



*Friends-of-the-Firm Briefing*

# Fundamentals of MRP

*A Reminder of the Power & Capabilities of This Decades-Old Planning & Scheduling Technique*

By  
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## *Forward by Alan G. Dunn*

Dear Friends-of-the-Firm,

Materials Requirements Planning, (MRP) has been used by manufacturers to plan and schedule inventory since the late 1950's. Invented by Joseph Orlicky in 1958 while working at IBM, MRP has evolved in many ways... some good and some not so good. Yet, in the end, MRP has led to dramatic changes in the ways inventory is managed in North America.

So why have so many companies reported failing with their MRP systems? Why has so much money been invested into sophisticated systems with so little reported return?

We believe the answer lies in the fundamentals... or more precisely stated... the lack of successful mastery of MRP fundamentals.

MRP is at its heart, a fairly simple computerized scheduling algorithm. To operate successful, MRP requires certain input data and operating parameters be impeccably maintained. Additionally, successful use of MRP outputs requires planning skills and judgment not usually resident in planners who have not been exposed to parameter driven systems. Finally, MRP requires new disciplines in data management, scheduling protocols and organizational communications between planners and factory floor personnel.

This Friends-of-the-Firm Briefing is provided as a reminder of the fundamentals that must be mastered if you are going to be successful with MRP as your primary planning tool. Admittedly, this Briefing presents no new information. It purposely presents old information (hopefully in an understandable format) as a reminder of how to make MRP work. Perhaps if the fundamentals get mastered, we all will hear less grumbling about MRP's failures and truly experience its power to schedule, reschedule and plan factories successfully.

Enjoy your reading.



Alan G. Dunn  
President  
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# Fundamentals of Material Requirement Planning

*By Alan G. Dunn*

Material Requirements Planning (MRP) can be an effective process for managing the materials equation. Computer hardware and software designed for use in MRP represent an effective tool for enhancing the process. Today's Materials Managers contribute significantly by applying the basics of MRP and not just implementing it. This Friends-of-the-Firm Briefing addresses the MRP fundamentals outlining the assumptions which MRP software doesn't tell you about.

## MRP - What It Is & What It Isn't

Material Requirements Planning has been cloaked in some mystery over the last two decades, considering such characteristics as "Class A, B & C" users, long implementation cycles, etc. The objective of this briefing is to bring MRP back to its basic and simple form and to give it back to the users to be used in the day-to-day business of manufacturing and distribution.

First, MRP is NOT a computer and associated software system for manipulating thousands of bytes of information and presenting material plans. It certainly is not a solution as is frequently presented by software and hardware sales people and marketers. Solutions usually imply problems and most companies should refuse to have an outsider attempt to sell them a solution when it's not really known whether a problem exists or not.

MRP is a combination of TOOLS and TECHNIQUES for assisting materials professionals, i.e., users, in managing the daily materials equation for:

- The right parts
- At the right place
- In the right quantity
- At the right time

Managing this daily equation successfully for any company is what we, as materials professionals, are paid to do. Doing it more efficiently and effectively represents that point where the tools of computer hardware and software come into play. **But these tools are not a substitute for good materials management practices. These practices must be in place as a prerequisite for bringing on any computer and its associated programs.** Many of us have seen and heard of numerous company MRP implementation failures. Many of these failures are attributed to the fact that they (the companies) have failed to clean up their act prior to spending the cash on hardware and software. "Beware of those, outside the company, bearing the solutions to your problems."

## The MRP Concept

As stated earlier, MRP is a tool and a technique for assisting the user in managing the materials equation. The tool accomplishes its results and gathers its energy from its basic organization.

That organization is made up of the following data files (we will discuss the people organization later):

- **Part or Item Master File.** This file contains a tremendous amount of information about a part. It is usually addressed or accessed by a part number. However, referencing to the file has, at times, been by part description, vendor part number or catalog number, commodity number, drawing number (very popular), etc. Today, the part number is the easiest and most direct access to the file, especially if there are plans to computerize the system. There are several characteristics about item master files and part numbers that we must all be aware of as managers of the materials equation. These are:
  - **The fewer the Item Master Files or records, the better job we can do managing them.** It truly is a numbers phenomenon.
  - **The fewer the digits in the part number, the fewer transaction errors we are likely to make.** With the use of commodity codes and various other sorting codes, it is possible to remove these types of information from the part number.
- **Bills of Material File.** This document itemizes all of the parts that go into an item. The item into which all of the parts go is called the "Parent" item, while the parts making the Parent item up are commonly referred to as "Components." The Bill of Material is a tremendously powerful and flexible concept. Not only are direct component parts included on the bill, but also consumable tooling can be considered. Raw materials (paint, steel, wood, etc.) may also be considered. The bill's primary purpose is to calculate the materials required to build the parent item. This is possible by including in the itemized list, the quantity of each component required to build one of the Parent. The calculated quantities of the components are often called the **gross requirements**. It is from these gross requirements that we determine if more materials are required in order to meet the company's assembly schedules and shipping schedules. There are some interesting characteristics about Bills of Materials. These are:
  - **The Parent item is "stockable" and can be transacted into inventory.** However, the more shallow the Bill of Material or the fewer number of single level bills it takes to link up for building the top item, the fewer number of inventory transactions and/or shop order transactions it takes to run the business. The fewer transactions of this nature, the easier it is to manage the inventory and the shop orders (work orders). Note that these transactions represent crucial points in the manufacturing process. They indicate that no further work is to be done on the part. This represents a perfect time to add all of the costs associated with the item's Bill of Material and compare them with the budgeted or standard cost associated with the item, to arrive at job variances. As we all know, everyone becomes a little anxious when tallying up the difference between budget and actual costs. It makes sense to minimize anxiety levels, especially when we, the users, have some control over them.

