



## Mass customization with configurable services

T-86.5300 Information and Communication  
Technology Enabled Commerce (ICTEC)

17.3.2008

Mikko Heiskala



## Outline

- ❑ Mass customization (quickly)
  - ❑ Definitions
  - ❑ Theoretic background
- ❑ Configurable products
  - ❑ MC with configurable products
- ❑ Configurators
- ❑ Configurable services
- ❑ Four-Worlds Model for configurable services
  - ❑ Overview, metamodel, example
  - ❑ Experiences from cases
- ❑ Conclusions



## Mass customization

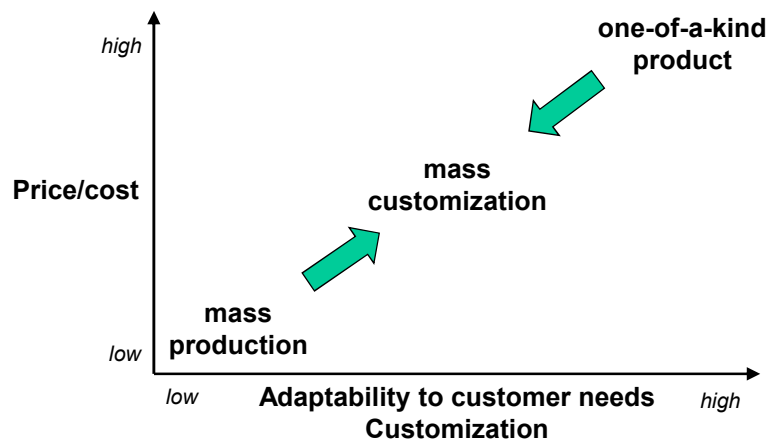
- Definitions:
  - Mass customization (MC) can be defined as a strategy of providing even individually customized goods or services at production costs and lead-times of, or close to, large-scale mass production (Pine 1993; da Silveira et al. 2001)
  - "the ability to provide your customers with anything they want *profitably*, any time they want it, anywhere they want it, any way they want it" (Hart 1995)
    - Idealistic definition
    - Profitability requires an "envelope of variety", a pre-determined range of what is offered to the customer
  - Pine 1993: historical development from craft production (blacksmiths) to mass production (Ford T-model) to mass customization

26.3.2008

3



## Mass customization vs. mass production vs. one-of-a-kind



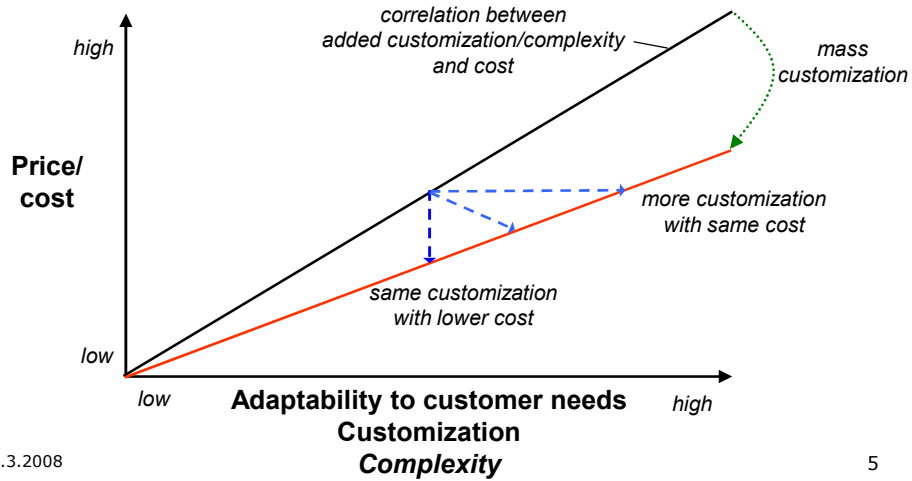
Adapted from  
Tiihonen & Soininen 1997;  
Svensson & Barfod 2002

