Chapter 3
Production Planning:
Advanced Issues and Implications

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ABSTRACT

This chapter explains the overview of production planning; the issues of remanufacturing production planning and control; Advanced Production Planning and Scheduling (APPS) and Radio Frequency Identification (RFID); production planning conflict resolution and optimization models; production planning and emission constraints; production planning and quality management; production planning and Cellular Manufacturing System (CMS); production planning in the steel industry; production planning in the energy industry; and production planning in the chemical process industry. The purpose of production planning is to organize the resources in order to efficiently manage the production costs, time, and staffing in the business operations. The individual in charge of production planning adjusts the workforce and process flow to obtain the regular utilization of organizational resources with minimal downtime, minimal bottlenecks, and a level of output consistent with all the resources being put into the manufacturing processes.

INTRODUCTION

Production planning is concerned with finding the effective plan of jobs into a manufacturing system so that its actual outputs over time match the customer demand with the least cost (Li, Yang, Uzsoy, & Xu, 2016). The effective production planning is essential for the industrial enterprises (Heck, 2014), modeled by means of linear programming with the expectation of the optimal solution in a reasonable time (Kim & Lee, 2016). The integration of planning and scheduling decisions is the major approach to obtaining the effective production operation in the modern manufacturing companies (Menezes, Mateus, & Ravetti, 2016). Analytical and iterative optimization techniques are utilized to solve the job shop-related capacity planning problem for the maintenance service provider with the lead time requirements (Kurz, 2016).

In global operations, each facility must meet the assigned customer demand in every period at a minimum cost through its production and inventory decisions (Sharkey, Geunes, Romeijn, & Shen, 2011). Produc-

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tion planning and scheduling problems are crucial for the profitability of companies and the utilization of resources toward meeting deadlines (Menezes et al., 2016) concerning casting industry (Camargo, Mattiolli, & Toledo, 2012), the food industry (Rocco & Morabito, 2014), and cargo transportation in port terminals (Robenek, Umang, & Bierlaire, 2014). In a supply chain operating under uncertainty, the important perspective to reduce the complexity and scope of the planning process is to organize all involved critical production planning decisions in a hierarchical structure (Aghezzaf & Sitompul, 2013).

This chapter aims to bridge the gap in the literature on the thorough literature consolidation of production planning. The extensive literature of production planning provides a contribution to practitioners and researchers by explaining the advanced issues and implications of production planning in order to maximize the impact of production planning in global operations.

BACKGROUND

Nowadays, most manufacturing companies produce a wider range of products and provide the greater new products more quickly by emphasizing market requirement (Gholamian, Mahdavi, Tavakkoli-Moghaddam, & Mahdavi-Amiri, 2015). Supply chain is the complex business entity that has a high degree of uncertainty, which is based on its real-world characteristics (Zarandi, Turksen, & Saghiri, 2002), so that uncertainty is the critical factor, which can affect the configuration and coordination of supply chains (Davis, 1993). Davis (1993) introduced three different sources of uncertainty in supply chains, which these sources are supply, process, and demand uncertainty. Defective raw materials received from suppliers or delays in the supplying are the important factors, which cause uncertainty in supply. Process uncertainty results from machine breakdowns, whereas demand uncertainty is the most serious perspective from other sources (Davis, 1993).

Production capacity can be uncertain due to many factors, such as unexpected breakdowns of unreliable machinery, unplanned maintenance of uncertain duration, and rework of the defective items (Hu, Duenyas, & Kapuscinski, 2008). Such uncertainties complicate production planning in that the output is not necessarily equal to the planned amount. The effect of uncertain capacities on production planning in the serial systems has been investigated by many researchers (Hwang & Singh, 1998). The unmet demand incurs penalty cost, while unused items result in disposal costs (Ji, Wang, & Hu, 2016). Lead time is the amount of time, defined by the supplier, that is required to meet a customer request or demand (Kasemsap, 2017a). When companies consider the differences in both costs and lead times, they tend to compromise by simultaneously considering new parts and remanufactured and recycled parts (Su & Lin, 2015).

Regarding production planning perspectives, Wang and Gerchak (1996a) explored both uncertain capacity and random yield and explained that the optimal policy is of a reorder-point type. Erdem and Özekici (2002) established the general periodic-review model that incorporates both uncertain capacity and random environment. The optimal policy is the base-stock policy, where the optimal order depends on the effective procedure in the manufacturing environment (Erdem & Özekici, 2002). For a single-period multi-stage system with setup costs and uncertain capacities at all production stages, Hwang and Singh (1998) indicated that the optimal policy is characterized by the sequence of imbedded critical numbers. Hu et al. (2008) emphasized the optimal joint control of inventory and transshipment for the manufacturing company that produces in two locations whose production capacities are uncertain.