- If the Parent gross requirements list is printed and sent to the stockroom for picking of the parts, it is implied that all of the parts must be gathered together at the beginning of the job. We know that this isn't necessarily so! Some parts are not needed until the end of fabrication. MRP usually implies otherwise. It is no wonder that work-in-process is so loaded with inventory. Also, picking parts in the stockroom should be considered a job related set up cost but it rarely is for planning and stockroom manning purposes. Hence it adds to lead-time. MRP does not provide a clue on how to reduce this indirect set up time!
- Since all of the materials going into the Parent (including subassemblies which are also built with their own Bills of Material) are itemized, the bill represents an excellent way of calculating a Parent item's material costs. It is also the road map for calculating labor costs, through each part's associated routers.
- To remain a tool for managing the materials equation, Bills of Material must have a high degree of accuracy (98% or better). Because gross requirements are determined by multiplication, large errors will result when the Bills are not accurate.
- **Inventory Files.** These records itemize parts that the company currently has on hand in its stockrooms. Upon calculating a Parent item's gross requirements, one naturally looks to see if those parts and their quantities are available within the company. There are features of inventory, however, which no hardware and software system tells us about, because they are implied or assumed. These are:
  - **Inventories must be accurate, at least to 95%.** It will cost the company some indirect labor dollars to determine its ongoing level of inventory accuracy. The expense is absolutely necessary, but because it is indirect and shows up as manufacturing overhead, it is hard to justify the expense.
  - **Daily transaction cut-offs must be religiously and dogmatically practiced!** This is probably the hardest lesson for companies to learn. Timing is a major ingredient to success!
  - **Parts must be segregated into various activity and dollar categories.** Pareto's law, not Murphy's Law, must prevail in the company's stockrooms and planning office. To apply the law, we must separate the trivial many from the important few. This is not to say that any one part is unimportant. It is to say, however, that service levels can be achieved by; (1) simple reordering processes for inexpensive items or, (2) by complex planning/ordering processes that consume valuable planning time. The challenge is to strike a balance between buying some excess inventories to achieve service levels and buying planning time to achieve the service level. Planning time, because it involves analysis and decision-making, is indeed a valuable resource to be used wisely. Segregating parts by planning categories is essential in using this time effectively.

- **Purchase Order & Work Order Files.** These files itemize those parts that the company already has on order for satisfying a Parent item's gross requirements. Orders are unique entities in and of themselves. They are very specific when it comes to: what's needed, who's satisfying the need, what quantity is required, when the items are to be delivered, what's the price, etc. The following principles apply to order files (which most hardware and software imply or assume):
  - **They, too, must be accurate.** They represent projected liabilities and payouts as well as supply. Hence, they must be cycle counted to verify each order's "open" status. Any order, still open after 99% of the original order quantity has been delivered, should be a suspect for closing. Many times they are left open (although not active) and the "open" order file grows bigger and bigger.
  - **The more orders there are in the system, the harder the files are to manage.** Again, MRP doesn't warn us about the numbers phenomena.
  - **The Receiving and Receiving Inspection Departments (like the stockroom) must practice daily transaction cut-offs religiously.**
  - **A purchase/work order's function is not completed until specified material is transacted into the stockroom for immediate use.**

## The MRP Formula

The MRP formula is the simplest part of the entire process. As you might imagine, it is rarely responsible for creating errors or problems. The formula is:

$$\begin{aligned} & \textbf{Gross Requirements} \\ & - \textbf{Quantity On-Hand} \\ & - \textbf{Quantity On-Order} \\ & \text{-----} \\ & = \textbf{Net Requirements} \end{aligned}$$

To keep things simple for MRP, one rule must be used when linking Bills of Material together into a top item product structure. That rule is:

*"The net requirement of the Parent is always equal to the gross requirement of the component after modified or exploded by the 'quantity per' on the bill of material."*

## MRP Organization Issues

An MRP system, whether manual or mechanized via hardware and software, demands company departmental integration! This means that each and every department has a responsibility in maintaining its part of the database (again, regardless of the use of manual or mechanized processes). Each data element must be assigned a department of primary responsibility. No department within the company is immune to these integration responsibilities. Below is a list of just a few such departments. The list is not all encompassing, because such a list can change depending upon a company's circumstances and the way it chooses to conduct its business.