26.3.2008

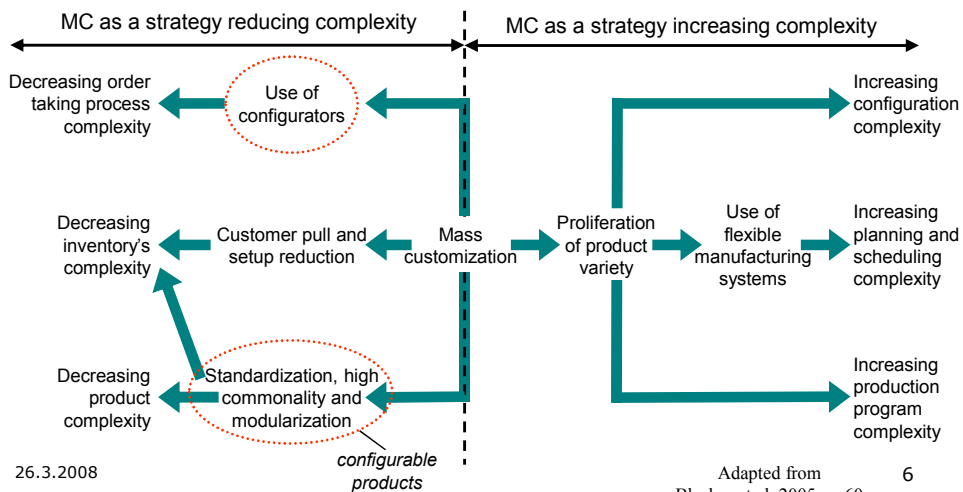
4



## Mass customization, a viewpoint



## Mass customization & complexity





## Configurable products

- ❑ Modular, standard components
- ❑ Characteristics:
  - ❑ Pre-designed for a given range of customer requirements
  - ❑ Each delivered product individual is adapted to the needs of a customer
  - ❑ Each product individual is specified as an arrangement of pre-defined components
  - ❑ The product has a pre-designed architecture
  - ❑ No creative or innovative design is needed as a part of the sales-delivery process
- ❑ PCs, cars, hamburgers, etc.
  - ❑ Cars: [www.volvocars.co.uk](http://www.volvocars.co.uk) – click Build and Price
  - ❑ PCs: [www.verkkokauppa.com](http://www.verkkokauppa.com) – ‘Pöytäkonelaskurit’
    - ❑ Does not check for incompatibilities

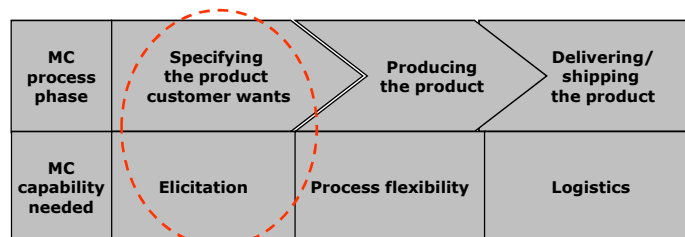
26.3.2008

7



## Mass customization with configurable products

- ❑ Specifying the product individual the customer wants
  - ❑ Often difficult and error-prone, both for supplier and customers
  - ❑ Numerous options, complex interdependencies
- ❑ Producing the specified product individual
  - ❑ Fire-fighting from specification errors, delays, iterations, rush-orders



26.3.2008

8



## Configurators

- ❑ Configurators are IT systems used...
  - ❑ ... to support the customer and/or sales person in eliciting customer needs and translating them into product specifications.
  - ❑ ... to model the adaptation possibilities of configurable products into configuration models, and to maintain and manage the product information embedded in the models.
- ❑ Can ensure correctness and completeness of product sales specifications (with artificial intelligence)
  - ❑ Less iterations and firefighting in production, shorter lead-time in sales, etc.

