

PRODUCT CONFIGURATION SYSTEMS

IMPLICATIONS FOR PRODUCT INNOVATION AND DEVELOPMENT

Kasper Edwards and Jørgen Lindgaard Pedersen

Department of Manufacturing Engineering
Technical University of Denmark
Building 423, Produktionstorvet
2800 Lyngby
Denmark
Email: {Edwards@ipl.dtu.dk, jlp@ipl.dtu.dk}

Product Configuration Systems (PCS) is a step in the direction of mass customization in the sense that PCS allows a firm to significantly lower the unit cost of configuration. Thus PCS is a valuable technology for lowering operating costs while retaining a high number of possible product configurations. However, costs are but one parameter on which firms compete and firms must continually innovate new and develop existing products.

This paper presents original empirical insights on implementation and use of product configuration systems in a number of Danish industrial firms. The paper discusses the organisational changes associated with PCS and how this affects product innovation and development.

The paper begins by introducing product configuration systems, which are then placed in context to the firm as a process technology which coordinate different processes: product development, order acquisition, order fulfilment and production.

Significance: This section should talk about the significance of your work. A 25-50 word section entitled **Significance**, indicating the industrial significance of the work. Leave 1 blank space between abstract and **Significance**.

Keywords: Product configuration system, innovation, product development.

(*Received* ; *Accepted*)

1. INTRODUCTION

Mass customisation has indeed become an important issue for many firms. Customers have become accustomed to the price of mass produced goods and are beginning to demand that products are customised to their needs while retaining the price associated with mass production. In Denmark firms are also pressured to deliver mass customization although Danish firms are characterised by an overweight of small to mid-sized companies, which traditionally have excelled in small batches and one of a kind production. However, like the rest of Europe Danish firms must follow suit, cut costs and deliver the desired products in which case mass customisation becomes a critical issue.

A means for firms to achieve mass customization are product configuration systems. A product configuration system consist of a computer model of a product, which contain information about the relationship between the individual components of the product and noteworthy any restrictions which one component impose on another. For instance a product model of a bicycle would have information regarding the frame, wheel, tube, tires, saddle, color, style of the different components etc. Restrictions in the model define what size of wheel fits with a give frame – no use in mounting a 26" wheel on a 12" frame.

The idea of mass customisation is little over 25 years old, beginning with Davis (1987) it has been research extensively since, see Silveira et al. (2000) for a literature review.

However it is only in recent years that off-the shelf software become available and many ERP systems now integrate configuration as a separate module in the system. So, things are dandy and firms should go ahead and achieve mass customisation with the available technology. Well, there are significant costs associated with achieving the potential benefits of a fully integrated product configuration system and this is exactly the theme of this paper.

The objective of this paper is to report preliminary results from a study of Danish Firms having implemented or are currently in the process of implementing product configuration systems. The project was initiated February 1st 2003 and will be terminated ultimo December 2004.

In the following paragraphs we will, more detailed, explain what a product configuration system is and place in a mass customisation context, followed by a section briefly describing the project, study and methodology. This is followed by a description of the involved firms and the results which are subsequently discussed and concluded.

2. PRODUCT CONFIGURATION SYSTEMS

In order to appreciate product configuration systems they must be placed within a context of mass customisation. In this paper mass customisation is defined by two dimensions: 1) The basic nature of customisation, and 2) The means for achieving customisation at or near mass production costs (Duray et al. 2000, p.607). The basic nature of customisation refers to the observation (op. cit.) that variety by itself does not constitute customisation. The customer must be involved in specification of the product. The means for achieving mass customisation at or near mass production costs are essentially that economics of scale must be achieved through modularity of the product. Individual modules and components can then be produced at near mass production prices.

A product configuration system is, as mentioned, basically a model of a product describing relationship between individual parts. The product configuration system makes it possible to interactively design a product by specifying which parts should be used in the final product. A product configuration system can have varying levels of detail depending on situation at hand. In general two extremes exist: 1) Tender configuration systems and 2) Production configuration systems. A tender configuration system is a product configuration system designed for the purpose of generating a tender. This implies the product configuration system only has knowledge regarding larger elements, which has significant impact on the total price. Tender configuration systems are often used in heavy engineering where the rough price of the elements is known but precise information about bill of material etc. is unknown. Generating a tender in heavy engineering projects, e.g. a cement factory, is by itself very costly and a tender generator can significantly lower the cost of generating a tender as the configuration system can make a tender at a fraction of the cost.