- Design Engineering
- Manufacturing/Industrial Engineering
- Sales
- Production Control
- Inventory Control
- Purchasing
- Stockroom
- Production
- Receiving
- Receiving Inspection
- Cost Accounting
- Accounts Payable
- Accounts Receivable

One of the easiest ways to determine which department is responsible for what, is to create an expanded "data dictionary." Again, it does not matter whether the company system is manual or mechanized. The dictionary itemizes each data element required by the MRP system (by its description and/or code) for the purposes of defining what the element is, how it is used, what calculations it is involved in, etc. In its expanded version, the dictionary includes then, the departments who are responsible for the accuracy of each data element, no matter how many individual records or files are involved. As an example, all parts have a lead-time associated with them. If a company has 5000 active parts, then there are 5000 individual lead times. Which company department is responsible for their accuracy?

## **The Costs of MRP**

MRP, especially in computerized versions, can handle a magnitude of parts and transactions. It is an excellent planning tool. However, it is not the only planning method, nor is it the only order launching process available to the materials professional. One thing is certain; it is an expensive planning process to use. Again, the hardware and software isn't going to tell you this! So fundamental in MRP is determining where to draw the line in using the MRP, dependent demand logic, as the primary planning method or tool in your company. There are many parts in a company's inventory that can be effectively planned and managed as though they had no dependency at all. Such parts are characterized by:

- They are common usage parts found in many assemblies and subassemblies.
- They are inexpensive (relatively speaking).
- They are usually in plentiful supply.

In drawing the line, materials professionals choose those items which have service levels that will be achieved using inventory in the form of safety stocks and large lot buys. For such parts, order point or min/max inventory planning with fixed lot sizes is sufficient for satisfying part requirements. These methods require little in the way of day-to-day planner time. For such parts, periodic planner reviews are more than sufficient to do the job. In the background, MRP is constantly recalculating requirements and act as a failsafe should the primary order point planning method fail.

Likewise, in drawing the line, the materials professional chooses those parts which have service levels that will be achieved by continuous planning and re-planning. Such a process requires concentrated planner involvement. This makes it (the review and re-planning process) an expensive endeavor and one of high company exposure. In these cases, MRP is well suited as the planning tool because the rewards justify the expense. Critical and/or expensive items are brought in frequently and consumed quickly. This results in lower inventory levels (over all) and better cash flow.

Drawing the line is not only true for planning methods, it is also true in order launch techniques as well. MRP implies and supports using purchase orders and work orders as its order launch process. However, in many instances, it also supports other less costly order launching methods. Card methods for creating/launching orders to vendors, to stockrooms or to the next work center are effective and usually inexpensive. Such card methods include Kanban and the 2-Bin process. Again, with MRP always running in the background as a fail safe, such card methods may prove to be an inexpensive alternative to launching orders in the computer. Continuing on with such logic, even the use of floor stock or line stock in assembly and/or fabrication operations, as an alternative to picking and issuing the material with each order, reduces order-picking time in the stockroom. Manufacturing lead times are in turn reduced and the benefits go on and on!



## Summary

MRP, especially when used in a mechanized version, is an effective tool in helping materials professionals manage the materials equation. *MRP is not a solution, although many hardware and software companies will call it that.* MRP is not the only method for parts planning nor does it have to be used on all of the parts in the company's stockroom. MRP is expensive. However, in many instances, its costs are justified by its benefits. We, the practicing materials professionals within each company, are compensated for our ability to know how and when to apply MRP in managing the materials equation. It is the practitioner who is the active ingredient to the success of a company. MRP is only the tool!

## About the Author



Alan G. Dunn is currently President of GDI Consulting & Training Company and founder of the Manufacturing Executive Institute (MEI). He is also the creator and lead-instructor of the 18-month Next Generation Global Supply Chain Leadership Development Program at the California Institute of Technology's (Caltech) Center for Technology & Management Education (CTME), where he has taught since 1984. Mr. Dunn also serves on the University of California at Riverside's (UCR) Advisory Board for Transformative Leadership in Disruptive Times.

Mr. Dunn specializes in supply chain management, strategic planning, manufacturing management, operations management, leadership development, cost management and business finance.

Previously, Mr. Dunn was a Vice President at Gemini Management Consulting and a Partner at Coopers & Lybrand. In both positions, he led large technical manufacturing teams through innovative productivity enhancement projects. Mr. Dunn has participated in >188 significant manufacturing and distribution projects inside >118 companies. He has worked in 24 countries and across most manufacturing sectors.

Over his 40-year career in global supply chain consulting, Mr. Dunn has served on the Boards of Directors of numerous public, private and non-profit companies. He is the recipient of the National Association of Corporate Directors (NACD) prestigious "*Director of the Year*" award in 2007.

Alan is a career Association of Supply Chain Management (ASCM) volunteer, having served as the President of the Orange County Chapter in 1984 and Chairman of ASCM in 2015. He was inducted into the "*ASCM New England Supply Chain Conference Hall of Fame*" in 2022.

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