Foreword by George W. Plossl

# MRP

## Integrating Material Requirements Planning and Modern Business

Terry Lunn
with Susan A. Neff

The Irwin/APICS Series in Production Management

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*For our mothers, Lenore and Liz*

# FOREWORD

When people do not fully understand how their computer-based systems work, they take one of two courses: follow them blindly or ignore them completely. Both are guarantees of failure to gain the full potential benefits.

Planners working with MRP programs need to understand more than the mechanics of the system; they must also know what latitude they have to override it and change the actions suggested. Many others, however, including cost accountants, design and process engineers, production workers, purchasing people, and clerical workers in internal sales activities, need to understand only how the MRP programs work and what information they can provide them.

The literature on MRP—material requirements planning—falls into two classes: in-depth concentration on the technique and its manifold components or superficial descriptions of it and its role in manufacturing planning and control. The former turns many people off; like the boy who asked the librarian for a book on zebras and, when offered a thick tome, said, "I don't want to know that much about them." The latter does not provide the basic working knowledge many nondirect users need.

This book bridges the gap, enabling support staff people to quickly and easily gain the basic knowledge they need. It also provides a fine primer for beginning the education of planners. It covers the mechanics of MRP in clear, concise language and shows its application to many types of production.

Throughout the text, Focus boxes direct attention to specific actions that enhance or endanger the successful use of the

techniques. At the end of each chapter, an Applications section illustrates how the techniques are being used in a variety of types of businesses, thus broadening readers' understanding and alerting them to potential problems.

This book is useful both as a text for educational programs and as a reference for practitioners in industry using MRP programs or interrelating with them in support activities. It has useful information for those implementing systems. The text is well written, figures are excellent, and appendixes provide details on supplemental reading, hands-on MRP exercises, descriptions of lot-sizing techniques, and a discussion of the closed-loop system of which MRP is a core element.

The publication of this book fills an empty niche and meets a long-standing need. It is a valuable addition to the literature of the field of manufacturing planning and control.

**George W. Plossl**

# PREFACE

Material requirements planning is the scheduling logic used to manage the flow of material in manufacturing operations. Every manufacturing company in the country is reevaluating its ability to compete, striving to find ways to educate and motivate its employees toward excellence. The efficient flow of material is a major objective of this drive toward excellence. We concluded that there is a vital need for a basic and approachable book on the subject of material requirements planning (MRP).

We are going to cut through the academic and technical jargon that has separated end users from the system, clearly tracing the logical system of MRP in easy terms and examples. Although material requirements planning is commonly computer-implemented, its basic principles can conceivably be applied manually in small business organizations. The ability to understand its essential premises is a prerequisite to the successful implementation of any manufacturing control system.

The essential components of a material requirements planning system are presented in simple sequential steps. The first nine chapters of the book deal with the inputs into the process and how this raw data is converted into meaningful management information. As far as possible, we have tried to use examples from the work life of a small plant that produces pens and pencils—products easily visualized by the reader. We will examine how employees are struggling to meet production schedules, satisfy customer requirements, and control operating costs—laudable goals that sometimes appear to be mutually exclusive. The reader will recognize problems and constraints that are familiar incidents in day-to-day plant operations and

will learn how to use and apply the powerful tools of a material requirements planning system to solve scheduling dilemmas and control the manufacturing environment.

Standardized definitions as recognized within the manufacturing community will be used throughout this book. We have indicated in the index those terms that are under the copyright of the American Production and Inventory Control Society (APICS).

We have included an appendix of supplemental readings that may help the reader to understand the fine detail of some of the topics we discuss. No book (even this one) can provide all of the experience and perspective we need to acquire on all aspects of the manufacturing process; we urge the reader to seek out as many learning experiences as possible to stay competitive.

To the best of our knowledge, FineLine Industries is wholly imaginary, but we kind of like to think of it as being located a couple of miles outside a small town someplace in West Tennessee.

This is *your* book, and we hope it helps you to achieve your goals. If you have any suggestions on how we might improve it, or if there was anything that was particularly useful to you, we'd like to hear from you.

**Terry Lunn**
**Susan A. Neff**

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No book is written in a vacuum, and this one is no exception. Without the contributions of countless people, this project would never have gotten past the stage of late-night discussions at various technical seminars.

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We also thank our families and friends, who may have been neglected during the writing of this book but were never forgotten. Special appreciation goes to Ronn for his patience during all the weekends and holidays when writing trips took precedence over everything else. And it was Ronn who reminded us that replacement parts for the competition's product also count as independent demand items.

**T. L.**
**S.A.N.**

# CONTENTS

# INTRODUCTION

People working together are the heart of any successful business enterprise today. Material Requirements Planning (MRP) is a scheduling technique used by many manufacturing firms as the tool through which people communicate to one another about the flow of material. Successful companies realize that it is of primary importance for people using this tool to understand both the technique and their role in its execution. There is a real need for today's businesses, across all functional lines, to understand the workings of a material requirements planning system. Once business professionals understand the simple concepts of the MRP technique and how its parts work together, they can effectively apply this tool to make their lives easier tomorrow.

