Editorial

Judith Sykes MEng, MPhil, CEng, FICE

Chair and Honorary Editor; Director, Expedition Engineering, London, UK

This issue of *Engineering Sustainability* highlights a common threat facing development projects around the world – that technological solutions alone will not address the sustainability crisis, and that as much of the challenge is around empowering and mobilising society to change its practices, accept different ways of doing things and adopt innovations that challenge the status quo.

This adaptation will need to be played out at multiple scales, from individual behaviours such as switching transport mode (Zhang *et al.*, 2018), to cities and states demonstrating strong leadership and good governance by implementing policies that can tackle cross-community and national issues such as pollution, air quality and energy security (Umar, 2018; Xue *et al.*, 2018).

Private sector organisations will also need to rise to the challenge, by providing attractive opportunities to fill growing skills gaps associated with sustainable development (Sing *et al.*, 2018), by working with stakeholders to develop more integrated procedures for treatment of industrial waste and by exploring business cases that enable such innovations to be viable (Wangdi and Nepal, 2018). Businesses will also need to demonstrate their commitment to improving our environment, by using the latest technical innovations to inform and improve their services (Giesekean and Pomponi, 2018).

Human health and well-being are a common theme to several papers in this issue. Sing *et al.* (2018) discuss some of the barriers preventing workers in Hong Kong from joining the construction industry. These include ‘harsh working conditions’, ‘job instability’ and ‘lack of career prospects’, highlighting the need to improve the image of the construction industry to prospective employees. There is a need to improve site safety management to reduce accidents, as well as providing more attractive workplaces that include welfare facilities such as showers and rest areas.

A barrier to career progression is the lack of routes to managerial positions for workers who are highly experienced but do not have academic qualifications. The authors recommend developing new pathways to attract skilled workers to the industry, by creating new roles such as ‘master craftsman’. Furthermore, moving away from the specialist trade approach to a multi-skilled construction workforce would create resilience for both commercial organisations and individual workers.

Public perceptions are also explored by Zhang *et al.* (2018), who carried out a feasibility study of bike sharing in Singapore. Bike-sharing schemes now operate in over 1000 cities globally, and bring multiple benefits such as reduced traffic congestion, improvements in local air quality and quicker journey times, as well as providing a healthy and active mode of transport for citizens.

The findings indicate that there is good potential for a successful bike-sharing scheme to be implemented in Singapore, with high existing awareness of the concept and a positive perception of the benefits of bike sharing. However, questions remain about what constitutes an acceptable and convenient pricing and payment structure, and the locations and availability of bicycles at different times of day.

Public health is the central concern of the review of air pollution in China by Xue *et al.* (2018). A consequence of rapid economic growth, air pollution is known to increase the risk and severity of numerous health conditions, including respiratory and cardiovascular disease, pneumonia and certain cancers (see the references cited at the top of p. 360 in the paper by Xue *et al.* (2018)). Smog is a persistent problem across the country, and it has been calculated that air pollution in China contributes to 1·6 million deaths a year (Rhode and Muller, 2015).

While regulations around air quality were introduced in China in 1982, and numerous environmental laws, regulations and programmes have since been implemented, the authors identify two additional opportunities. Firstly, their research indicates that there is willingness among citizens to contribute towards air quality improvements in their local area; this could be catalysed by providing appropriate tools and resources for people to participate in initiatives in meaningful ways. Secondly, more could be done to increase the executive power of national and provincial environmental and health agencies, so that innovative policy-making can be nurtured.

Another recurring topic in the papers is that of material flows and how to manage the planet’s natural resources responsibly. Wangdi and Nepal (2018) have evaluated the potential for adopting ‘industrial ecology’ as a strategy for sustainable economic development in Bhutan. Industrial ecology seeks to understand the flows of materials and energy through industrial systems, to

identify symbiotic linkages that could be exploited to reduce resource consumption and move away from a 'cradle to grave' approach and toward a more circular 'cradle to cradle' system. Based on a review of case study projects in Denmark, Canada and Thailand, the authors identify effective legislation, collaboration and information sharing, and diversity of industries as both barriers to and opportunities for applying the concept effectively.

