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## Editorial

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### Peter Ball

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**Biographical notes:** Peter Ball is Senior Lecturer in Manufacturing Operations in the Manufacturing Systems Centre at Cranfield University. His research interests lie in the area of design and operation of manufacturing systems and supply chains and how models and modelling techniques support this, i.e., processes and their analysis. Research projects to date have included manufacturing systems simulation, supply chain simulation, business process modelling, business process outsourcing, business collaboration models, sustainable manufacturing and process innovation. He is a chartered and active member of the Institution of Engineering and Technology (IET) and a member of the Institute of Operations Management (IOM).

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This special issue presents emerging thinking and applications of modelling and simulation beyond traditional operations, manufacturing and supply chain boundaries. Significant work has been carried out on modelling and simulating 'simple' service or production systems as well as business processes and supply chains. Such work examines flows of parts, products or information. However, with business models that have emerged from industry and commerce there are challenges to existing theories, functionality of tools, techniques for model building and the understanding of performance through modelling. Information and product flows may have to be combined; the products may never leave the system and products returned from the field. Examples of emerging business models include recycling, servitisation (where service is provided using a manufactured product) and outsourcing.

This special issue looks to provide theories, tools and case studies of the application of modelling and simulation techniques beyond 'traditional' systems. Following the call for papers less than half of the papers submitted emerged from the review process to give examples of new applications as well as the new techniques and principles that underpin them. The papers presented examine a range of manufacturing and retail applications focusing on business processes, agent based techniques, re-manufacturing and lean.

Hughes and Perera present their work on embedding simulation into an organisation. The paper proposes

moving from the use of simulation on a 'one-shot basis' to becoming a more formal, habitual activity guided by their five-stage process of foundation, introduction, infrastructure, deployment and embedding. Anand and Kodali present a different way to embed simulation into an organisation through its support for a commonly used lean technique. They found that the field of applying simulation modelling to lean, and in particular Value Stream Mapping (VSM), is sparsely reported in the literature, and present a detailed case of how this can be achieved. Moving from beginning of life to end of life manufacturing systems, Berthaut, Pellerin and Gharbi examine hybrid repair and remanufacturing. They experiment with policies of a system that undertakes planned overhauls as well as emergency repairs of capital equipment and the uncertainty of parts supply. Continuing the theme of deploying simulation in new environments we move into the domain of retail with the challenges of buyer behaviour authored by Siebers, Aickelin, Celia and Clegg. Their experiments use agent-based simulation to investigate people management practices and their effect on customer satisfaction.

In summary, the work reported here shows that the reach of simulation is expanding. It captures the use of simulation from merging with other techniques to advancing those that exist. The papers show how simulation can be more accessible from embedding into the business to advancing applications in fields of retail, lean and remanufacturing.