In the opposite end of the spectrum we find production configuration systems, which is a product configuration system most often linked or integrated to an ERP system. Thus, when the desired configuration has been created, the system has complete knowledge of the product to be produced. The configuration is used by the ERP system to create routing, bill of material, inventory etc. Production configuration systems find use in situations where the product can be completely configured using the product configuration system. Standard cars and bicycles would be examples of products which lend themselves to this kind of configuration. It must be stressed that we make a distinction between product-, production-, and tender configuration systems, where latter two is a subset of the first.

Returning to the mass customisation issue, product configuration systems is a means of achieving customisation. However, product configuration systems is not per se a means for achieving customisation at or near mass production costs. As Pine (1999, p196) notes: "The best method for achieving mass customization – minimising costs while maximising individual customization - is to create modular components that can be configured into a wide variety of end products and services", which is also recognised by Duray et al. (2000, p608). While it is easy to design a product configuration system around a fully modular product it is not a necessity and it is possible to design a product configuration system for a non-modular product. The latter product will not see the cost advantages of modularisation and the process of creating the configuration system will also be more complex due to idiosyncrasies in the individual product variants. Naturally this is recognised by other scholars and Riis (2003) strongly encourage a strict product review before creating a product configuration system.

3. MAJOR HEADING 3

1st Paragraph indented as here.

2nd and all subsequent Paragraph indented as here.

Leave one space between the Figure and the title for the Figure

Figure 1. Caption.

Figure 2. Caption.

6. REFERENCES

1. Davis, Stanley, 1987, "Future Perfect"
2. Duray, Rebecca, Peter T. Ward, Glen W. Milligan, William L. Berry, "Approaches to mass customization: configurations and empirical validation", *Journal of Operations Management* 18 (2000) 605-625.
3. Empirical evidence from the PETO project (Product Models – Economics, Technology and Organisation). More than 30 interviews are planned and in the process of being conducted in Danish companies. Currently 9 interviews have been completed.
4. Edwards, K. et al. 2003 "Teoretisk Foranalyse", The PETO project, Department of Manufacturing Engineering and Management, Technical University of Denmark.
5. Faltings et al., 1994, "Constraint-based knowledge representation for configuration systems" Technical report No. TR-94/59, Department D'Informatique.
6. Forza, Ciprane and Fabrizio Salvatore, 2002, "Product configuration and inter-firm co-ordination: an innovative solution from a small manufacturing enterprise", *Computers In Industry* 49 pp. 37-46.
7. Forza, Ciprane and Fabrizio Salvatore, 2001, "Managing for variety in the order acquisition and fulfilment process: The contribution of product configuration systems", *Int. J. of production economics* 76, pp. 87-98.
8. Hansen, Benjamin Loer, 2003, "Development of Industrial Variant Specification Systems, Ph.D. thesis, Department of Manufacturing Engineering and Management, Technical University of Denmark.
9. Hvam, Lars, 1994, "Anvendelse af Produktmodelling – set ud fra en arbejdsforberedelsessynsvinkel", Ph.D. Dissertation, Driftteknisk Institut, Technical University of Denmark.
10. Hvam, Lars, 1999, "A Procedure for building Product models", *Robotics and Integrated Manufacturing*.
11. Pine, B. Joseph II, 1999, "Mass customization – The New Frontier in Business Competition", paperback, Harvard Business School Press.
12. Riis, J. 2003, (In Danish) "Fremgangsmåde for Opbygning, implementering og vedligeholdelse af produktmodeller", Ph.D. Thesis, Department of Manufacturing Engineering and Management, Technical University of Denmark.
13. Silveira, Giovanni Da, Dennis Borenstein and Flávio S. Foglito, 2000, "Mass customization: Literature review and research directions", *Int. J. of production economics*.
14. Schwartze, S., 1996, "Configuration of Multiple-variant products", BWI, Zürich.

| | | | |
|--|--|--|--|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Table 1. Title of Table