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Editorial

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Editorial: Towards a systems view of infrastructure: a critical need, a massive gap

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When we talk about the significant and critical role that civil engineering infrastructure had, and continues to have, in the development of society, the systems aspects of these assets are only generally implied. In the last several decades, the increasing need to meet sustainable development objectives in asset planning, design and management required more explicit considerations of their environmental and social impacts in addition to the more traditional focus on technical, functional and economic performance. This has led to design and assessment frameworks for engineered assets that consider at least four, and sometimes even more 'bottom-lines' (i.e. 4BL or 5BL) in decision making (Foliente *et al*., 2007).

When civil infrastructure is seen as part of a larger whole requiring the above considerations, the approach to its feasibility assessment, design and analysis, construction, maintenance and end-of-life options will also require a more integrated systems approach (Labi, 2014). The tasks and challenges at each phase will have broader scope relative to the traditional approach, and some of these need to be carried over from one asset life cycle phase to another, if not for the whole life cycle. Contributing to this goal, the Institution of Civil Engineers recently published guidance on how a systems approach can improve the delivery of complex infrastructure projects (Crudgington, 2020).

But not all 'systems' are the same. In other words, just invoking the term is not sufficient. A clear definition of scope and boundary (or inclusions and exclusions) needs to accompany any systems approach to, or analysis of, a project. A description of context (i.e. governing constraints and specific purpose of application in research and/or practice) is also needed. Altogether, they provide valuable information when understanding the nature and range of potential benefits, value or impacts of certain asset management decisions.

Conversely, allocating and prioritising resources to assess, mitigate and manage risks – for example, those related to normal wear and tear, sustained chronic stress loads and/or extreme events such as intentional attacks and those caused by climate change that can lead to performance degradation or failure scenarios – also require information about an infrastructure system's scope of considerations and context because the potential extent of socio-economic impacts depends on these (Hasan and Foliente, 2015).

The present issue is not strictly a themed issue about infrastructure systems. The preceding paragraphs briefly outline the key issues needing further consideration towards a more holistic view of infrastructure as a critical element and enabler of societal development. And while the articles in this issue are based on independent motivations, with each one having different focus and set of objectives, they all note the benefits to – and/or the roles or influence of – different stakeholders in their studies. In other words, they present some consideration about the social factors in a systems view of infrastructure. The four articles are mostly exploratory or initial studies with findings based on a specific case study or scope or limited data, but the specific context and current limitations are well described. As the authors outline the areas for further enquiry or research, they also hint towards themes related to a systems approach as noted above.

Ninan *et al*. (2022) explore the implications of strategic discourses (as gleaned from semi-structured interviews, news articles and social media) that occur pertaining to asset management at project, programme and portfolio management levels. Focused on a case study of a metro rail asset in India, the authors found that strategic discourses affect decision making, indicating an overemphasis-of-time rationality or urgency bias. They note the power shifts of stakeholders as the project moves from one phase to another. This means that the concept of 'community' needs to be expanded to all stakeholders because those that are usually considered to be on the periphery of a specific asset's service or performance can also have influence and can also be impacted, especially through social media. They recommend that megaprojects should also have a media strategy not just an engineering strategy. I should add that a more disturbing implication is that key decision makers may be susceptible to misinformation or targeted mainstream and/or social media campaigns.

In the article by Madhusanka *et al*. (2022), the authors extend the application of relationally integrated value networks for total asset management (Rivans-Tam) – which links project management with asset management – from single project/asset management to project portfolio management, and to include ongoing construction projects with operational assets. Based on interviews of people representative of built asset intensive organisations in Hong Kong, their findings provide a basis to "unlock the potential synergies from 'overall best value'-focused relational integration of hitherto disconnected diverse stakeholders" (Madhusanka *et al*., 2022; p. 123). However, at specific project levels, there are relevant stakeholder issues raised in Ninan *et al*. (2022) – such as stakeholder power shifts in different project phases and the potential influence of strategic discourse, particularly the public ones – that will also be important to this study.

Akaa *et al*. (2022) present a method for cost-effective reinstatement of pavement markings considering an exemplar scenario and conditions related to rural strategic roads of the New Zealand state highway, but they note the need for further work that considers more complex scenarios and uncertainties.

Considering uncertainties in future mobility patterns and infrastructure management flexibility, Martani *et al*. (2022) explore the use of a quantitative evaluation method using real options to evaluate designs for a fictive case study of a highway (with tunnel and bridge) in Switzerland. Their method shows potential by clarifying the rationale or justification for design choice considering the effect that uncertain future mobility patterns have on a variety of stakeholders. They identify where further research are needed.

This issues' collection of articles highlights the importance of considering the social and stakeholder dimensions in infrastructure asset design and management within the scope and context of the respective studies. But these are clearly baby steps in the overall scheme of developing a systems view and approach to whole-life infrastructure planning, delivery and management that will serve society as a whole. Infrastructure Australia, an independent statutory body that provides advice for Australian governments, industry and the community on nationally significant infrastructure needs, recently produced a series of reports, starting with its holistic systems-based reform agenda, to achieve their 2036 aspirations (Infrastructure Australia, 2021). A real-world agenda has been laid out. Broad and deep transdisciplinary research collaborations towards this goal cannot start soon enough.

REFERENCES

Akaa O, Douglas D, Arrowsmith D and Darnell M (2022) An asset management methodology for value-for-money reinstatement of pavement markings. *Infrastructure Asset Management* **9(3)**: 156–168, https://doi.org/10.1680/jinam.21.00026.

Crudgington A (2020) *A Systems Approach to Infrastructure Delivery – A Review of How Systems Thinking Can Be Used to Improve the Delivery of Complex Infrastructure Projects*. Institution of Civil Engineers, London, UK.

Foliente G, Kearns A, Maheepala S, Bai X and Barnett G (2007) Beyond triple-bottom-line: Sustainable Cities RD&D at CSIRO. *Proceedings of the State of Australian Cities Conference SOAC2007, Adelaide, South Australia, Australia*, CD-ROM.

Hasan S and Foliente G (2015) Modelling infrastructure system interdependencies and socio-economic impacts of failure in extreme events: emerging R&D challenges. *Natural Hazards* **78(3)**: 2143–2168, https://doi.org/10.1007/s11069-015-1814-7.

Infrastructure Australia (2021) *Reforms to Meet Australia's Future Infrastructure Needs – 2021 Australian Infrastructure Plan*. Infrastructure Australia, Canberra, Australia.

Labi S (2014) *Introduction to Civil Engineering Systems: A Systems Perspective to the Development of Civil Engineering Facilities*. Wiley, Hoboken, NJ, USA.

Madhusanka N, Kumaraswamy MM, Pan W and Chan SYS (2022) Relationally integrated value networks for total asset management in project portfolios. *Infrastructure Asset Management* **9(3)**: 123–134, ttps://doi.org/10.1680/jinam.19.00059.

Martani C, Eberle S and Adey BT (2022) Evaluating highway design considering uncertain mobility patterns and decision flexibility. *Infrastructure Asset Management* **9(3)**: 135–155, https://doi.org/10.1680/jinam.21.00018.

Ninan J, Mahalingam A and Clegg S (2022) Asset creation team rationalities and strategic discourses: evidence from India. *Infrastructure Asset Management* **9(3)**: 114–122, https://doi.org/10.1680/jinam.19.00062.