Guest editorial

Data analytics and big data in construction project and asset management

The increasing adoption of digital technology and the rapid proliferation of data have spurred the application of data analytics and big data to drive smart project and asset management. We are likely to see the rise of new approaches to information management and data usage within the architecture, engineering and construction (AEC) sector. Transforming data and information into knowledge and intelligence would change the way projects and assets are managed and will facilitate optimal solutions across the sector. This special journal issue provides a forum to explore, develop and disseminate emerging concepts of data analytics and big data and their potential applications and opportunities in the AEC.

In the opening paper of this special issue, Marzouk and Enaba explores how data in building information model (BIM) can be furnished with descriptive analytics within the BIM environment to analyse construction project performance. They developed a dynamic model that helps in detecting hidden patterns and different progress attributes from construction project raw data. Their study assumes that integrating BIM and data analytics in a construction project is beneficial. They then validated this assumption on a case study project. Marzouk and Enaba study is interesting because by leveraging data embedded in BIM to gain actionable insight using analytics, the AEC sector can increase the benefit and value derived from BIM efforts on projects thereby increasing the adoption of BIM and big data.

The second paper by Farghaly, Abanda, Vidalakis and Wood investigates "the transfer of information from the BIM models to either conventional or advanced asset management platforms using Linked Data". Employing a participatory action research approach with focus group and interviews as well as prototyping, they proposed a process for generating linked data in the asset management context and its integration with BIM data. In view of the very limited application of BIM data for asset management, the process proposed in their paper can improve the data exchange from BIMs to asset management systems during handover stage and consequently improve asset management outcomes during the operation and maintenance stage. Applying the process that they have developed to a real-world case study of BIM for facilities management would provide empirical evidence of the value and challenges of BIM-linked data integration for asset management.

Amit Mitra and Kamran Munir focus on how big data can influence asset management. Drawing from interviews of leaders of digital transformation projects in three organisations that are within the insurance industry, natural gas and oil, and manufacturing industries, they argued that as asset information becomes a project deliverable, and as data increases in volume, velocity and variety; and as it is aggregated and re-used, there is need to improve semantic processors to deal with the vast array of data in variable formats. Evidently, the increasing volume and variety of asset management data will make the implementation data analytics inevitable if organisation must derive value from their asset information. Although the research is still in its infancy, it is interesting because it reminds us that the value of asset information does not lie in the volume of the data itself but in the insight that organisations can garner from the data to achieve better asset management outcomes.

Still on the application of big data and analytics, Jafari and Akhavian use data analytics models to predict the driving forces of housing prices arguing that this can be extremely useful in the built environment and real estate decision-making processes. Based on a data set of 13,771 houses, they developed a hedonic pricing method of the key factors that affect the residential housing prices across the USA. They tested and validated their model using 22 houses not used in models. The results of their study show that the main driving

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forces for housing transaction price are square footage of the unit, followed by location, and number of bathrooms and bedrooms. They also highlighted that the impact of neighbourhood characteristics such as distance to open spaces and business centres on the housing prices is not as strong as the impact of housing unit characteristics and location characteristics. Perhaps these factors could vary according to housing submarkets. This needs to be explored further to better understand the conditions under which specific factors are more important than the others. Over the years, there have been many analytic models of this nature developed in the academic domain. It will be useful to understand the extent to which these models are being adopted in practice and the barriers.

Turning to review papers, Madanayake and Egbu identify the gaps and potential future research avenues in the big data research in the construction industry. Based on a systematic review of publications produced over a period of 10 years from 2007 to 2017, they concluded that although there are plenty of research in the application of big data in construction, research on the implications of big data in the overall sustainability – social, economic and environmental dimensions – is lacking. They proposed up to 15 topic areas of research needed to address the use and implications of big data within these three dimensions. This paper should be useful to researchers when setting up agenda for research in this area.

In a second systematic review of the literature, Yap, Ho and Ting examine the application of different multi-criteria decision-making (MCDM) methods for the tasks of selecting the most suitable location for energy generation, logistics, public services and retail facilities. They identified the most commonly used MCDM methods as well as the most frequently used criteria. They made a very important observation that, in the near future, as built environment implement Internet of Things sensors to capture data in various formats, we would need new MCDM methods which can account for the changing nature of the various criteria in order to determine optimal site selection outcomes. Evidently, MCDM methods can benefit from big data and analytics for better decision making.

In response to the low rate of adoption of big data and analytics in practice, Ram, Afridi and Khan argue that gaining an understanding of the adoption process and the factors that drive big data adoption in construction will facilitate devising strategies and plans to increase the adoption as well as it will help digitalization of the industry. As a result, they developed a conceptual model of the factors which drive big data adoption in construction. They propose several factors that influence adoption from a theoretical perspective. Their work is useful towards the development of context specific factors influencing big data adoption. However, their model would need further empirical testing to confirm some of the factors put forward.

Despite its significance, the application of data analytics is an emerging and growing area in the AEC sector. With the increasing digitisation of built environment project and asset management, implementing big data and analytics is evitable if the AEC must derive greater benefits from digitisation efforts. The variety of papers contained in this special issue provide readers with starting point for pursuing further research in this area. Action research approach could help in developing specific strategies for effective implementation of big data and analytics in various contexts. The guest editors would like to thank all authors who submitted the papers for this special issue as well as to the reviewers for their valuable contributions. Many thanks to Professor Mohan Kumaraswamy, the Editor-in-Chief, for supporting this special issue. His encouragement made this special issue possible.

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