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EDITORIAL

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Special issue: Advances and prospect of engineering management

As an important part of engineering domain, construction engineering and management focuses on studying the planning, execution and maintenance of civil and infrastructure projects. This special issue is composed based on a collection of research papers contributed by a group of leading experts, dedicating to providing a state-of-the-art development in construction management research.

Ding and Xu review recent large-scale metro construction projects in China with a specific focus on its organization and market mode, cost structure, safety control and schedule management. Then, an examination about metro engineering of the National Natural Science Foundation of China (NSFC) is also conducted, which indicates that information and automation based technologies are increasingly used in practice.

Cao et al. develop and empirically test a model for understanding how the implementation of building information modeling (BIM) in construction projects impacts the performance of different project participating organizations through improving their interorganizational collaboration capabilities. Based on two sets of survey data collected from designers and general contractors in BIM-based construction projects in China, the results from partial least squares analysis and bootstrapping mediation test provide clear evidence that BIM-enabled capabilities of information sharing and collaborative decision-making as a whole play a significant role in determining BIM-enabled efficiency and effectiveness benefits for both designers and general contractors.

In discussing the application of System Dynamics to high-level strategic simulation in construction, Lee elaborates System Dynamics' strength on representing feedback processes, aggregation, soft variables, and continuous simulation clock for high-level simulation in real modeling examples. From this exercise, it is concluded that System Dynamics offers a great potential for strategic simulation in construction. Further, the author proposes a comprehensive simulation framework that integrates System Dynamics and Discrete Event Simulation for a strategic decision making process in construction where operational details should be taken into account.

In their position paper, Shi et al. argue that data analytics is ready to change engineering management in the following areas: 1) by making relevant historical data available to the manager at the time when it's needed; 2) by filtering out actionable intelligence from the ocean of data; and 3) by integrating useful data from multiple sources to support quantitative decision-making. Considering the unique need for engineering management, the paper proposes researchable topics in the two broad areas of data acquisition and data analytics. The purpose of the paper is to provoke discussion from peers and to encourage research activity.

Scheepbouwer et al. propose a compelling argument that the Construction Engineering Management (CEM) culture should refocus its efforts on enhancing project cost certainty rather than merely searching for means to design a project in a manner that produces the lowest initial cost and awards the construction to lowest tender offer

focusing on cost savings during the project development and delivery process. The difference in the two approaches is subtle but extremely important. To make the transition, the engineering management tools must be advanced to the next level. This means that all the project control tools for managing cost, schedule, and technical scope must be transformed from working in the deterministic mode to the stochastic mode, thus making the probability of completing the project within or below its official budget the primary decision criterion. To do so, CEMs must accept that there is a benefit in paying more for an alternative that increases cost certainty for the entire project. The authors of this paper hope that it will provide the grist for a more general dialog across all industry sectors where engineering management is practiced.

Wang and Gang introduce a general methodology for the design and control optimization of building energy systems in the life cycle. At the design stage, the design scheme of building energy systems is optimized. Primary steps and related issues are introduced. At the operation stage, the optimal control strategies for different systems are presented and key issues are discussed. To demonstrate the effect of the methods, the energy system of a high-rise building is introduced. Design on the chilled water pump system and cooling towers is improved at the design stage. The control strategies for chillers, pumps and fresh air systems are optimized at the operation stage. The energy saving and cost from the design and control optimization methods are analyzed. The presented methodology will provide users and stakeholders an effective approach for the development of smart buildings and smart cities.

Wang et al. investigate the potential of applying blockchain technology in the construction sector. Three types of blockchain-enabled applications are proposed to improve the current processes of contract management, supply chain management, and equipment leasing, respectively. Challenges of blockchain implementation are also discussed in this paper.

Avetisyan and Skibniewski develop a decision-making optimization model by incorporating logical strategies of supply chain management to optimally select construction equipment for any construction site while taking into account the costs, availability and transportation-related issues as constraints. The model benefits those responsible for informed decision-making for construction equipment selection and allocation. It also benefits the owners of construction companies owing to its cost minimization objective.

Yang et al. propose a theoretical method to analyze the postures tracked by videos with biomechanical models. Through the biomechanical skeleton representation of human body, the workload and joint torques are rapidly and accurately evaluated based on the rotate angles of joints. The method is then demonstrated by two case studies about (1) plastering and (2) carrying. The experiment results illustrate the changing intramuscular torques across the construction activities in essence, validating the proposed approach to be effective in theory.

In an original paper, Zou et al. review the energy efficiency policies/programs in five States in Australia: Victoria, New South Wales, South Australia, Western Australia, and Queensland in terms of respective policies and targets, implementation methods and current progress. The lessons learned from these programs were also discussed. This research revealed that the factors for a successful government building energy retrofitting program are 1) having a properly enforced energy efficiency mandate with clear energy saving targets, 2) establishing an expert facilitation team and 3) implementing suitable financing and procurement methods.

This special issue clearly highlights the complexity and diversity associated with construction management research. We are grateful to the Chinese Academy of Engineering (CAE) for providing generous support and guidance. Especially, we are extremely grateful to all the authors who contributed to this special issue of Frontiers of Engineering Management. We are also indebted to all the reviewers who took special care and attention in ensuring that all the accepted manuscripts reached the high standard we set for ourselves.

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Focusing on the research of Construction Engineering and Management informationization and Safety Risk Management, Prof. Ding has made outstanding achievements in the fields of safety risk identification, early warning and controlling in metro construction, and made great contribution to the improvement of safety performance in construction engineering in China. His research findings have been successfully applied in many metro and infrastructure construction projects in China. Prof. Ding has won the Second Class Award for National Science and Technology Progress twice.

Prof. Heng LI is a Chair Professor of Construction Informatics at The Hong Kong Polytechnic University. He is the Review Editor of *Automation in Construction*, and serves as editorial board members for many other journals. Heng started his academic career from Tongji University since 1987. Heng then researched and lectured at the University of Sydney, James Cook University and Monash University before joining The Hong Kong Polytechnic University. During this period, Heng has also worked with engineering design and construction firms and provided consultancy services to both private and government organizations in China and Australia. Heng has conducted many funded research projects related to the innovative application and transfer of construction information technologies, and he has published 2 books, more than 200 journal papers in major journals of his field and numerous conferences papers in proceedings. His current research interests include smart construction site management using computer vision and artificial intelligence.