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APPROACHES AND KEY FACTORS OF MASS CUSTOMIZATION

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Abstract: Mass customization does not mean the production of products of one type, as was the case in classical mass production. It is the production of a large number of product variants, of the same product family at competitive costs of mass production and quantity economics. New production concepts for Industry 4.0 and mass customization will require totally revolutionary ways of planning and managing production. These must be based on the autonomy and application of artificial intelligence and evolutionary principles.

1 Introduction

New production concepts for Industry 4.0 and mass customization will require totally revolutionary ways of planning and managing production. These must be based on the autonomy and application of artificial intelligence and evolutionary principles. Although the level of automation in production is growing rapidly and in the future this growth will be exponential, it is far from reaching the level, versatility and flexibility that people have. Today, in the transition period, due to the complexity and variety of the production of personalized products and their enormous variation or complexity, production is not made without people. On the contrary. Man will remain the most intelligent part of production for a long time, the most versatile and most flexible part of it. It is to be expected that even in the coming decades the need for highly skilled and skilled workers in manufacturing will be high. Production jobs are gradually being eliminated, mainly those jobs where routine work or repetitive operations are performed and can be easily automated [1].

However, future production also requires new production concepts that will focused on industry conditions 4.0. Current organizational and operational models of production will not suffice to introduce mass customization. Therefore, a new concept of organizational-management models will need to be overlooked, which would provide manufacturing companies with guidance on how to gradually re-orient themselves to future production, especially for small and medium-sized enterprises. The most important factor that will affect the existing production environment will be the customer. He will be able to configure his product in detail. This configured, customer design will be sent to a factory that will have to be able to produce the product he wants in a short time. In order to complete the product in a very short time, the suppliers' activities will be managed in the same way as the final manufacturer [2].

2 Concept of mass customization

The process of globalization and the 4th Industrial Revolution force researchers to look for new flexible business-organizational structures. It is clear that the classical vision of the business and its activities no longer corresponds economic reality. This is especially true for manufacturing companies. Today's manufacturing businesses must have a high degree of specialization in different areas of work and a flexible production system that listens to and adapts to customer needs [3,4].

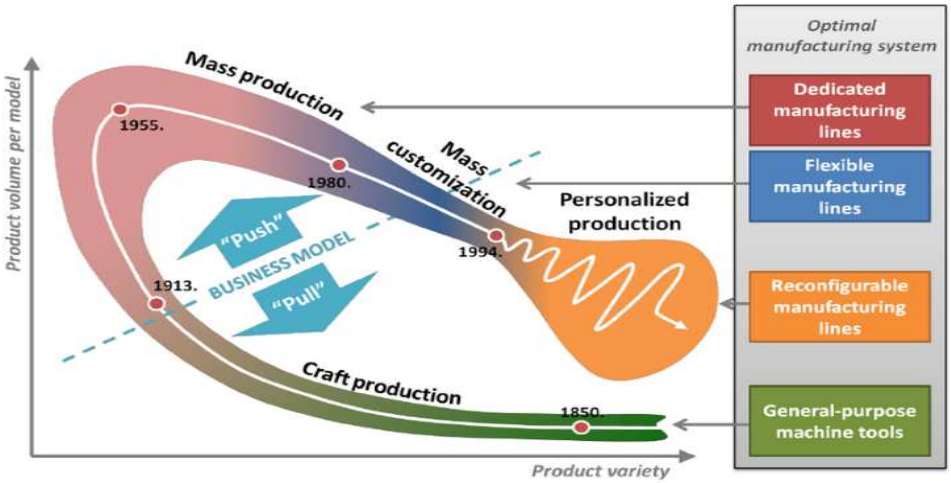

Figure 1 Volume variety relationship in manufacturing paradigms [3]

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2.1 Advantages of mass customization

For mass customization, it is imperative that the operating network is flexible and dynamic because the main purpose for mass customization is to adapt to individual customer requirements. The goal is to give the customer the opportunity to design their own specific products [5].

Main advantages of mass customization:

- Better position and market share - maximize customer satisfaction, better references
- Lower cost of material waste and inventory - it is a contract production, it is not necessary for the company to have a stock of finished products
- Faster cash flow: quick production - quick turnaround
- Reducing delivery time ensures flexible production and information flow enables manufacturers to quickly adapt to customer requirements.
- The manufacturer's ability to offer a wide range of products with low production costs - various product types with the same basic components but different final design will allow manufacturers to offer a whole range of products to satisfy every customer.

