Chapter 3

MASS CUSTOMIZATION AND COMPLEXITY

The strategic benefits of mass customization have been widely discussed in the theory of business management. However, large deficits deal with the practical application (Piller/Reichwald 2002, p. 1) because moving into and practicing mass customization represents a very difficult task (Hart 1994, p. 36), especially for suppliers who are accustomed to practicing their business by applying the rules of traditional management concepts. In this context, a relevant reason ascribed to the failure of some mass customization projects is the increasing complexity problem.

Research that examines complexity in the specific case of mass customization is still missing. Up to now, it is very common that one extrapolates the findings of studies on variety and complexity that are achieved in batch or even mass production in order to point out the effects of complexity in mass customization. This point of view is not correct because mass customization has some particularities that should be taken into account when dealing with the complexity issue.

Mass customization induces a high complexity level because of various customer requirements and a steadily changing environment. However, it has some potential to reduce complexity. In this chapter, the interdependencies between mass customization and complexity will be discussed in order to demonstrate that mass customization is not just an oxymoron linking two opposite production concepts, namely customization and mass production, but also a business strategy that can actually lead to success. After presenting a literature review on complexity, we will deal with both of the complexity faces of mass customization. On the one hand, mass customization increases production program, manufacturing and configuration complexities. On the other hand, mass customization can contribute to a reduction in complexity at the levels of the order taking

process, product and inventories. Then, the main results attained through the analysis are integrated in a comprehensive framework that shows the complexity increasing and decreasing aspects when introducing and pursuing mass customization.

1. COMPLEXITY: A LITERATURE REVIEW

Up to now, the term complexity has no satisfactory and generally admitted definition. It is basically discussed in connection with the system theory and is referred to as a system attribute. A system consists of elements or parts (objects, systems of lower order, subsystems) and the existing relationships between them. It is also argued that a system should perform a specific function and have to be well distinguished from its environment without confusion. The complexity of a system is defined with respect to three complexity variables, namely number, dissimilitude and states' variety of the system elements and relationships. These variables enable one to make the distinction between structural and dynamic complexity. Whereas structural complexity describes the system structure at a defined point in time, dynamic complexity represents the change of system configuration in the course of time. For example, by considering the solution space of the mass customizer that consists of all theoretically possible product variations, the product configurations that can be manufactured at a point in time determine the structural system complexity. However, the dynamic complexity basically depends on the frequency and magnitude of changes in the solution space when new product variants are introduced or eliminated.

On the basis of the structural and dynamic complexities, Ulrich/Probst (1995, p. 61) have determined a taxonomy for system complexity. When both complexities are low, then the system is simple. In the case of a high (low) structural complexity and low (high) dynamic complexity, the system is considered to be complicated (relatively complex). When both complexities are high, then the system is said to be extremely complex (Figure 3-1).

Saeed/Young (1998) define complexity in companies as the "...systemic effect that numerous products, customers, markets, processes, parts, and organizational entities have on activities, overhead structures, and information flows". The main problem triggered by too much complexity is the hidden costs. The costs of complexity are generally not visible and can negatively affect the competitive advantage of the enterprise. Mass customization triggers high complexity because of the variety of products, markets ("Markets of one"), processes, customers, etc. However, the mass customizing system cannot be a simple one owing to the complexity of its