

## **“Sustainable and resilient extractive and circular economies under uncertainty”**

Increased uncertainty in the global economy and business environment characterised by rapid demand fluctuations and technological breakthroughs, digitization and global disruptions, creates the need for systemic transformation of extractive and construction industries. Extractive industries such as the mining and oil and gas (O&G) sectors, and the construction industry that includes both construction and demolition (C&D) sectors have faced systemic transformative changes during recent decades. These industries now respond to increasing calls for embracing sustainability and resilience practices by dealing with the unique complexity of mining, O&G and C&D projects and by developing resilient and digitally integrated value chains particularly with recent developments of the Industry 4.0. In addition, the recent COVID-19 pandemic has demonstrated the vulnerabilities of globally connected supply chains. This has created a pressing need to develop novel organisational strategies and policy frameworks to ensure that business operations are resilient to unforeseen disruptions and to secure uninterrupted service and supply of (critical) materials and products.

Prior research has been concerned with the application of emergent technologies to improve effectiveness and sustainability of project delivery systems, and the logistics of extractive operations and construction sites. The extant research has also discussed various facets of circular economies, closed-loop supply chains and reverse logistics solutions, supply chain digital transformation and resilience. Recent global supply disruptions, which will possibly become a norm in the future, calls for novel managerial approaches, policy and regulatory frameworks, decision-support tools and technological innovations that collectively enable a critical step towards sustainable and resilient extractive and construction industries and enhance value creation for all industry stakeholders. The special issue addresses this challenge by exploring how extractive and C&D sectors manage the emerging trends and prepare to face the uncertainty through changing management paradigms and technological innovations. It aims to facilitate discussion and attract relevant research to extend the boundaries of project management and decision-making theory, policy and practice as applied to the extractive and construction sectors.

Four papers of this special issue focus on the challenges faced by the *C&D sector*. For example, Abruzzini and Abrishami discuss the limitations of the decision-making process at the end of a building's lifecycle, particularly related to the limited data available from the building's history, the difficulty in assessing the condition of a building, and the variety of stakeholders' needs to be satisfied. Authors argue that building information modelling (BIM) application can solve this problem. Kineber *et al.* examine the influence of value management (VM) and critical success factors (CSFs) on the implementation of VM activities in Egypt construction projects. The influence of VM CSFs on VM implementation is established, suggesting moderate effects and strong relationship between VM implementation activities and its CSFs. Prasad *et al.* contribute to finding some alternative cementitious material for concrete that can replace ordinary Portland cement to overcome CO<sub>2</sub> emissions due to the utilization of cement in the construction industry. An attempt has been made to utilize a waste material (high calcium fly ash) from thermal power plants and M-sand to produce a geo polymer concrete. This research analyses the type of binder material, molarity of activator solution and curing condition and contributes to the reduction of the largest CO<sub>2</sub> footprint of a single material. Onturk *et al.* analyse the recycling of waste



within the subbase of road construction. The study examines the effect of using two types of waste, granite waste and coal fly ash, on the engineering properties of road subbase fill materials (i.e. kaolinite) mixed with lime. This research could help reduce landfilling of recyclable materials.

Three papers review and offer technological and managerial solutions for the *extractive sector*. Nguyen *et al.* discusses the extractive industry experiences of deploying digital technologies to improve health risk management during the COVID-19 pandemic. The paper draws lessons learned and provide recommendations to improve the organisational capacity to envision the trajectory of digital solutions for health risk management in extractive industries. The authors claim that although EI sectors have various plans for minimizing pandemic impacts, unexpected disruptions and delays of the COVID-19 responses revealed limitations of the existing HRM system. In addition to the specific challenges of health risks in the Covid context, the transparency of health risk management is particularly importance for reputational risk for maintaining the social legitimacy of extractive industries with the broader community.

Visualisation and digitalization of the mining value chain is one of the key principles to ensure sustainable and resilient mining operations. In the mining value chains, run-of-mine (ROM) stockpiles serve for reducing the short-term variations of ore grade. Zhao *et al.* describe the development of the 3D model for ROM stockpiles, that helps to improve product quality control, which ultimately helps to meet sustainability goals and ensure more resilient operations of the mining enterprise. These new metrics are an important contributor for offsetting the chronic mining challenge of declining ore grades.

Enhancement of value creation through projects is key for mining organisations to effectively transition towards more sustainable and resilient operations. Lawson *et al.* discuss value creation in asset integrity and improvement projects of a mining company. The research uses project and portfolio value creation frameworks to critically review the current asset integrity and improvement portfolio management practices and systems in the mining company, and to suggest practical improvements to the existing practices. The authors highlight that key stakeholders need to have clear roles in the project value management and work in alignment to deliver value throughout the project lifecycle using value management tools. These efforts must accelerate to offset the negative impacts of recent mining tailings disasters.

A specific focus is placed on the *humanitarian logistics* in face of disaster interventions as a key feature of sustainable and resilient economies. Diehlmann *et al.* focussed on decision support algorithms for organising humanitarian logistics, in particular, the water supply, during disaster interventions. Their approach included preferences into bi-criteria decision making within cost and deprivation Pareto front to decide on the most favourable water supply locations. This approach is helpful to increase transparency in decision making during supply chain interruptions and can support disaster preparedness.

The papers in this special issue are focussed on a variety of aspects pertaining technological and social transformation in the extractive and construction sectors, and the role of managerial practice and technologies in facilitating these endeavours. Broadly, three key research directions were developed.

#### *Sustainable and resilient supply chains*

Three papers focus on various facets of resilient and closed-loop supply chains. Diehlmann *et al.* suggest a decision-making approach to increase the effectiveness of humanitarian logistics. Prasad *et al.* and Onturk *et al.* contribute to circular economy and closed-loop

*Industry 4.0 and digitalisation*

Digitalisation, Industry 4.0 and increased pressure for sustainable operations have further heightened the need for renewed research and political agendas. Nguyen *et al.* discuss AI-based public health monitoring, digital collaboration, 3D printing and wearable health tracking for effective pandemic response and the role of nontechnical elements affecting technology adoption in extractive industries. Zhao *et al.* demonstrate the value of mining value chain digitalisation, offering a near real-time high-resolution 3D ROM stockpile model to improve ore quality management. Abruzzini and Abrishami suggest a framework to use BIM as a digital data source, from which machine learning and data analytics would extract the relevant data needed to analyse the building end-of-life options.

*Organisational management and systemic innovations*

Tackling complexity and uncertainty is a key challenge and opportunity for value creation in extractive and construction projects. Development of innovative approaches requires utilising state-of-the-art managerial practice. Drawing on the case of an Australian mining company, Lawson *et al.* offer a framework to increase the efficiency of value management in the asset integrity and improvement project portfolio. Kineber *et al.* offer insights into sustainability in the construction industry the implementation of VM activities in building projects in Egypt. The study established critical success factors that serve as a catalyst for enhancing value of building projects.

The Guest Editorial team believes that the frameworks and models proposed in this special issue will inform researchers and industry practitioners about the current and future agenda in these sectors to facilitate transformative change.

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