The specific material flows associated with biomass electricity generation are explored by Umar (2018) in a study of Oman's biomass energy potential. The briefing estimates the amount of electricity that could be generated from two sources: animal manure and waste water. It concludes that up to 10% of the current electricity demand in Oman could be met using biomass. This would contribute to reducing Oman's reliance on fossil fuels, which currently provide 100% of its energy needs, and improving energy security and resilience.

Finally, Giesekan and Pomponi (2018) consider embodied carbon dioxide emissions in buildings from a UK perspective. Embodied carbon dioxide emissions can account for as much as 90% of whole-life emissions in a construction project, and therefore need to be addressed as part of the UK Climate Change Act 2008 commitment. Despite its significant impact, embodied carbon dioxide is seldom assessed on commercial projects, despite there being a comprehensive and growing body of publicly available guidance. Suggested reasons for the lack of adoption of embodied carbon dioxide assessments include difficulty accessing reliable product data, lack of standardisation in methods and limited reporting of results in a consistent and comparable manner. The briefing concludes that policy instruments may be required to encourage industry to evaluate embodied carbon dioxide routinely.

Collectively, these papers demonstrate the breadth of knowledge about improving our built environment that is being amassed and disseminated across the world. Despite drawing our attention to numerous challenges facing our global communities, the research nonetheless provides a positive view of societies' ability to create and manage the complex and sophisticated infrastructures needed to move towards a more sustainable future.

The Institution of Civil Engineers (ICE) is supporting work to ensure engineering skills and knowledge are used to improve health and well-being and address social challenges. The ICE Sustainability

Leadership Team recently held a half-day event on the social value of infrastructure (ICE, 2018), bringing together civil engineers with other built environment professionals to discuss how our work can inherently create value for society.

The need to focus on people was also highlighted in the recent National Infrastructure Commission report *The Value of Design in Infrastructure Delivery* (NIC, 2018), by considering user experience, using good design to encourage more people onto public transport and providing enjoyable and fulfilling working environments.

REFERENCES

- Climate Change Act 2008. *Chapter 27*. Her Majesty's Stationery Office, London, UK.
- Giesekan J and Pomponi F (2018) Briefing: Embodied carbon dioxide assessment in buildings: guidance and gaps. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 334–341, <https://doi.org/10.1680/jensu.17.00032>.
- ICE (Institution of Civil Engineers) (2018) <https://www.ice.org.uk/eventarchive/social-value-of-infrastructure-london> (accessed 29/08/2018).
- NIC (National Infrastructure Commission) (2018) *The Value of Design in Infrastructure Delivery*. NIC, London, UK. See <https://www.nic.org.uk/supporting-documents/design-task-force-the-value-of-design-in-infrastructure-delivery/> (accessed 29/08/2018).
- Rohde R and Muller R (2015) Air pollution in China: mapping of concentrations and sources. *PloS One* **10**(8): e0135749, <https://doi.org/10.1371/journal.pone.0135749>.
- Sing MCP, Tam VWY, Fung IWH and Liu HJ (2018) Critical analysis of construction workforce sustainability in a developed economy – case study in Hong Kong. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 342–350, <https://doi.org/10.1680/jensu.17.00007>.
- Umar T (2018) Briefing: Towards a sustainable energy: the potential of biomass for electricity generation in Oman. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 329–333, <https://doi.org/10.1680/jensu.17.00001>.
- Wangdi SC and Nepal MP (2018) Towards the development of eco-industrial estates in Bhutan. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 368–379, <https://doi.org/10.1680/jensu.15.00059>.
- Xue B, Butler T, Ren W *et al.* (2018) Reviewing air pollution and public health in China. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 358–367, <https://doi.org/10.1680/jensu.16.00056>.
- Zhang J, Koh PP, Meng M, Leow BW and Wong YD (2018) Feasibility study of bike sharing in Singapore. *Proceedings of the Institution of Civil Engineers – Engineering Sustainability* **171**(7): 351–357, <https://doi.org/10.1680/jensu.16.00082>.