3 Mass customization approaches

According to Joseph Pine, II [6], there are Four Approaches to Applying Adaptation in Mass Customization:

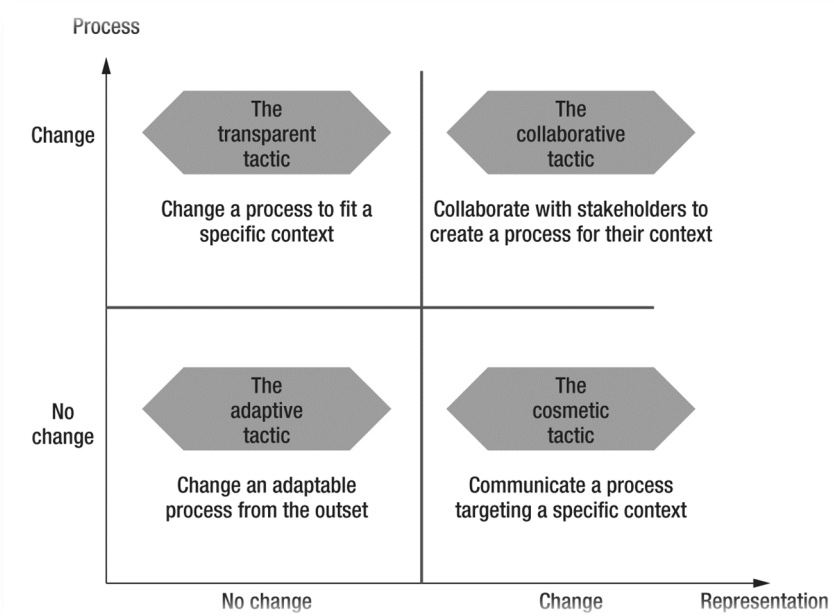

Figure 2 Two approaches of mass customization [6]

- **Collaborative customizers:** These organizations offer customers the opportunity to participate in the resulting design to meet their needs (size, colour, functionality).
- **Adaptive Customers:** Customers buy a standard product but can customize it according to their needs (software, programming language).
- **Cosmetic adaptations**: These companies (mostly suppliers) offer a standard product but present it differently from different customers (different packaging).
- **Transparent adaptations:** these companies offer customers customized products without knowing (e-shops).

4 Key success factors

Mass customization is able to customize products in bulk for less cost in a relatively short time. Many experts on mass customization agree that the success of mass customization is dependent on some key factors:

4.1 Modular product design

In the modular design of products, products are designed within some modules or processes, so they can be used for different types of products. For example, Boeing Co. has thousands of components for its standardized aircraft, configured for different finite aircraft types. This system enables companies to simplify ordering, engineering and production. Modular product design can be built on "project shop" models or workspaces with required throughput [5-8].

Requirements for the modular system:

- enough input standardized components (the need for reliable suppliers),
- skilled, highly educated employees with excellent technical qualifications,

- relevant organizational structure that improves coordination between modules [12].

Benefits:

- the ability to use standardized components for different product types,
- shorten production time - modules can be run simultaneously, thereby reducing production time,
- simple problem diagnostics, possibility to isolate individual errors, quality problems, easier control [7,9].

4.2 Flexible Manufacturing Process

This factor envies the capacity, the difference of products and the delivery times. If the company is able to efficiently organize a modular product design production system is flexible what brings more variety and lower costs to the market [5].

4.3 Sophisticated Order Management

Mass customization is based on customer requirements. Because Individual Claims are different order management is a critical factor in the relationship between the customer and the company. Therefore, any company that wants to meet the requirements should have an established system that would include the open profiles of each customer and would be so easy to meet its requirements [9-13].

Factor requirements:

- close customer relationships,
- system for processing a large amount of information (orders, delivery dates, payments),
- integrating the value chain from customer communication through marketing to sales [5,9].

4.4 Integrated Information System

The main requirement for mass customization is an efficient information system that ensures a smooth and accurate flow of information between customers and manufacturers, including among corporate divisions. To handle such decision-making between minutes and multiple decisions, a decision support system is required that integrates information from all participants throughout the organization as well as between customers and producers [9].

4.5 Organizational structure

Organizational hierarchies with many levels are not relevant to a mass personalization society. The organizational structure should have a lower level and effective coordination between processes (modules). It focuses on a high degree of integration between the various functions and employee participation. The result is a much higher degree of decentralization in decision-making. In addition, the structure is open to both suppliers and customers because (suppliers and customers) are seen as an extension of the organization [5,12].

With regard to the concept of mass customization, the organizational structure should be as follows:

- Management focuses on three parts: vendor relations, customer relationships, and resource management.
- All departments are integrated along the value chain.
- The information system connects parts of the organization and also provides relationships with suppliers and customers [5].

Conclusions

The concept of future production systems will require completely new approaches to the organization of work in production. They will use all the good of past production approaches and combine it with the latest advanced technologies. The latest technologies, often referred to as breakthroughs, will make it possible to change existing production principles.

The future production will produce product which will be tailored for needs of customer. Future production will produce products that are tailored to the needs of a particular customer, highly sophisticated, comprehensive, capable of offering new functionality, and will therefore require a completely new production environment.

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