## WHAT IS MRP?

Material Requirements Planning is a phrase that puts the primary emphasis on the word *planning*. It is, above all else, a planning and scheduling technique. Much confusion surrounds the concept, however, because the acronym MRP can mean several different things, including material requirements planning, closed-loop MRP, and MRP II. *MRP* in its most restricted form refers to the mathematical logic used to plan material amounts and to determine the date that those materials are needed. However, anyone in manufacturing will quickly tell you that it is what we actually do with those plans and schedules that determines success. A planning system feeds an exe-

cution system—such as shop floor control or production activity control.

Success with a planning system is an iterative process. As our plans drive the execution system, conditions begin to change over time. As these conditions change, it is necessary to have a feedback loop to manage the plan. When people are unable to execute according to the plan, we must consider the options. First and foremost, have we exhausted all possible alternatives to achieve our plan? If so, then we must tell the truth to the system and change the plan accordingly. This is called *closing the loop.* We will contrast the steps necessary to complete the execution of the plan with the steps that are necessary when replanning must be performed.

MRP planning is typically used to schedule the flow of materials to and through a manufacturing process. When these plans are accurate and we use them for execution, we are then able to use the materials flow as a base for planning all the company's resources. For example, we can compute the money required for raw materials by using future purchase expectations. We can calculate capacity required, which extends to labor needs, which extends, in turn, to payroll requirements. We can examine those resources that may take some time to modify, such as equipment, space, and energy requirements, so that we can look ahead to an orderly, structured adjustment in these areas. In total, we can extrapolate our material plans into financial plans.

When our planning becomes this extensive, it is called *MRP II,* or *manufacturing resource planning.* Generally, in the discussions that follow, when we refer to an MRP system, we are referring to this MRP II concept. We create and maintain the plans with MRP planning logic, we close the loop as execution progresses, and we use these numbers to run our total business enterprise.

At all times, we must keep in mind the essential premise that MRP is our tool, not our master. We control the tool with parameters as we make our operating decisions, and it suggests the actions we should take to implement these decisions.

## WHOSE MRP IS IT?

There is one key to success in any MRP system: people. How well do you and I understand our role in this complete planning system? To help us visualize this, the book is divided into five sections. The first section, Process, reviews the basic MRP function: How does the logic of MRP planning work? In the second section, Inputs, we discuss the elements necessary as inputs to the basic MRP function. Third, we will examine the Outputs and how they are used. Once we understand the inputs and outputs, we will then turn our attention to the fourth area, Managing with MRP. We will conclude with the fifth section, People, the ultimate owners and users of the system.

## HOW DO WE LOOK AT MRP?

In its abstract form, MRP applies to all business enterprises. There are certain business types, however, in which it is more easily applied. Its logic is more evident, for example, in a manufacturing company producing material in discrete lots, in which we include the range of make-to-order, job shop, make-to-stock, and repetitive manufacturing.

For purposes of effective discussion, we will use this environment to describe the MRP concepts. We will use an uncomplicated product—pens and pencils—to illustrate the key concepts and their applications. Throughout our discussion, we will consistently develop our illustrations through the manufacture of pens and pencils, products to which all readers can relate. We will show that if you do this well in one plant and one operation, you can go on, using other technologies, to link several plants or operations using the same essential concepts.

When appropriate, we will apply specific concepts to other industry types: continuous flow process, distribution, and service industries. This will enable you, the reader, to stretch your mind to envision how to apply these concepts to help improve your own operation. These Applications sections do not go into

exhaustive detail about *how* certain well-run companies are moving toward excellence through creative adaptation of MRP principles; this is, after all, a book on how to perform the basic operations effectively. What we have tried to do in these sections is to kindle your imagination and give you a glimpse of what can be done once you've started that journey toward excellence. When you are farther down the road, having really internalized the basics, you should be able to see the unique things that can be done within your own company.

We have not used, in our examples and discussions, many defense-oriented businesses that are required to comply with guidelines issued by the Department of Defense (DOD). For many years, there was a misapprehension that resulted in a sort of "myth" that MRP was incompatible with DOD requirements.

Quite frankly, this line of argument is simply not true. What *is* true is that to meet DOD guidelines, some special requirements and assumptions must be built into the process and the system. MRP, for example, is less applicable in prototyping situations but is extremely useful in managing the flow of material to support long-term and repetitive contractual commitments.

As you read this book, remember that thousands of people in all functional areas of every imaginable business environment are working with MRP systems. You don't need to be a computer expert to be able to understand and use this powerful tool. We're going to walk through the basic logic with you, show you some common applications, and point out some neat tricks that creative users have put into place in their companies. Perhaps one of their ideas will light a spark for you.

# SECTION 1

# PROCESS