



A Note on Manufacturing Resource Planning (MRPII)

Manufacturing Resource Planning (MRPII) is a computer-based planning and scheduling system designed to improve management's control of manufacturing and its support functions. MRPII translates a firm's business, sales and production plans into specific day-to-day tasks through such well-defined techniques as master scheduling, materials planning, capacity planning, shop floor control and vendor scheduling. The system enables management to set priorities, anticipate crises, and measure performance to schedules and plans.

MRPII evolved from Material Requirements Planning (MRP), a computerized tool for scheduling and ordering materials. MRP is a technique for exploding bills of material to calculate net materials requirements and plan future production. Early MRP systems used four pieces of information to determine what materials should be ordered and when: the master production schedule, which describes when each product is scheduled to be manufactured; bills of material, which list exactly the parts or materials required to make each product; production cycle times and materials needs at each stage of the production cycle; and supplier lead times. The master schedule and bills of material indicate what materials should be ordered; the master schedule, production cycle times and supplier lead times then jointly determine when orders should be placed. Over time, such features as capacity planning, vendor scheduling, and work-in-process tracking were added to MRP systems, so that management could also monitor operating performance.

MRP is only one element of a complete MRPII system. Technically, MRPII marries an MRP operating system to the firm's financial system, allowing all departments to work from a single, visible set of numbers. Equally important, MRPII provides a management process for integrating financial planning, marketing, engineering, and purchasing with manufacturing. As one user has observed: "To work well, MRPII has to cut across business disciplines. These disciplines are driven by differing motivations; normally no one is rewarded for integrating them."¹

¹ John Teresko, "MRPII: A Strategic Tool for Survival," *Industry Week* 9/30/85, p. 42.

Associate for Case Development Janet L. Simpson prepared this case under the supervision of Associate Professor David A. Garvin as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

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Components of MRPII

An MRPII system has three components: Top Management Planning, Operations Management Planning, and Operations Management Execution. (Exhibit 1.)

Top Management Planning. In a fully integrated MRPII system, a firm's business, sales and production plans are fed into the MRPII execution model and updated monthly.

Business Planning sets specific goals for margins, return on assets (ROA), and other business objectives. These goals are drawn from the firm's strategic plan for markets, products and profits.

Sales Planning provides product projections--rather than dollar forecasts--based on anticipated market demand.

Production Planning balances the sales plan with available capacity and constraints derived from engineering (time to release new designs), vendors (lead times), and manufacturing (facilities, equipment and people). Resource allocation decisions based on capacity, inventory levels, and the desired level of customer service are then incorporated into the production plan.

Operations Management Planning. The master scheduler converts the production plan into a **Master Production Schedule**, a specific statement of what products are to be built, in what quantities, and when. The master production schedule then drives the ordering and scheduling of all material (**Materials Planning**) and provides direction for optimal use of labor and machine capacity (**Capacity Planning**). These plans are evaluated weekly; proper execution requires accurate bills of material, inventory records and routings.

Operations Management Execution. Operations management plans are communicated, in the form of daily schedules, to engineering, tooling shops, purchasing, and the production floor. The material plan provides **Purchasing** with schedules for material acquisition that specify parts, quantities, and dates. The capacity plan and master schedule generate daily work center schedules to assist shop supervisors in setting priorities and assigning work to people or machines. **Shop Floor Control** encompasses all of these daily lists, plus work-in-process tracking, shop order delivery, and scheduling and rescheduling controls. On-time vendor delivery and shop floor performance are essential if master schedule targets are to be met.

Classification of Users

A checklist and an ABCD rating scheme are widely used to measure how well a firm is operating its MRP or MRPII system. Using the checklist, independent consultants evaluate technical considerations (such as the mechanics of capacity planning), data integrity, ongoing employee education, and performance to plans and schedules. Firms are then rated from "Class A" to "Class D", based on the following generally accepted industry criteria²:

Class A. A Class A MRP company has material requirements planning, capacity planning, shop floor dispatching, and vendor scheduling systems in place and being used. Management

²The description of rating criteria was adapted from O. Wight, The Executive's Guide to Successful MRPII, (NH: O. Wight Publications, 1984) pp. 107-108.

participates in production planning and constantly monitors the accuracy of inventory records, bills of material, and routings, as well as the attainment of master schedules, and capacity plans.

A Class A MRP II user has tied its financial system to its MRP system. Simulation capabilities have been developed so that "what if" questions can be answered. Management uses MRP II to run the business and monitor performance. In a Class A firm, the system provides a companywide game plan for sales, finance, manufacturing, purchasing, and engineering. Each of these functions uses the formal system; there is no attempt to override schedules through expediting or shortage lists.

Class B. A Class B firm uses components of an MRP or MRP II system for production and inventory control. The Class B company typically has materials requirements planning, capacity planning and shop floor control systems in place, but has done little with purchasing. Top management does not use the system to run the business directly and shortage lists tend to override shop schedules.

