ORDER MANAGEMENT IN METALLURGICAL PRODUCTION

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Abstract

Strong competition on the market has led to increased customer's requirements according to manufactured products. Customers expect unique products that meet their individual needs; low prices and a very good quality service. Strong competition is also a reason for seeking more and more opportunities to gain a competitive advantage by firms in the market, leading to a significant increase in the number of unique orders with specific characteristics definite by the customer. This trend is clearly visible in the metallurgical production, which is steadily growing share of the make-to-order systems.

The article presents the latest trends and issues related to the order management of metallurgical production and proposes improvements in the planning and verification of production orders. The proposed solutions are dedicated for make-to-order systems of especially medium metallurgy enterprises.

Keywords: order management, make-to-order system, metallurgical production

1. INTRODUCTION

Customers expect wide range of newly design, high quality products, which meet their individual needs and specific requirements. Therefore, offered products on the market are becoming more complex. Also a strong pressure for shorten time of delivery is observed. For these reasons, a main trend in manufacturing sector is increased specialization in production. Nowadays, products are manufactured by a group of specialized companies that deal with the implementation of high-quality components and the provision of professional, highly specialized services and represent only a small part of the entire product development process. Complex supply chains are created where significant tasks of companies are to make products exactly due to customer's specification and strictly within a specified period [2]. The high performance of processes and employees are needed [8], [10], [11]. Also using many modern methods which help to improve production and increased efficiency is expected [14], [15], [16] [17]. These trends are clearly visible in metallurgical production, which is steadily growing share of the make-to-order systems (MTO).

Big enterprises, which apply metallurgical production, the most often use ERP systems, which help them to manage of order planning. The real problem arises in the group of small and medium-sized enterprises that do not typically use ERP systems due to the high costs of implementation and maintenance. The lack of methods and tools which support an order management in the sector of MTO small and medium enterprises is clearly observed.

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proposed solutions are dedicated for make-to-order systems of small and medium enterprises applied metallurgical production.

2. CHARACTERISTIC OF MAKE-TO-ORDER SECTOR

Make-to-order means companies which produce bespoke and customized products to particular customer specifications but not repeated on a regular basis or in a predictable manner. In the MTO sector, some or all of the production takes place after the customer order has been received. MTO companies have few standard products and difficult-to-predict, volatile demand. They manufacture products to customer specification. For this reason, in the MTO sector is needed more flexibility to customize the products to the specific needs and requirements of individual customers [9]. The main characteristic of MTO companies is shown in Table 1.

The MTO sector includes especially small and medium sized enterprises (SME's). From a manufacturing strategy point of view, the key strengths of make-to-order SME's are flexibility, quick decision making and cooperation from employees. The most important weaknesses are: the lack of technical superiority, infrastructural facilities and financial resources [7]. Two types of make-to-order companies can be identified in relation to contract type [1]:

1) Repeat Business Customizers (RBC);
2) Versatile Manufacturing Companies (VMC).

The type has a huge influence on market strategy [1]. VMC's operate in all levels of supply chains and explore of new markets. They manufacture a high-variety of products but compete for each order separately. Repeat Business Customizers provide customized products on a continuous basis over the length of a contract. RBC's are able to establish more stability by enticing customers into a more committed and predictable relationship. They are generally located upstream in supply chains. The retention of existing customers is especially important for RBC's.

The customer enquiry stage can be considered to be the most critical as it deeply affects the subsequent stages amongst the identified production planning and control (PPC) stages in MTO companies. The job entry stage is a key point at which capacity planning is undertaken as jobs are confirmed. Additionally, these companies are mostly SME's requiring affordable solutions; hence, the corresponding software needs to be flexible enough to support activities. These companies are mostly positioned midstream and upstream in supply chains, which causes MTO companies to be prone to and most affected by any changes that their customers may make to their production plans. Thus, software needs to enable successful and up-to-date information sharing. Finally, MTO systems need to constantly entice new customers, or convert one-off jobs into repeat business, due to competitive and volatile market conditions. Information systems have become an indispensible part of manufacturing but a good fit is needed. Therefore, software solutions applicable to this idiosyncratic production strategy are essential. In addition, Customer Relationship Management (CRM) systems which can help MTO's to turn one-off customers into repeat-purchasers are required [1].

Table 1. The significant features of the make-to-order systems of small and medium enterprises [1], [3], [4], [5], [6], [9], [12], [13].

