Chapter 3

ORGANIZATIONAL, SYSTEMS AND HUMAN ISSUES IN PRODUCTION PLANNING, SCHEDULING AND CONTROL

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Abstract: With global markets and global competition, pressures are placed on manufacturing organizations to compress order fulfillment times, meet delivery commitments consistently and also maintain efficiency in operations to address cost issues. This chapter argues for a process perspective on planning, scheduling and control that integrates organizational planning structures, information systems as well as human decision makers. The chapter begins with a reconsideration of the gap between theory and practice, in particular for classical scheduling theory and hierarchical production planning and control. A number of the key studies of industrial practice are then described and their implications noted. A recent model of scheduling practice derived from a detailed study of real businesses is described. Socio-technical concepts are then introduced and their implications for the design and management of planning, scheduling and control systems are discussed. The implications of adopting a process perspective are noted along with insights from knowledge management. An overview is presented of a methodology for the (re-)design of planning, scheduling and control systems that integrates organizational, system and human perspectives. The most important messages from the chapter are then summarized.

Key words: Production planning, scheduling, organizational structure, human factors

1. INTRODUCTION

Effective planning and scheduling processes are essential for success in manufacturing operations. In today’s environments manufacturing
operations are typically supported by IT systems that, potentially, provide an abundance of real-time status information. There is a strong inclination to assume that the planning and scheduling process can be 'hard-wired' within the decision structures of the IT system by embedding appropriate models and algorithms. Indeed modern Enterprise Resource Planning (ERP) systems and 'add-ons' such as Advanced Planning and Scheduling (APS) systems try to embrace this philosophy (Padmos et al. 1999). However, the limitations of treating planning and scheduling as essentially mathematical problems capable of being isolated from their environments, fully specified and then solved for feasibility or optimality have been frequently noted (Buxey, 1989; Shobrys and White, 2000; MacCarthy and Wilson, 2001a).

Contemporary ERP systems may bring many benefits to operational control in manufacturing. The benefits are often derived from improvements in data representation, data handling and data integration. Frequently, however, ERP systems come with traditional hierarchical planning and control modules. Although more usable than MRP-based systems from two or three decades ago, they suffer from many of the same issues and limitations—difficulties in supporting responsive planning and control, lack of transparency, limited support for capacity planning and management, poor fit to particular sectors or industrial environments (Davenport 1998, Chen 2001). Many organizations have gone through ERP implementations, often driven by a desire to address operational control, response and order fulfillment problems. Re-engineering of information systems in businesses generally has proved difficult, if not daunting (McAfee, 2003). Many of the 'traditional' planning and control issues may remain after an ERP implementation (Konicki, 2001).

If existing systems, models and algorithms fail to provide full support to planning, scheduling and control functions, then what is missing, what should be included or what should be put in their place? These are difficult questions. This chapter addresses them.

The mathematical approaches to production planning, scheduling and control (PSC) are well known. They are embodied particularly in mathematical programming models that capture decision variables, constraints and objectives (e.g. Hax and Meal, 1975; Shapiro, 1993) and in classical scheduling theory that typically studies algorithms and heuristics to assign jobs to machines to optimize some objective(s) over a time domain (e.g. Baker 1973). Simulation approaches and combined optimization and simulation techniques have also been advocated (Shanthikumar and Sargent 1983).

In this chapter we look at the 'non-mathematical' research in planning, scheduling and control, in particular the key thinking on organizational, systems and human issues and its importance in the context of contemporary