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## EDITORIAL

**Editorial for the special issue of decision support for sustainable design and manufacturing**

Sustainable design and manufacturing is of critical importance to all manufacturers in order to gain competitive advantage and become economically sustainable in the long run. As natural resources become limited and energy costs keep rising, minimizing negative environmental and societal impacts while maintaining economically viable has become a paramount issue for design and creation of manufactured goods. In the progression of sustainable design and manufacturing, decision support remains as a central task in managing various complex trade-offs in materials, design, processes, and services through the entire life cycle. Several notable challenges exist, to name a few, prolonged information cycle, obscure information concerning impact assessment, complex modeling of hierarchical and heterogeneous information, data dynamics and uncertainty, and so on. Therefore, this special issue is dedicated to reveal the state-of-the-art of a broad concept of decision support in the context of sustainable design and manufacturing and endeavor how such research efforts can benefit a wider community from design and manufacturing, to business and social science.

The first paper, "The Importance of Understanding the Business Context when Planning Eco-design Activities" by Domingo, Buckingham, Dekoninck and Cornwell, offers a novel management tool called Company Characterization Process (CCP) to support design change happened in a typical project of eco-design. Essentially, CCP aims to better reflect the current status of the company which has committed to an eco-design initiative and is able to characterize seven salient features of its business context that have major impacts on the effectiveness and efficiency when executing eco-design activities. Two case studies are provided, respectively, to rationalize the proposal of CCP and demonstrate its merits in shaping early design activities in companies which are new to eco-design.

"Value Mapping for Sustainable Business Thinking" by Bocken, Rana and Short, reports their efforts in exploring how sustainable business thinking, which seeks to integrate considerations of the three dimensions of sustainability – social, environmental, and economic – can be systematically supported using value mapping as a tool and process. Among the many issues that have been discussed, one key finding particularly shows that the inclusion of multiple stakeholders and a systematic consideration of both positive and negative outcomes of doing business can provide a useful supporting framework for sustainable business thinking and it has the

potential to better consider unintended impacts and to offer greater alignment between stakeholders' interests.

"Maturity Grid Development for Energy and Resource Efficiency Management in Factories and Early Findings from its Application" by Litos and Evans, targets specifically on how management practices, systems, and processes can impact environmental performance in factories. Different from the prevailing studies centered on how eco-efficiency in production activities can be defined in a way facilitating its subsequent calculation, the authors argue that environmental performance can hardly be strictly defined numerically, and hence, present their findings primarily based on environmental performance benchmarking and guidelines in the form as a maturity grid through which system properties can be reflected and system behaviors can be analyzed.

Among the many tasks in considering sustainability in asset management, one critical challenge is to balance the trade-offs between conflicting objectives. In this regards, "A Multi-criteria Decision Support Framework for Sustainable Asset Management and Challenges in its Application" by Niekamp, Bharadwaj, Sadhukhan, and Chryssanthopoulos, has offered a viable approach to tackle this issue. Relying on a multi-criteria decision analysis framework proposed, the authors have managed to integrate all major sustainability criteria over the whole life cycle. Participations from various stakeholders and assessment of uncertainty associated are all considered explicitly so that the results derived from the proposed framework stand by themselves in higher confidence.

By acknowledging the challenges and barriers of implementing sustainability in the manufacturing firms, Koho, Tapaninaho, Heilala, and Torvinen have proposed a structured approach for measuring, improving and managing sustainability performance in the paper "Towards a Concept for Realizing Sustainability in the Manufacturing Industry." Based on a generic framework of Define, Measure, Analyze, Improve and Control (DMAIC), the study has shown its applicability to Finnish manufacturing industry.

"A Framework for Material Flow Assessment in Manufacturing Systems" by Gould and Colwill, works on a methodology in assessing material efficiency in production systems. While it is generally known that radical improvements in material efficiency are needed so to assist manufacturing companies lowering negative environment impact and sustain manufacturing activities in the long term, literature survey shows that research

efforts are considered insufficient in this aspect. To cope with the difficulty, the proposed methodology uses a combined approach of quantitative and qualitative means to model and assess material flow efficiency. A case study is presented to illustrate the process of implementation.

The six articles selected for this special issue were nominated from the accepted papers initially submitted to the International Conference on Sustainable Design and Manufacturing 2014 in Cardiff, UK. After an extensive enrichment on theoretical foundation, research methodology and case study, these six articles were further revised and improved after two rounds of rigorous reviews conducted by the special issue. In the first round, each paper was peer reviewed by at least two

reviewers, and in the second round, the revised articles were reviewed by the guest editors. We would like to take this opportunity to thank all contributing authors for their excellent work. We are very grateful to the reviewers for offering their precious time and efforts and for providing constructive comments. Without all of you, this special issue would not be possible.

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