Editorial: advances in mass customization

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Mass customization research

This special issue marks the 25th year of mass customization research. Twenty-five years ago, leading companies turned to mass customization to improve customer satisfaction, market share, and company success. Companies developed customer integration techniques, modular design techniques, flexible manufacturing systems, and supply chain management (SCM) methods. Research papers described mass customization goals, elements, and configurations.

Over time, research papers turned from describing mass customization to developing new customer integration techniques, modular design techniques, flexible manufacturing systems, and SCM methods. Over the past 25 years, more than 500 research papers were published that described new customer integration techniques, modular design techniques, flexible manufacturing systems, or SCM methods.

Advances in mass customization research

The special issue contains one initial review paper, eleven new research papers, and one final review paper. The initial

review paper describes prior advances in mass customization research. The twelve new research papers demonstrate current advances in mass customization research. The final review paper describes opportunities for future advances in mass customization research.

The initial review paper by Smith et al., “Mass customization in the product life cycle,” presents an introduction to mass customization in the product life cycle. The paper reviews early papers that describe mass customization goals, elements, and configurations. The paper reviews recent papers that describe new customer integration techniques, modular design techniques, flexible manufacturing systems, or SCM methods.

The paper shows that most companies use ‘assemble-to-order’ configurations to create standardized products for a large number of grouped customers. The paper shows that companies need new interactive customer integration techniques, collaborative modular design techniques, reconfigurable manufacturing systems, and integrated SCM methods to create individually customized products, with mass production volume, cost, and efficiency.

New customer integration techniques

The paper by Carulli et al., “An approach for capturing the Voice of the Customer based on Virtual Prototyping,” describes a new interactive customer integration technique. The technique uses interactive virtual reality prototypes to determine individual customer requirements for products. The paper uses the technique to determine visual, haptic, and auditory customer requirements (knob shape, number of clicks, click sounds) for washing machines.

The paper shows that interactive virtual reality prototypes can be used to determine visual, haptic, and auditory

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customer requirements for individual customers. However, interactive virtual reality prototypes are expensive to build and use. They increase design time. As a result, they can only be used to determine individual customer requirements for high-cost customized products and a small number of individual customers.

The paper by Luh et al., “Augmented reality-based design customization of footwear for children,” describes a new interactive customer integration technique. The technique uses interactive augmented reality prototypes to determine individual customer requirements for products. The paper uses the technique to determine visual individual customer requirements (color, texture, embroidery, shape) for children’s shoes.

The paper shows that interactive augmented reality prototypes can be used to determine visual customer requirements for individual customers. However, interactive augmented reality prototypes are also expensive to build and use. They increase design time. As a result, they can only be used to determine individual customer requirements for high-cost customized products and a small number of individual customers.

The paper by Smith et al., “A KE-LSA approach for user-centered design,” describes a new interactive customer integration technique. The technique uses virtual reality prototypes, Kansei engineering (KE) surveys, and KE-LSA semantic spaces to determine individual customer requirements for products. The paper uses the technique to determine visual customer requirements (phone type, screen shape, body shape) for individual customers’ cell phones.

The paper shows that virtual reality prototypes, KE surveys, and KE-LSA semantic spaces can be used to determine visual customer requirements for individual customers. Virtual prototypes, KE surveys, and KE-LSA semantic spaces are not expensive to build and use. They reduce design time. As a result, they can be used to determine individual customer requirements for low-cost customized products or a large number of individual customers.

The paper by Okudan et al., “Perceived feature utility-based product family design: a mobile phone case study,” describes a new interactive customer integration technique. The technique uses questionnaires, grouping, and multi-attribute utility theory (MAUT) functions to determine grouped customer requirements for products. The paper uses the technique to determine visual and functional requirements (shape, speed) for grouped customers’ cell phones.

The paper shows that questionnaires, grouping, and MAUT functions, can be used to determine visual and functional customer requirements for grouped customers. Questionnaires, grouping, and MAUT functions are not expensive to build and use. They reduce design cost, design time, and product cost. As a result, they can be used to

determine grouped customer requirements for low-cost customized products or a large number of grouped customers.

New collaborative modular design techniques

The paper by Wang and Tseng, “Customized products recommendation based on probabilistic relevance model,” describes a new collaborative modular design technique. The technique uses probability functions and customer design evaluations to match individual customer requirements to designs for standardized products. The paper uses the technique to match individual customer requirements to designs for standardized computers.

The paper shows that probability functions and customer design evaluations can be used to create designs for standardized products and individual customers. Probability functions and customer design evaluations are not expensive to build and use. They reduce design cost and design time. As a result, they can be used to create designs for low-cost standardized products or a large number of individual customers.

The paper by Kristianto et al., “Mass customization design of engineer-to-order products using Benders’ decomposition and bi-level stochastic programming,” describes a new collaborative modular design technique. The technique uses Benders’ decomposition and bi-level stochastic programming to match customized product configurations to customized manufacturing system configurations and module design parameters.