26.3.2008

9



## What about service mass customization?

- ❑ Mass customization of physical products by configuring is well established
- ❑ Long research tradition on configurable products, related processes, and their IT support
- ❑ Can we apply the successful idea of configurable products to services?
- ❑ Can configurators support configurable services?

26.3.2008

10



## Service MC issues: strategic

- ❑ When is systematic service customisation indicated?
  - ❑ need for more cost-efficient long term customer interface
  - ❑ heterogeneous customer base, diverse, unique or quickly changing needs
  - ❑ highly competitive market
  - ❑ product proliferation and new introductions high; portfolio too complex to manage
  - ❑ need to battle price sensitivity with improved fit
- ❑ Issues to consider:
  - ❑ expected revenues, profitability
  - ❑ cost of adaptation of such services, do they undermine or cannibalize current offering
  - ❑ capabilities of the company



## Service MC issues: customers

- ❑ What and when must be known about the customer(s) and their needs to be able to construct and manage appropriate service configurations?
- ❑ What and when does the customer need to know about the service offering, delivery, and provider?
- ❑ Customer willingness to participate in service specification and value co-production – at what cost?
- ❑ Willingness of customers to pay premium for convenience, ease, flexibility?



## Service MC issues: structural view

- ❑ Systematisation to manage uncertainty and inconsistent performance
- ❑ Service delivery process modules
  - ❑ Should be easily combined "like lego", repeatable, replicable, predictable, measurable, switching efficient
  - ❑ Benefits: learning effects, cost-quality control, more accurate pricing, justifying costs to customers, easier selling, easier training
- ❑ Design and create capabilities for efficient, systematic delivery
  - ❑ Information flows must be designed and supported
  - ❑ Using a configurator without this background is not beneficial
- ❑ Pricing principles and decisions
- ➔ Systematic management of variation based on pre-designed offering with pre-defined pricing model

26.3.2008

13



## Service MC issues: processes

- ❑ Separate processes
  - ❑ Development
  - ❑ Sales specification
  - ❑ Service production / delivery
- ❑ The service solution exists only through the processes
- ❑ Processes are key to the quality perception of the customer

26.3.2008

14



## Service MC issues: sales specification

- ❑ Key: specifying a promise to deliver
  - ❑ Specification as self service -- driven by frontline employee?
  - ❑ Several sales channels, especially in B2C
  - ❑ Different customers want different levels of control
- ❑ Genuine customer participation is beneficial
  - ❑ More correct choices; customer may "take blame"
  - ❑ Important for customer to know in advance how expected to participate
  - Managing expectations, more predictable customer behavior (?)
- ❑ Potential to improve specification process (from cases)
  - ❑ Sales process tends to be product-centric rather than consultative
  - ❑ Available configurable options are not always offered actively
  - ❑ Show and have available relevant information!

26.3.2008

15



## Service MC issues: production

- ❑ Key: Delivering what was promised
- ❑ Configuration decisions affect delivery process
  - ❑ How to deliver individualised service solutions efficiently?
  - ❑ Information flows important – service delivery process must act based on what was agreed in the specification phase.
  - ❑ What; when; who (does, manages or decides something); what information must be delivered and where?
  - ❑ A case: core service delivery process (what) little affected by configuration
- ❑ Integration is required
  - ❑ Organisational vertical "silos" a hindrance, different business units, sharing resources across borders; IT integration
- ❑ Customer involvement is an unpredictable element
- ❑ Contrary to traditional service definitions, customer participation does not always take place

26.3.2008

16





## Configurable services

- ❑ We define configurable services as...
  - ❑ services that can be customized to individual specifications from a set of options designed to meet a pre-determined range of customer needs
- ❑ Examples:
  - ❑ Insurance agreements, machinery maintenance contracts, mobile, broadband etc. subscriptions, traveling trips
  - ❑ A valid service solution customized to customer requirements must be specified; contracts typically complex
  - ❑ Web-based services are abundant: eBooking, amazon.com, spares-on-line, on-line banking...
  - ❑ Straight-forward, contain limited number of options and interdependencies, therefore not truly configurable

