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The two level master production schedule and planning bills in a just in time MRP context

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Abstract

The evolution of industrial firms has recently passed from a strong growth phase to a phase where there is a greater complexification of products: widening the range of products in catalogues, diversification and personalization of models. The current trend is to use, with production management techniques such as classical manufacturing resource planning (MRP2), the concept of two level master production schedule (MPS), using planning bills with percentages indicating the probability that such or such an option will be used. This necessitates, however, the implementation of a rigorous approach to continuous improvement using just in time (JiT) and total quality (TQ) concepts. In the first part of our paper we discuss principles of operating two level MPS; secondly, we analyze these effects on management and organization. Our paper is based on a case study. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: Manufacturing resource planning; Master production schedule; Just in time

1. Introduction

The evolution of industrial firms has recently passed from a phase of strong growth to a phase of product complexification: widening the range of products in catalogues, and diversification and personalization of models.

Imagine, to clarify this statement, the simple example of a company that manufactures flow meters. Initially, the only product manufactured is a 50 mm diameter 220 V flow meter.

Rapidly, and under the constraints of the market, this enterprise will have to diversify its production

by proposing a variety of diameters and other voltages. This increase in the complexity of products constitutes a certain competitive advantage when it provides real added value for the consumer. However, it also entails far more complex industrial management of manufacturing processes.

So, if the productive system is complex, the functioning principles must remain simple. Behind this complexity, we find only two major flows (material and information flows). The information flow speed is very different from the material flow speed (except if the information is moved by people). Therefore, the human activities must facilitate and accelerate the flow, eliminate wastes in the processes [1].

Classical production management techniques such as manufacturing resource planning (MRP2) manage well these flows and adapt well to a

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FLOWMETER

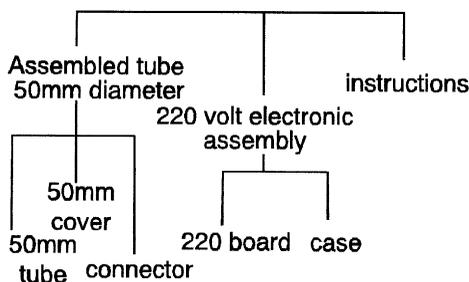


Fig. 1. Single bill of material.

simple bill of material structure [2]. Using our example, we show this bill of material structure in Fig. 1.

This single finished product bill of material is perfectly suitable as long as the company sells only 220 V 50 mm diameter flow meters.

On the other hand, as soon as the firm wishes to diversify its production by proposing a variety of diameters and different voltages, it has to create as many bills of material as there are assembled finished products (for example, with 10 diameters and three voltages, the number of finished products goes up to 30 – at kitchen manufacturers, one can find up to several thousand finished products). Using classical MRP2 logic, it becomes heavy to manage so many bills of material and forecasts.

The goal of assembly planification is to identify different sequential variants for the course of assembly operations and to evaluate these variants so as to determine the optimal sequences. To do that, the optimization criterion is the minimum cost of the entire process.

It is a difficult combinatorial task to select the optimum sequence. Among the best-known methods for generating assembly sequences are those developed by Bourjault and Henrioud [3], Homen de Mello [4], Heemskerk [5], Delchambre [6] and Lebkowski [7]. These methods analyse all possible assembly sequences. A set of these realizable sequences is obtained for the most part by analyzing all the cost in the structural graph of the product being assembled. These methods identify the optimal sequence before the assembly process begun, and a great deal of computer calculation time is typically required.

As Forrester [8] advised, “It’s more useful to concentrate on the fundamental system structure than on the mathematical scheduling methods”. The present article proposes a thought in regard of the first steps of the decision process. It proposes to use the concept of two-level master production schedule (MPS), using planning bills incorporating percentages which indicate the probability that such or such an option will be used. This necessitates, however, the implementation of a rigorous approach to continuous improvement using a just in time (JiT) and total quality (TQ) philosophy.

Using two level MPS is a characteristic of the assembly firms. This fact refer to the firm classification proposed by Gousty and Kieffer [9]. This typology is based on two fundamental dimensions: complexity and uncertainty. Complexity is given by product structure, and therefore, by the bill of material (BOM). That leads to highlight two types of systems: assembly system and manufacturing system. From four criteria (market answer, production repetitivity, “product-process” organization and type of value added) the AFGI¹ typology gives a graphical representation. A “diabolo” (see Fig. 2) is a picture of the “product-process” structure concerned by the two-level MPS.

In this conceptual framework some production piloting and planification models can be used. Pourcel [10] proposes a production system decomposition in accordance with the system activities. He shows a pyramidal decision model in regard of the long term (investment decisions) and the short term (resource affectations and planification decisions). The piloting system structure recommended by APICS² refers to this model [11].

From a classification of the level and method decisions, Gorry and Scott-Morton [12] proposed a decision typology for the production systems. According to this typology, the actions on the BOM levels belong to the “hybrids” decisions (decisions classified by method) and to the piloting decisions of the short term (decisions classified by level).

¹ French industrial management association, AFGI: Association Française de Gestion Industrielle.

² American Production and Inventory Control Society.

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