Class C. A Class C company uses MRP/MRP II primarily as an inventory ordering technique rather than a scheduling tool. Shop scheduling is still done from a shortage list, and the master schedule is typically inaccurate.

Class D. A Class D company has MRP/MRP II working only in its data processing department. Typically, inventory records are poor. If the company has a defined master schedule, it is usually grossly mismanaged.

In 1985, a survey of 1,123 American MRP/MRP II users found that fewer than 200 plants met Class A criteria.³ Those that did reported a 28% improvement in customer service, a 25% reduction in inventory levels, a 16% increase in productivity, and an 11% reduction in purchase costs. These improvements produced significant costs savings. For example, 40% of the Class A users reported annual savings exceeding \$1 million, while only 2% reported savings of less than \$100 thousand annually. Other classes of users also reported improvements in customer service, productivity, and inventory reduction, but their cost savings were markedly lower (Exhibit 3).

MRP II Implementation

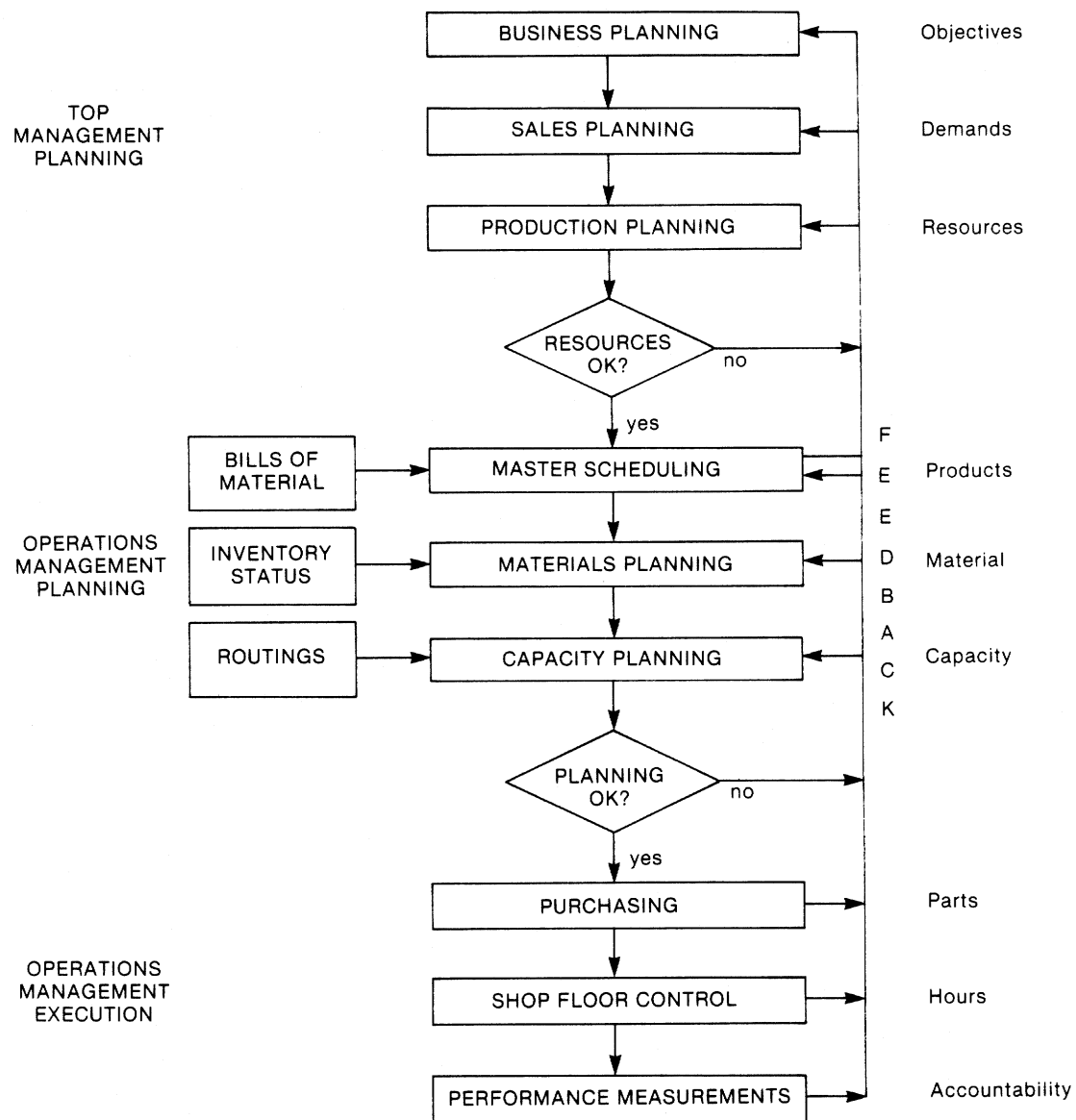
In practice, MRP II users employ a series of performance metrics to monitor progress toward achieving a Class A rating. These metrics typically address the accuracy of each key component in the MRP II model. For example, the sales plan may be evaluated by measuring the accuracy of forecasts by product line; the master schedule, by comparing scheduled units to units completed; and purchasing, by on-time vendor delivery. Systems are said to be operating at a Class A level when the average accuracy of these metrics reaches 90 percent. A sample list of metrics appears in Exhibit 2.