Criterion	Features of make-to-order systems
Type of products	bespoke high-variety customized to customer specifications
Production	not repeated on a regular basis only few standard products
Demand	difficult-to-predict volatile
Key problems	dealing properly with enquiries
Key strengths	flexibility quick decision making quick and effective cooperation from employees
Weaknesses	lack of technical superiority lack of infrastructural facilities lack of financial resources
Competitive factors	price technical expertise delivery time reliability in meeting due dates
Crucial factors in winning the order	realistic and currently competitive delivery dates realistic and currently competitive prices reputation for technical skill reputation for quality financing package archiving and retrieval of product data assessment of available design, product skills and facilities estimation of lead times, costs, profit margins effective communication and coordination between all departments

3. THE ROLE AND IMPROVEMENTS OF A PLANNING AND VERIFICATION PROCESS

The process of production order planning and verification is a key issue in order management of today's MTO systems. As literature analysis and industrial practice indicated, a key problem of MTO companies is dealing properly with enquiries [9]. This kind of enterprises are in competition with other companies on the basis of price, delivery time, technical expertise and reliability in meeting due dates. The bid has to contain realistic and currently competitive delivery dates (DD) and prices, which are crucial factors in winning the order, although aspects such as the enterprise's reputation for technical skill, quality, or the financing package can also be significant.

In MTO systems, each order may be different. When a customer provides a request for quotation or invitation-to-tender for a particular product, he requires due date and the determination of price. Therefore, these decisions require: the archiving and retrieval of product data; the assessment of

available design, product skills and facilities; the estimation of lead times, costs, profit margins; and effective communication and coordination between all departments involved in the activities [1], [7].

The decision support system requires to include the following significant features [6]:

- effective capacity planning and control;
- flexibility to be able to document aspects of product development throughout the order processing cycle;
- effective mechanisms to generate alternative due date plans and pricing to deal with customer enquiries;
- incorporation of a job release decision point in planning;
- a need for aggregate, dynamic planning and control which takes unconfirmed bids into consideration;
- a need to enable a high level of coordination amongst departments playing a critical role in MTO planning.

The analysis of literature shows that many problems of small and medium enterprises from the MTO sector are caused by a limited set of decision points in the flow of orders. A review of concepts for MTO SME's indicates that these areas have been neglected in literature to date [9].

In the paper is proposed a new procedure of the planning and verification of production orders which the main aim is to improve this process to make a possibility to give a quick response to customer inquiries. The proposed solutions are dedicated for make-to-order systems of small and medium enterprises applied metallurgical production. The proposed procedure based on the Theory of Constraints and relies on the propagation of constraints. Sequentially sufficient conditions to be met are tested to ensure that order realization is possible within a specified due date by customer and is consistent with the strategic goals of the enterprise. To shorten time of response, only these constraints are checked which:

- determine whether it is possible to realize a production order in the manufacturer's system;
- have a direct impact on the time and cost of order realization [13];
- are connected with the realization of the most important aspect of an enterprise strategy [12].

The result of the verification is a set of production batches which meets the defined constraints. The eventual variant selection is carried out during negotiations with the client. The proposed procedure of production order planning and verification consists of seven stages (Table 2.).

Table 2. The procedure of production order planning and verification process [12], [13].

Stages	Constraints
1	Obtaining data about production order
2	Forming a set of production batches due to production capacity
3	Availability and capacity of internal transport
4	Availability and capacity of buffers
5	Time of order realization
6	Cost of order realization
7	Key Performance Indicators for significant strategic objectives

CONCLUSION

In metallurgical production increases the sector of small and medium make-to-order enterprises. Order management plays a key role in such systems. The strong pressure for quick creation of answers for customer enquires is observed in MTO enterprises. Therefore, there is a need to develop methods and tools which help quick to answer for the customer questions about possibility of production order realization in manufacturing system, about price and time of realization.

The proposed solution is an alternative to time-consuming and cost-intensive simulation methods, in which the planning of the order is much more accurate and aims to find the optimal solution, but in which it is not possible to quickly (in the "on line" mode) prepare information for the process of negotiating the terms of the agreement with the customer. In the simple way allows realization of production order to be planned taking into account only the most important constraints.

ACKNOWLEDGEMENTS

National Scholarship Programme of the Slovak Republic for the Support of Mobility of Students, PhD students, University Teachers, Researchers and Artists during the academic year 2014/2015; application ID 10750.

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