26.3.2008

17



## Can services be modeled as configurable products and how it should be done?

- ❑ Requirement for configurator support
- ❑ Experimented modeling & configuration with WeCoTin configurator
  - ❑ B2C broadband and mobile subscriptions, maintenance contracts, and insurance policies
  - ❑ Can be modeled using concepts for physical products
- ❑ The customer, other stakeholders and/or related equipment, environment (or their properties) often had to be modeled
  - ❑ A conceptual mismatch: service elements, customer, etc. as components → Four-worlds model

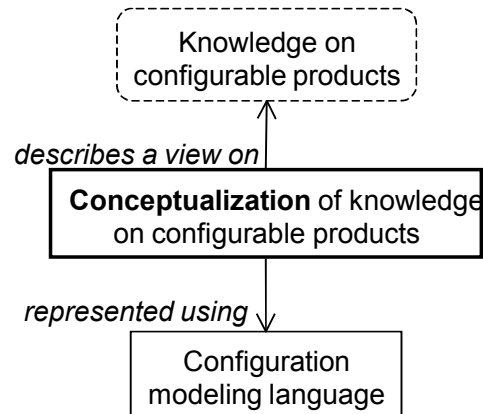
26.3.2008

18



## Conceptual model

- Purpose of a conceptual model is to provide the concepts fit for describing relevant phenomena in an area of interest
- Configuration modeling language is integral to the configurator
- This model aims to provide concepts to model configurable services, used in a configurator
  - Self-service over the web
  - Consultative selling with sales and customer together



*Adapted from Soininen 2000*

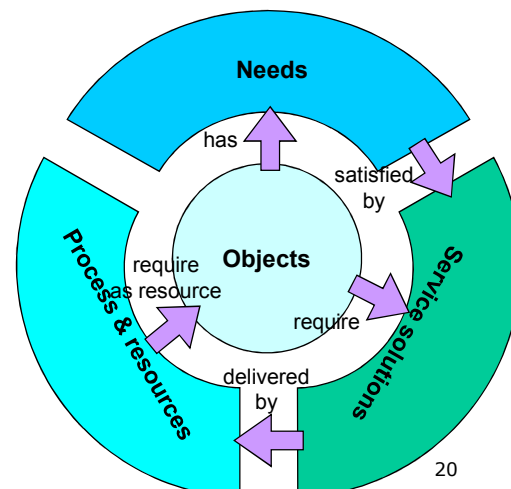
26.3.2008

19



## Overview of Four-Worlds Model for Configurable Services

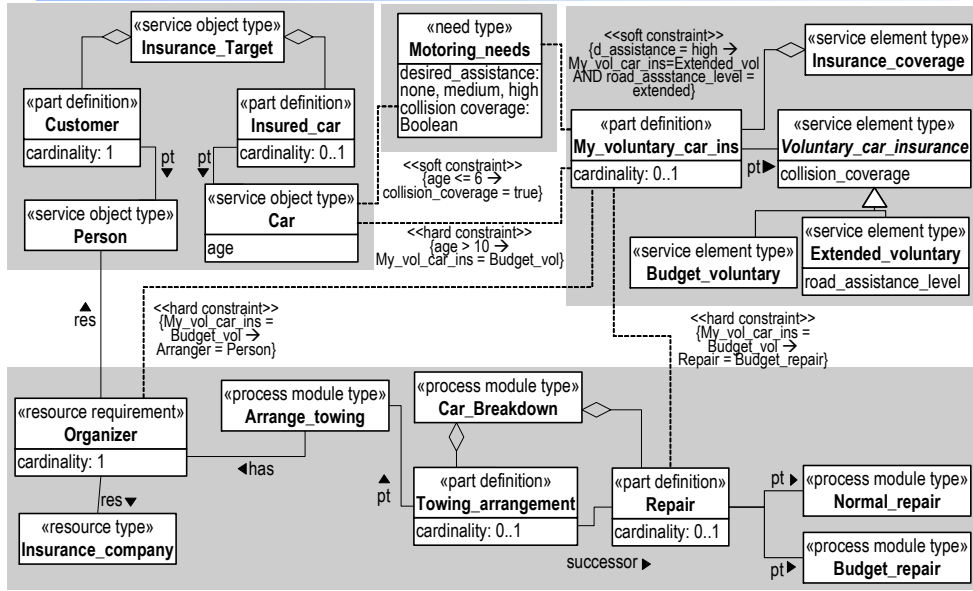
- **Objects-of-service world:** describe the recipient of service delivery and its environment
- **Needs world:** describe the reasons *why* a customer would want to buy service
- **Service solutions world:** *what* is to be delivered; agreement or contract options
- **Process world:** describes the delivery process and resources used in it; *how* and *with what* the service is put into practice