While the proper use of these metrics can highlight problem areas during implementation of MRP II, they may also be used to improve performance once the Class A rating is achieved. For example, vendor delivery may initially be considered "on-time" if deliveries arrive within one week of the due date. Once that target is achieved, on-time delivery may be redefined to mean deliveries arriving within one day of the due date. Through such practices, a firm can use MRP II to gain continuous improvement in its manufacturing performance.

According to the 1985 survey cited above, companies spent an average of \$907,000 to implement MRP/MRP II systems. Class A users spent \$1,181,000. Surprisingly, Class D users spent nearly the same amount, \$1,002,000. However, sharp differences between the groups were reported in two areas: top management commitment, and education. Only 20% of Class A users felt they had

³The Oliver Wight Companies 1985 Newsletter: Control of the Business, (1985: Newbury, NH).

not received enough top management support; by contrast, 78% of the Class D users reported a lack of management commitment. In addition, while more than half the companies surveyed reported they should have done a better job educating their employees, Class A companies had been far more active. For example, 82% of the A users had educated their top management at outside classes against only 50% of the D users. A summary of these survey results appears in Exhibit 3.

Exhibit 1 Manufacturing Resource Planning (MRPII)

Source: David W. Buker, Inc., Chicago, Illinois. Reprinted with permission.

Exhibit 2 MRPII: Representative Performance Metrics

<u>MRPII Component</u>	<u>Performance Metric</u>
<u>Top Management Planning</u>	
Business Planning	Return On Assets
Sales Planning	Product Forecast Accuracy
Production Planning	Production Planning Accuracy
<u>Plant Performance</u>	
Master Scheduling	Scheduling Accuracy
Materials Planning	Accurate Material Priority Planning
Capacity Planning	Accurate Work Center Scheduling
<u>Database Accuracy</u>	
Bills of Material	Accurate Bills of Material
Inventory Control	Accurate Inventory Records
Routings	Routings Accuracy
<u>Plant Execution</u>	
Purchasing	On-Time Vendor Delivery
Shop Floor Control	On-Time Shop Order Completion

Exhibit 3 1985 O. Wight Survey of MRP/MRPPII Users

1. What is the approximate dollar volume (in millions) of your plant or division?

	<u>All MRP Companies</u>	<u>Class A Companies</u>
Under \$10 million	10%	4%
\$10-24 million	20	12
\$25-49 million	22	31
\$50-99 million	18	19
Over \$100 million	30	34

2. What were your approximate costs in implementing MRP/MRPPII?

	<u>All MRP Companies</u>	<u>Class A Companies</u>
	(000s)	
Computer Hardware	\$ 257	\$ 394
Computer Software	176	175
Inventory Record Accuracy	52	108
Bill of Material Accuracy	43	52
Routing Accuracy	29	39
Education	66	97
Consulting	45	48
Other Costs	<u>239</u>	<u>268</u>
Total	\$ 907	\$1,181

3. What would you estimate to be your yearly benefits from MRP/MRPPII?

	<u>All MRP Companies</u>	<u>Class A Companies</u>
Under \$100 thousand	25%	2%
\$100-249 thousand	19	11
\$250-499 thousand	16	26
\$500-749 thousand	12	14
\$750-999 thousand	5	7
\$1.0-1.4 million	10	14
\$1.5-1.9 million	3	9
\$2.0-2.9 million	5	6
\$3.0-3.9 million	1	--
\$4.0-4.9 million	1	1
\$5.0-5.9 million	--	1
Over \$6 million	3	9

Exhibit 3 (continued)

4. In implementing MRP/MRP II, which of the following did your plant or division do?

	<u>All MRP Companies</u>	<u>Class A Companies</u>	<u>Class D Companies</u>
Top Management Education	64%	82%	50%
Formal Cost/Benefit	46	66	36
Full-Time Project Leader	68	83	49
Proven Implementation Plan	43	60	24
MRP Consultant	51	73	44
Key Mgrs. Educated Outside Classes	69	86	58
Video-Assisted Education	62	70	55
Ongoing Education-Classes	47	73	32
Ongoing Education-Video	32	49	24

5. What would you have done differently in implementing MRP/MRP II?

	<u>All MRP Companies</u>	<u>Class A Companies</u>
More Education	55%	35%
Better Software	28	23
Top Management Commitment	48	20
Other, Not Listed	21	18
Would Do Nothing Differently	11	39

Source: The Oliver Wight Companies 1985 Newsletter: Control of the Business (1985: Newbury, NH). Reprinted with permission.