

Guest Editorial

**Enabling Technologies and Frameworks for New Product Development:  
A Selection of Papers from ICMR2005**

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The product development activity is facing new challenges to communicate, collaborate and share knowledge across multiple organisations, locations, systems, viewpoints and languages. Original Equipment Manufacturers (OEMs) will own part or all of the design and manufacturing knowledge. In complex engineering products, the service component is already a major part of the revenue stream in the product lifecycle, which is driving an additional requirement to own, retain and control this product design knowledge in order to support a service based product offering which goes through and even beyond a traditional product life cycle. The research challenge is to propose a set of methodologies to facilitate the *provision and sharing* of appropriate enterprise knowledge to managers and engineers within the different players in the Extended Enterprise respecting the different intellectual property agreements and functional requirements. In addition to the knowledge provision and sharing issue, best practice *business models* and *supporting tools* based on enabling technologies such as the information and communication technologies must also evolve to meet the new challenges.

This special issue consists of selected papers from the 3<sup>rd</sup> International Conference on Manufacturing Research (IMRC2005) held at Cranfield University on 6<sup>th</sup> – 8<sup>th</sup> September 2005, in the theme of *enabling technologies and frameworks for new product development*. The papers have been updated, extended and further peer reviewed and improved to the high standard of the journal. Initially 12 papers (around 10% of the total papers presented at the conference) were requested for extension and further review, and 9 papers are finally selected for inclusion in this special issue.

There are three main streams of research presented, i.e., (1) Provision and sharing of knowledge across product lifecycle through digital frameworks and ontologies; (2) Supporting tools and evaluation systems such as cost evaluation, quality control and service and customer requirements management, and (3) Design management and best practice model for new product development. These papers are briefly summarised below.

In the knowledge *provision and sharing* stream, *Bradfield and Gao* reported findings of an in-depth industrial investigation and identified three categories of knowledge

sharing problems in the new product development process, i.e., no explicit definition and prioritisation of process knowledge, lack of tools to support multi-lingual knowledge environment, and difficulties in communicating the knowledge. They have proposed and tested a knowledge sharing methodology focusing on the development of a task knowledge ontology, and mechanisms to enable the visualisation and dissemination of the ontology through the Web.

*Young et al* reported extensive research in the sharing of manufacturing knowledge, from the context of the extended product lifecycle, including product development. They have extensively tested the use of standards-based heavyweight ontology approach such as the Process Specification Language (PSL) for standardising and sharing manufacturing process knowledge. The significance of using the ontological approach is the sharing of meaning and semantics. The advantage of the heavy-weight ontology is its mathematical rigour. Limitations of PSL have also been analysed.

*Mountney et al* reported a thorough industrial case study to investigate the manufacturing impacts on preliminary design. A classification scheme for these impacts is proposed, consisting of impact on 'configuration', 'tooling' and 'manufacturing geometry'. The impacts can be expressed as 'Empirical', 'Quantified' and 'Standardised', based on measures of the maturity of the manufacturing process. In support of the communication of manufacturing knowledge, the knowledge can be classified into three types: 'Structured', 'Semi-structured' and 'Unstructured'. The significance of their work is the study of the maturity of manufacturing capability and its impact on iterative product and process development.

*Maropoulos et al* introduced the Digital Enterprise Technology (DET) framework developed by this leading research team. The DET framework is used to configure digital product and process development technologies with high-degree of real-time measurement feedback to validate product tolerance specifications, and the selection of production and assembly processes. The distinction of this research is the use of different levels of completeness of information about product and process, and the risk and resource awareness in managing large scale assembly operations in the space, aerospace and shipbuilding sectors.

In the *supporting tools* stream, *Tang et al* presented a quality control platform for product development through decomposing, transforming, optimising, evaluating and monitoring Quality Characteristics (QCs). The platform uses various quality tools in the different stages of product development, and focuses on information management and communication for cross-function teams. In particular this paper provides information about the practical application of the research in an industrial setting, which is a particular strength of research at Asian universities.

*Newnes et al* reported an on-screen real time automated computer system for cost estimating to support product development, which enables designers to make informed choices in terms of design, materials and complexity. The distinction of this approach is that it considers design complexity and is based on the CAD design environment which is the traditional and preferred environment by designers. Most reported research in cost engineering has no link to CAD systems.

*Chen and Sackett* addressed the challenges facing Asian companies in developed countries in terms of higher customer demands. They investigated the different types of stakeholders in the high technology product market and proposed a methodology for managing their requirements for the purpose of improving service capability, providing a basis for sustainable competition that exploits global market opportunities and enables ultra-fast-to-market products to be supported. Knowledge generated during service is becoming increasingly important to product design as the provision of service is replacing the provision of products, and more revenue is generated through the service focused business.

In the *business models* stream, *Shum and Lin* address the financial performance of new product development. They have investigated world-class companies' best practice and identified four factors in new product development, i.e., Strategic fit and shared vision, Market orientation, Slack resources and stimulus and Organisation for collaboration and communication. Product changes in the later stages of product development are more costly than in the early stages. Engineering changes in terms of drawings and documents are well standardised, *Scholz-reiter et al* proposed a new change classification scheme and an organisational concept for better management of changes during the production ramp-up phase. The project considered the links between design and production systems, and targeted the highly competitive automotive industry.

Most papers in this issue focus on industrial applications and cover a wide range of industries including space, aerospace, automotive, shipbuilding, electronics, domestic heating systems, and white goods. Each industry has very different product development and market characteristics. We believe that this special issue will be very beneficial to researchers and industrialists involved in the highly challenging new product introduction process, and we would like to thank all the authors who have presented their leading research work for sharing with the rest of the community. In particular, we would like to thank the internationally respected experts who have reviewed the papers several times and given valuable comments and suggestions.