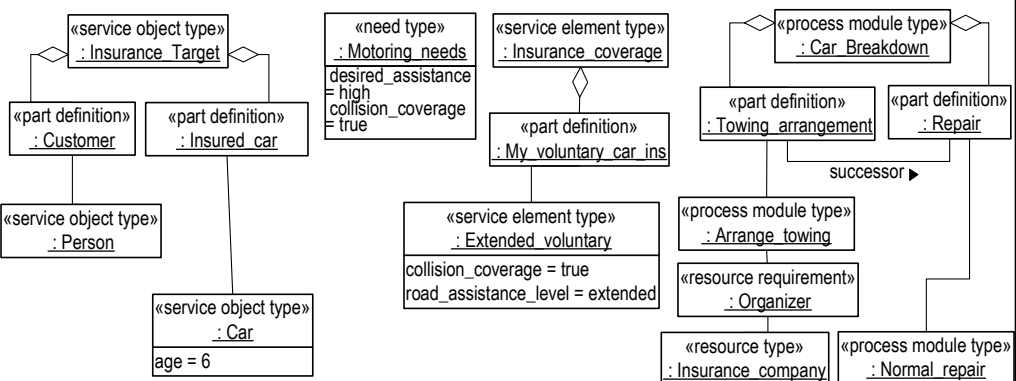
26.3.2008

20





## Configuration





## Experiences from cases: modeling

Anderson 2005, Heiskala et al. 2006

- Case broadband subscriptions
- Used information from the company's website
  - Configuration model contains 59 types, 72 attributes, 20 parts, and 31 constraints. Quite large.
  - Self-service viewpoint
- Information on the website can be divided to the four worlds
  - Modeling quite straightforward, felt natural to use the worlds
  - Currently the information is scattered on the website
  - Recommendations for suitable solution shown separately from the solutions, customer has to memorize them (*Needs*)
  - Service delivery issues, what the customer has to have in place, contact info etc. Customer has to interpret these according to the configuration choices made (*Process*)

26.3.2008

25



## Experiences from cases: modeling

Heiskala et al. 2006

- Case equipment maintenance
- Information from interviews, company marketing and contract material
  - The model contains 28 types, 66 attributes, 22 parts, and 34 constraints. Large. Modeling again relatively easy.
- No process world modeled because customer participation is minimal.
- Consultative selling viewpoint used, for internal use.
- Objects-of-service world:
  - equipment characteristics, its installation environment, use frequency etc.
- Needs world:
  - Safety, reliable and continuous operation, criticality of the equipment, etc.
  - Not all configurable in the sense of yes/no, but a matter of degree
  - Can be used to communicate what solutions meet the needs everyone has
- Solutions:
  - Service contracts and their options. Easy to model.

