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Long-term capacity management: Linking the perspectives from manufacturing strategy and sales and operations planning

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Abstract

Efficient long-term capacity management is vital to any manufacturing firm. It has implications on competitive performance in terms of cost, delivery speed, dependability and flexibility. In a manufacturing strategy, capacity is a structural decision category, dealing with dynamic capacity expansion and reduction relative to the long-term changes in demand levels. Sales and operations planning (S&OP) is the long-term planning of production levels relative to sales within the framework of a manufacturing planning and control system. Within the S&OP, resource planning is used for determining the appropriate capacity levels in order to support the production plan. Manufacturing strategy and sales and operations planning provide two perspectives on long-term capacity management, raising and treating different issues. In this paper, we compare and link them in a framework for long-term capacity management. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Capacity management; Manufacturing strategy; Sales and operations planning; Production planning; Resource planning

1. Introduction

The management of capacity in a manufacturing firm is often divided into three or four stages, ranging from long-term capacity planning to short-term capacity control and execution. Intermediate capacity management is related to rough-cut capacity planning, linked to the master schedule, and capacity requirements planning, linked to the material requirements plan. In this paper, we deal with the longest-term perspective. The relevant issues treated at the long-term capacity management level are related to determining when and by how much the capacity levels should change. Capa-

city is most often treated at an aggregate level, dealing with key work centres rather than all individual resources and based on forecasts of product families rather than of individual products. More specifically, long-term capacity management is most interested with the capacities that take a long time to change, either to acquire new capacity or to reduce capacity levels. Typically, the planning horizon is 1–5 years and the planning period is a month, at least for the first year, and then possibly quarters or even longer periods.

The input to long-term capacity management is a sales plan, based on a demand forecast. Such a sales plan must at least cover the time perspective for acquiring new capacity or reducing the relevant capacity. The sales plan can be translated into a corresponding capacity plan. However, decisions

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regarding the production plan, in terms of e.g. production smoothing, means that production will not be identical to the sales plan. Furthermore, capacity may be acquired or reduced at times or quantities other than those required by the sales plan. Such issues are treated from two separate perspectives, on the one hand the manufacturing strategy perspective and on the other the sales and operations planning perspective, representing the highest planning level in a manufacturing planning and control system.

In a manufacturing strategy, capacity is considered as one of approximately seven decision categories, for which the manufacturing firm must have some policies. The other decision categories are facilities, production process, vertical integration, quality, organisation and personnel, and finally information or planning and control systems (see e.g. [1,2]). Capacity, facilities, production process and vertical integration are considered structural decision categories, dealing with the long-term manufacturing operations structure. The latter three decision categories deal with the manufacturing infrastructure. The capacity issues are related to the strategic relationship between capacity and demand levels, specifically translated into capacity expansion or reduction strategies. The basic foundation for such a strategy is that capacity comes in large, discrete steps rather than in small increments. Therefore, it is of strategic importance to decide whether capacity should come first, i.e. prior to expected changes in demand, or if capacity should be acquired first when the corresponding level of demand has been acknowledged. There are three different strategies in principle: lead, lag or track. Lead means that capacity is added in anticipation of increasing demand, whereas lag means the opposite. Track is a switching strategy, where the differences between capacity and demand levels are kept to a minimum. There is a corresponding discussion for capacity reduction. Thus, the main focus on capacity management from a manufacturing strategy perspective is the *timing of capacity changes*.

Sales and operations planning (S&OP) is the longest-term planning level in a manufacturing planning and control (MPC) system. Thus, S&OP belongs to a manufacturing infrastructure decision

category from a manufacturing strategy perspective. Nowadays, many MPC systems support the MRPII structure, i.e. manufacturing resource planning, from where the term sales and operations planning originated. In early MRPII terminology, the term production planning was used instead of S&OP, but today the latter is being used to a larger extent. At the S&OP level, a production plan is developed based on a sales plan. Here the issue is related to the production level relative to the demand level in various periods. The principal options available are level, chase and mix (or combination). These are sometimes called planning strategies. Level means that a production rate is established over the planning horizon, whereas chase implies that production matches demand in a manner such that all demand in a period is produced in the same period (typically month). In the mix option a production rate is used for a few periods and then changed. Any difference between the sales plan and the production plan will result in a corresponding inventory or backlog plan — an inventory plan in a make-to-stock situation and a backlog plan for make-to-order or engineer-to-order environments. The production plan is translated into a capacity requirements plan in terms of aggregate resources in the so-called resource planning. Then, under- and over-capacities are identified in the resulting capacity plan. Thus, the focus of capacity management from an S&OP perspective is on the *rate of production relative sales*.

Both perspectives deal with the long-term management of capacity, i.e. how to best utilise ‘slow-moving’ resources for manufacturing operations. Still, the issues, objectives and options differ. According to the decision categories identified by Hayes and Wheelwright [1] we have structural decisions related to capacity (expansion or reduction strategies) and infrastructural decisions related to MPC systems (e.g. sales and operations planning). This paper links these two decision categories traditionally treated as belonging to different groups of categories. This raises interesting questions regarding the integration of capacity issues and whether they should be treated in sequence or not. The purpose of this paper is to discuss the relationships between the two perspectives, in order to integrate strategic and planning/control issues

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