs. Thus, some concretes may have a higher impact at project outset, but a lower impact across service life. Future work could include comparison of maintenance with non-concrete materials in similar environments.

Finally, in the paper by Doorley *et al.* (2019), active transport in Dublin, Ireland, is modelled using a methodology extended to consider less-examined travel cost impacts, alongside more commonly studied health and environmental impacts. Showcasing the use of big data in a smart cities sense, the methodology incorporates burden of disease variables converted into monetary values, distance travelled converted into metabolic equivalent of task, national survey data, modelled health conditions from previous studies, value of a life year, the WHO mortality database, a non-linear traffic collision model, authority collision data, a model for increased pollution inhalation and a newly introduced generalised cost of travel (GCoT) factor. They identified health and environmental costs were positive and an increase in GCoT for cyclists was offset by decrease in congestion costs; cycling may take longer, but it helps reduce congestion. However, they highlighted that some subpopulations of different demographics may experience a net negative impact from a switch to cycling, posing an interesting ethical question on how cycling is promoted and to whom – those with lower value of time? They helpfully acknowledge

future work could include choice-modelling experiments with the local population; benefits and risks experienced by different demographics of cyclists are relatively underexplored.

And so we have come full circle; Doorley *et al.* end by talking about choice-modelling experiments with the local population – lay knowledge as opposed to the expert knowledge presented in Sodangi's paper. Both papers draw our attention to an appreciation that whether the topic is cycling impacts or social sustainability in construction projects, the 'people' aspect is key. This brings us back to the focus on methods and the questions I posed at the beginning of this editorial, which are in summary: how can we enhance the standing of qualitative approaches alongside quantitative ones in the physical sciences to deepen the richness of representation of social systems within infrastructure system modelling research?

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