26.3.2008

26



## Experiences from cases: documentation and design

- Model used for documenting of configurable services in one case
  - Analyze and document their services with the model
  - Much of the knowledge dispersed in sales persons heads
  - Model seems to provide a natural way for structured thinking about the services, about their customizable aspects
  - Expected benefits (*early days...*)
    - Easier training of new employees, making tacit knowledge explicit, more uniform communication to customers, better understanding of own services, etc.
  - Further, the company has embarked on using the model on their own for new offerings
- In another case, Four-Worlds model used to support development of new services
  - Thinking about the customers and what they really need, are there gaps in the solutions, how they use the service (process), etc.

26.3.2008

27



**Thank you!**

**Questions?**

[mikko.heiskala@tkk.fi](mailto:mikko.heiskala@tkk.fi)



## Some readings, references

- Tiihonen J.: **Long-Term Management Of Configurable Telecommunications Service Offering: A Case** Joint Conference 2007 International Mass Customization Meeting 2007 (IMCM07) & International Conference on Economic, Technical and Organisational Aspects of Product Configuration Systems Hamburg, Germany June 21-22, 2007
- Sarinko K.: **A Documentation Method for Describing Product Variability in Product Development of Two Case Companies**, (PETO'07)
- [Heiskala et al. 2007] Heiskala, M., Tiihonen, J., Paloheimo, K-S., Anderson, A.; **Mass Customization with Configurable Products and Configurators: A Review of Benefits and Challenges**, in Blecker T., Friedrich G. (eds); Mass Customization Information Systems in Business, 2007
- Talja T.: **Neljän maailman malli sopivan palvelun löytämistä tukevassa käyttöliittymässä**, Pro Gradu
- [Tiihonen et al. 2006] Tiihonen, J., Heiskala, M., Paloheimo, K-S., Anderson, A.; **Configuration of Contract Based Services**, Proceedings of the ECAI 2006 Workshop on Configuration, pp. 25-30, August 28-29, 2006, Riva del Garda, Italy
- [Heiskala et al. 2006] Heiskala, M., Tiihonen, J., Soininen T., Anderson A. **Four-worlds Model For Configurable Services**; International Conference on Economic, Technical and Organisational Aspects of Product Configuration Systems (PETO'06) (presented 22.6.2006).
- [Heiskala et al. 2005b] Heiskala, M., Paloheimo, K-S., Tiihonen, J. **Mass Customization of Services: Benefits and Challenges of Configurable Services**. Proceedings of eBRF 2005 - Frontiers of e-Business Research (FeBR 2005), pp. 206-221, 2006. ISBN: 951-44-6556-3.
- [Heiskala et al. 2005a] Heiskala, M., Tiihonen, J., Soininen, T. **A Conceptual Model for Configurable Services**, Proceedings of the IJCAI 2005 Workshop on Configuration, July 30, Edinburgh, Scotland.
- [Paloheimo 2004] **Exploring the quality of relationships: Case study on expectations of and experiences from process industry**. 8th International Seminar in Service Management, La Londe les Maures, Ranska, July 8-11, 2004. Puyricard, France 2004, IAE Aix-en-Provence, pp. 603-618.
- [Heiskala 2005] Heiskala, M. **A Conceptual Model for Modeling Configurable Services from a Customer Perspective**, Master's Thesis, Helsinki University of Technology, Department of Electrical and Communications Engineerings, June 2005.
- [Anderson 2005] Anderson A, **Towards Tool-Supported Configuration of Services**, Master's Thesis, Helsinki University of Technology, Department of Electrical and Communications Engineerings, December 2005.