The paper shows that Benders’ decomposition and bi-level stochastic programming can be used to create designs for customized products and individual customers. Benders’ decomposition and bi-level stochastic programming techniques are not expensive to build and use. They reduce design cost and design time. As a result, they can be used to create designs for low-cost customized products or a large number of individual customers.

New reconfigurable manufacturing systems

The paper by Muller et al., “Reconfigurable handling systems as an enabler for large components in mass customized production,” describes a new reconfigurable manufacturing system. The system uses programmable robots as reconfigurable jigs and fixtures. The system uses reconfigurable jigs and fixtures to assemble large standardized products. The paper uses the system to assemble large standardized airplanes.

The paper shows that reconfigurable jigs and fixtures can be used to assemble large standardized products for individual customers. Programmable robots are expensive to

purchase. They reduce manufacturing setup time (when they are used as reconfigurable jigs and fixtures). As a result, they can only be used to assemble large high-cost standardized products for a small to large number of individual customers.

New integrated supply chain management methods

The paper by Fujita et al., “Mathematical model for simultaneous design of module commonalization and supply chain configuration toward global product family,” describes a new integrated SCM method. The method uses genetic algorithms (GAs) and simplex methods to create integrated SCM configurations for standardized products. The paper uses the method to create integrated SCM configurations for standardized cars.

The paper shows that GAs and simplex methods can be used to create integrated SCM configurations (modules, production sites, assembly sites, distribution centers) for standardized products and grouped customers. GAs and simplex methods are not expensive to build and use. They reduce manufacturing cost. As a result, they can be used to create integrated SCM configurations for low-cost standardized products and a large number of grouped customers.

The paper by Shahzad and Hadj-Hamou, “Integrated supply chain and product family architecture under highly customized demand,” describes a new integrated SCM method. The method uses linear programming models to create integrated SCM configurations for standardized products. The paper uses the method to create integrated SCM configurations for generic standardized products.

The paper shows that linear programming models can be used to create integrated SCM configurations (modules, production sites, distribution centers) for standardized products and grouped customers. Linear programming models are not expensive to build or use. They reduce manufacturing cost. As a result, they can be used to create integrated SCM configurations for a low-cost standardized products and a large number of grouped customers.

New product development processes

The paper by Kuo, “Mass customization and personalization software development: a case study eco-design product service system,” describes a complete product development process. The process uses quality function deployment, rules, and customer-designer negotiations to create customized software products. The paper uses the process to create customized eco-design product service systems.

The paper shows that quality function deployment, rules, and customer-designer negotiations can be used to create

customized software products for individual customers. Quality function deployment, rules, and customer-designer negotiations are not expensive to build or use. They increase product customization and reduce product cost. As a result, they can be used to create customized software products for a large number of individual customers.

The paper by Wang and Dargahi, “Mass customization under capacity constraints: an auction-based model,” describes a complete product development process. The process uses combinatorial iterative auctions and capacity constraints to create customized service products. The paper uses the process to create customized “build your own” 7-day holiday-season (flight, hotel, car, activity) travel packages.

The paper shows that combinatorial iterative auctions and capacity constraints can be used to create customized service products for individual customers. Combinatorial iterative auctions and capacity constraints are not expensive to build and use. They increase product customization and increase company revenue. As a result, they can be used to create customized service products for a large number of individual customers.

Special issue conclusions

The special issue papers show that significant advances have been made in mass customization research. Interactive virtual reality prototypes can be used to determine customer requirements for high-cost customized products and a small number of individual customers. Virtual reality prototypes and KE-LSA semantic spaces can be used to determine customer requirements for low-cost customized products or a large number of individual customers.

Probability functions and customer design evaluations can be used to create designs for low-cost standardized products or a large number of individual customers. Programmable robots can be used to assemble high-cost standardized products for a small to large number of individual customers. GAs or linear programming models can be used to create integrated SCM configurations for low-cost standardized products and a large number of grouped customers.

The special issue papers show that software and service companies have moved from mass production to mass customization. However, due to economic issues, manufacturing companies still use ‘assemble-to-order’ configurations to create standardized products for a large number of grouped customers. Companies need new mass customization techniques, systems, and methods to create individually customized products, with mass production volume, cost, and efficiency.

The special issue papers show that research has advanced from describing mass customization to creating new mass customization techniques, systems, and methods. However,

most research papers still focus on ‘assemble-to-order’ configurations, standardized products, and grouped customers. New research papers are needed that focus on creating individually customized products, with mass production volume, cost, and efficiency.

The final review paper by Zhou et al., “Affective and cognitive design for mass personalization (DFMP): status and prospect,” describes the move from standardized products

to individually customized products. In particular, the paper explores the affective and cognitive aspects of DFMP. The paper shows that more work is needed to create individually customized products that meet affective and cognitive customer needs, with mass production volume, cost, and efficiency.