Editorial

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Biographical notes: David Baxter is a Senior Research Fellow in the Innovation Group of the School of Management, Cranfield University, UK. He obtained his PhD in Engineering Management from Cranfield University, UK, in 2008. He has extensive research experience in knowledge management for innovation, in collaboration with leading UK and international companies such as Rolls-Royce, Edwards Vacuum, and ArvinMeritor. He has published over 20 papers, including articles in *Research Technology Management*, *Research in Engineering Design*, and *International Journal of Production Research*. He has also acted as a Guest Editor for special issues of the *Journal of Engineering Design, Robotics and Computer-Integrated Manufacturing*, and *International Journal of Production Research*. His current research is developing the theme of how R&D managers can make the most of tacit knowledge.

James Gao holds the Medway Chair of Manufacturing Engineering, and the Head of Centre for Innovative Product Development, School of Engineering, University of Greenwich. Prior to his current position, he was a Lecturer/Senior Lecturer at Cranfield University from 1993–2006. He is a Fellow of the Institution of Mechanical Engineers. He obtained his BSc in Mechanical Engineering in 1984 from Dalian Institute of Technology, China, and obtained his MSc and PhD from the University of Manchester Institute of Science and Technology, UK, in 1987 and 1989, respectively. He has over 170 publications in international journals and conferences, and directed a large number of research projects in the areas of knowledge and innovation management, product lifecycle management and computer aided design and manufacturing.

Yingguang Li is a Professor in the College of Mechanical and Electrical Engineering, Nanjing University of Aeronautics and Astronautics, China. He obtained his PhD in Manufacturing Engineering of Aerospace Vehicle from Nanjing University of Aeronautics and Astronautics in 2004. He directed a large number of research projects funded by the Chinese Government in collaboration with industry. His current research interests include feature-based product design and manufacturing, product lifecycle management and knowledge management, and he has authored or co-authored over 70 papers in these fields.

This special issue on *innovative product development* contains seven invited papers from the CIRP-sponsored 6th International Conference of Digital Enterprise Technology, held at the University of Hong Kong on the 14th–16th December 2009 (DET 2009). The conference addresses aspects of electronic business and digital enterprise technology, bringing academic rigour and novelty to industrial applications. Over 120 delegates from 12 countries attended the conference.

We invited those authors from the conference who presented high quality, novel, and promising work to submit their work to this special issue. The contributions reflect a wide range of topics relevant to product lifecycle management, the core subject are of the journal, and innovative product development, as a special area of interest for the editors. Initially, 15 papers were selected from over 130 included in the proceedings. The papers were substantially revised and rewritten to include the authors' latest research outcome for submission to this special issue, and each one was subject to a double blind peer review process by at least two reviewers. The editors also reviewed each paper, assisted authors in interpreting and responding to referee comments, and reviewed all author revisions. After several iterations of reviews and revisions, we recommend seven papers to the editor of the *International Journal of Product Lifecycle Management* for publication.

The first two papers propose methods to assess product design through performance modelling and cost modelling. The following three propose new methods to *manage* design, focusing on failure reduction, sustainable manufacture and reverse engineering. The next paper addresses knowledge management system design. The final paper examines contributors to new product success. This paper is of particular interest, due to their finding that the product team is thought to be the major contributor to success. It serves as a reminder that product development is a complex process of integrating individual capabilities, and that digital technologies ultimately serve to support human processes. Here, we outline the content of each paper.

Nguyen, Vignat and Brissaud identify that the performance of a manufactured product will always be different than a prediction based on a perfect product, since the perfect product (or nominal CAD/CAM model) cannot be achieved in practice. Manufacturing methods will always result in a degree of variation from the nominal model. They present a *method to model product performance* that takes geometrical variation into account. This enables designers to model expected product performance in advance of manufacturing, potentially saving significant redesign effort.

Cheung, Mileham, Newnes, Marsh and Lanham develop a new approach to *cost modelling* that overcomes limitations of existing methods by integrating costing in the PLM environment. Their proposal enables life cycle cost estimates of large scale, novel

and complex products to be carried out at an early stage of design. They also provide support for collaboration in the costing process.

Dai, Maropoulos, Cheung and Tang present a novel *method to manage the risk of product failure* through design. The method uses data from past failure events to identify relationships between failure scenarios and quality characteristics, which enables the calculation of priorities to address product quality in a new design. They suggest that the method overcomes limitations of quality function deployment (which is difficult to manage) and failure mode and effect analysis (which does not link related failure modes).

Wang and Tseng propose a *methodology for sustainable manufacturing*, which allows manufacturing companies to consider the issues of material usage and end of life disposal early in the design stage. Their method applies a novel measure to describe product modules from an end of life perspective: life cycle commonality. This metric enables designers to consider the economic impact of a given end of life strategy, and to maximise total value recovered. They indicate that their approach needs to be extended to include whole life cost, recognising that this requires different methods from producer and customer perspectives. That is, the producer is concerned with production and disposal costs, whereas the customer is concerned with purchase and operating costs and residual value.

Tang, Kang and Zhu present a *method for reverse engineering*. They identify that reverse engineering focused exclusively on geometry (i.e., scanning a product to reproduce a CAD model) has a number of limitations, including the failure to reproduce design intent. Their methodology – functional reverse design – includes the additional steps of functional modelling and functional reengineering, first to reproduce the original product function structure, and then to improve on the original structure. They term this 'secondary innovation' – product redesign from a functional perspective.

Zhang, Gao and Wang present a methodology to *specify a knowledge management system* for product development, based on enterprise architecture frameworks. A standard framework is extended with a method to capture and refine user requirements. They discuss the need for an enterprise knowledge framework that identifies the various sources of knowledge relevant to each user, with the intention to make them available through a common system. In addition to the reflection that enterprise knowledge is critical, they identify a key limitation of such frameworks; that some of the people interviewed could not specify precisely what they need. As a potential limitation of the methodology, this also reflects the opportunity for a knowledge management system to partially fill that gap.

Chan, Ip and Chung administered a questionnaire investigating two key constructs which contribute to *new product success*: the innovation process and the project team. They found that the project team has a greater perceived impact than the innovation process. Their novel approach focused on a large sample within a single leading company, demonstrating that there are significant differences across management grades in the perceptions of which factors influence product success. This has important implications for existing and future survey studies relying on a single respondent within each firm. The findings of this paper should enable engineers and business managers to reflect on the essential character of product development as a knowledge intensive, collaborative activity seeking to bring together the diverse expertise of a number of specialists. Even when it is all about technology, it is not all about technology.