26.3.2008

29



## Some readings, references

### Other:

- Akkermans, H., Baida, Z., Gordijn, J., Peña, N., Altuna, A. & Laresgoiti, I. (2004). Value Webs: Using Ontologies to Bundle Real-World Services. *IEEE Intelligent Systems*, 19(4), 57-66.
- Anderson, J.C. & Narus, J.A. (1995). Capturing the Value of Supplementary Services. *Harvard Business Review*, Jan-Feb 1995, 75-83.
- Blecker, T., Friedrich, G., Kaluza, B., Abdelkafi, N. & Kreutler, G. (2005). *Information and Management Systems for Product Customization*. New York, USA: Springer.
- Böhmman, T., Junginger, M. & Krcmar, H. (2003). Modular service architectures: a concept and method for engineering IT services. *Proc. of the 36th Annual Hawaii International Conference on System Sciences (HICSS'03)*, 74-83.
- Chen, J. (2005). Improving reliability and speed in service mass customization: a case study in Chinese restaurant. *Proceedings of IEEE International Conference on Services Systems and Services Management, 2005 (ICSSSM '05)*, Vol. 2, 828-834.
- Dausch, M. & Hsu, C. (2003). Mass-Customize Service Agreements for Heavy Industrial Equipment. *IEEE International Conference on Systems, Man and Cybernetics*, 5, 4809-4814.
- Fitzsimmons, J.A. & Fitzsimmons, M.J. (2004). *Service Management – Operations, Strategy, and Information Technology*. Fourth Edition, International Edition, ISBN 0-07-121457-7, McGraw-Hill
- Grönroos, C. (2000). *Service Management and Marketing: A Customer Relationship Management Approach*, 2nd Edition. John Wiley & Sons, Ltd.
- Hart, C.W.L. (1995). Mass customization: conceptual underpinnings, opportunities and limits. *International Journal of Service Industry Management*, 6(2), 36-45.
- Harvey, J., Lefebvre, L.A. & Lefebvre, E. (1997). Flexibility and technology in services: a conceptual model. *International Journal of Operations & Production Management*, 17(1), 29-45.
- Lampel, J. & Mintzberg, H. (1996). Customizing Customization. *Sloan Management Review*, 38(1), 21-30.
- Paloheimo, K-S., Miettinen, I. & Brax, S. (2004). *Customer Oriented Industrial Services*. Espoo, Finland: Report Series – Helsinki University of Technology, BIT Research Centre.

26.3.2008

30



## Some readings, references

- Papathanassiou, E.A. (2004). Mass customisation: management approaches and internet opportunities in the financial sector in the UK. *International Journal of Information Management*, 24(5), 387-399.
- Peters, L. & Saidin, H. (2000). IT and the mass customization of services: the challenge of implementation. *International Journal of Information Management*, 20(2), 103-119.
- Pine, B.J. II, (1993). *Mass Customization: The New Frontier in Business Competition*. Boston, Massachusetts, USA: Harvard School Business Press.
- Salvador, F. & Forza, C. (2004). Configuring products to address the customization-responsiveness squeeze: A survey of management issues and opportunities. *International Journal of Production Economics*, 91(3), 273-291.
- da Silveira, G., Borenstein, D. & Fogliatto, F.S. (2001). Mass customization: Literature review and research directions. *International Journal of Production Economics*, 72, 1-13
- Soininen, T. (2000). An Approach to Knowledge Representation and Reasoning for Product Configuration Tasks. *Doctoral dissertation*, Helsinki University of Technology, Department of Computer Science and Engineering
- Svensson, C. & Barfod, A. (2002). Limits and opportunities in mass customization for "build to order" SMEs. *Computers in Industry*, 49, 77-89.
- Tiihonen, J. & Soininen, T. (1997). Product Configurators – Information System Support for Configurable Products. *Technical Report TKO-B137*, Helsinki University of Technology, Laboratory of Information Processing Science.
- Wimmer, A., Mehlaui, J.I. & Klein, T. (2003). Object Oriented Product Meta-Model for the Financial Services Industry. *Proceedings of the 2nd Interdisciplinary World Congress on Mass Customization and Personalization (MCPC'03)*, Munich, Germany.
- Winter, R. (2001). Mass Customization and Beyond – Evolution of Customer Centricity in Financial Services. *Workshop on Information Systems for Mass Customization (ISMC2001)*, Dubai.
- Zipkin, P. (2001). The Limits of Mass Customization. *MIT Sloan Management Review*, 42(3), 81-87.