Title: Why MRP II Implementation Isn't Always Successful

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Abstract: The purpose of this paper is to explore why, in spite of its popularity, many MRP system implementations are unsuccessful. In order to illustrate my points, I examine two companies and review the results. These companies offer a good representation of problems other companies may have experienced, and that one can relate the companies' successes and failures, at least in some measure, to the success or failure of their MRP implementation.

WHY MRP II IMPLEMENTATION

ISN'T ALWAYS SUCCESSFUL

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INTRODUCTION

MRP, Material Requirements Planning, is one of the earliest computerized techniques for factory management. In its earliest form, an MRP system generated unconstrained production scheduling based on Bills Of Material (BOM) and estimated production time requirements. The next generation, MRP II, Manufacturing Resource Planning, was expanded to consider other facets of production facility management. MRP II provided sophisticated factory accounting capabilities, plus modules for capacity planning. It also provided for shop floor data collection. The MRP II techniques were effective for longer term scheduling and order launching. All this was necessary for successful day to day production scheduling.

In spite of its popularity, records of successful implementations are scarce. An often quoted figure of success rate is 15%. While many failures are blamed on management understanding and commitment, some of the blame must be placed on the shortcomings of MRP II. The system does not provide for easy tracking of manufacturing plant activities which affect the status of inventory parts.[1]

The purpose of this paper is to explore why, in spite of its popularity, many MRP system implementations are unsuccessful. To illustrate my points, I will look at two companies -- McQuay-Perfex and MarkHon -- whose implementation processes are very familiar to me. I feel these companies offer a good representation of problems other companies may have experienced, and that one can relate the companies' sucesses and failures, at least in some measure, to the sucess or failure of their MRP implementation.

During the first half of the 80's, after enough history became available, manufacturing experts started exploring reasons for American manufacturing failures.

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[1]Kamenetzky, Ricardo D. 1985, "Successful MRP II Implementation Can Be Completed By Smart Scheduling Sequencing Systems", Industrial Engineering, October, 1985, vol. 7, 10:44-64.

By summarizing what successful companies had in common, it became evident that a lack in just one or two areas could create an unsuccessful company. As the research process continued, new ways were found to improve manufacturing systems, about which much has been written. A study of these improvments is the topic for an entirely different paper.

After giving a brief history of both cases under study, I will attempt to explain a successful concept and what outcomes a company can expect with success or failure of the concept under discussion. I will then discuss this concept in relation to the two cases under study.

McQuay-Perfex Industries

McQuay-Perfex (McQuay) is located in Spirit Lake, Iowa. The Spirit Lake factory is a division of the Perfex Corporation located in Minneapolis, Minnesota. The time of reference for study purposes was 1977 to 1981. During this time the Iowa division made air-conditioning and heating units for high rise buildings and hotels. They also produced industrial ice makers for the restaurant industry.

The Spirit Lake plant employed 350 people, of which 35 were management or support personnel. All major components, except items such as compressors, fans and screws were made at the facility. The factory produced sequentially. Most parts started as raw sheet metal and were cut to size, shaped or formed and painted. There were two assembly lines, one for the air-conditioning and heating units and the other for ice machines. Up to the assembly line there was no differential made between part families.

The sheet metal cutting and forming areas operated on three shifts. The paint area operated on two shifts and the assembly, shipping and receiving, and support areas operated during the one (the first) shift. This allowed for most of the needed parts to be available at the beginning of the day for assembly production. There wasn't a large staging area at the end of the paint line. Scheduling was such that by afternoon as a pallet of parts was completed, it was moved to the start of the assembly line. Although this scheduling was done manually, little changed after implementation of their MRP II system.

Access to Spirit Lake was only by truck. The largest city and air transportation was 90 miles away. If components, such as the right compressor, were not available, the line was down for days. This was the reason for implementing the MRP II system. Their biggest problem, before implementation, was knowing what was in inventory and knowing when to order replacements. New products were usually introduced yearly.

MarkHon Industries

MarkHon Industries was located in Warsaw, Indiana. They were a spin-off of Honeywell and derived their name from Mark Honeywell, the founder of the parent corporation. By the beginning of the 1980's, most mainframe computer manufacturers were starting to contract out the manufacturing of the computer frames and cabinets. In 1982, the Phoenix, Arizona Honeywell facility decided to follow suit. They sold their entire sheet metal and fabrication area to the Indiana company. MarkHon took all the equipment, workers and management and opened a division in the Phoenix area.

The original facility at Honeywell was small and work was scheduled by demand. Honeywell used an MRP style system which they developed in-house to which the manufacturing area was tied. Some of the parts--drawing and BOM-were on the computer. When an order was received, a clerk built the scheduling requirements from the bill-of-material and handed the information over to a scheduler. Scheduling of the manufacturing area was done manually.

As soon as new facilities were built, the entire operation moved in. Much planning was done in advance to allow for as little loss of production as possible. A complete computer and MRP II system was purchased from the Burroughs corporation. The decision about what to purchase was made by the division president and controller. A contractor was hired to port the data that was computerized and a key-punch person was hired to input the non-computerized data. The whole process was scheduled to take 2 months.

WHAT MAKES A SUCCESSFUL IMPLEMENTATION

MRP II can help, but is not the whole solution.

Once the need for a change is noted and implementing an MRP II system is determined to be the solution, the company should involve consultants, managers and employees in the process. According to an editorial in Modern Materials Handling, implementation takes total commitment and a lot of genuine support from all levels of the organization.[2]

Most managers believe that once new hardware/software is implemented, improved operating performance will result. Education of these managers is the key and consultants can help with this process. The main role of a consultant is to prevent or eliminate problems, not create implementation plans or run meetings. A good consultant can work with the employees to help them overcome the *"not-invented here"* attitude.[3] They can help personnel ask the right questions and come up with solutions that they feel they own. Consultants should be used as valuable advisors when putting MRP in place but shouldn't be exclusively relied upon.

There is alot of advice about how to successfully implement an MRP II system. The following four tips come from an editorial in Modern Material Handling. They are almost identical to the suggestions in an article about Digital Equipment Corporation's successful venture with MRP.

1. Seek outside guidance from someone with a proven track record.
2. Establish operating performance measurements to identify performance areas and chart areas for improvement.
3. Establish a project team whose members come from different operational or functional areas of the business.
4. Choose a project manager from operations, not data processing.

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[2] "Total commitment makes MRP II work," Modern Materials Handling, April, 1985, 40:63-5

[3] "MRP succeeds with user involvement", Modern Materials Handling, March, 1986, 41:11

Software --Development in-house vs. purchased.

Before purchased software was readily available, in-house development was the most common solution. Since the personnel who would be using the MRP system were unfamiliar with it, they were unable to make recommendations about how to design it. Ricardo Kamenetzky, in an article for Industrial Engineering, asserted that because so many changes came so fast, the output from DP was obsolete by the time it was delivered. Systems soon become un-maintainable by Data Processing. Large companies were continually having to update hardware to keep up with the changes. Management applied pressure to convert too fast. This resulted in patched programs which compromised maintainability. An important in-house development concept is that functional departments within manufacturing have a chance to affect changes when negotiating the specifications of the software. While this is a positive effect, many times the negotiations turn into power struggles. The opposite and desired effect is that they create ownership. [4]

Purchased software usually clearly spells out training procedures and provides usage documentation. Experience has shown, though, that it doesn't always provide the solution required. Large plants and companies shouldn't try to standardize the software across all divisions or plants. A company should be sure that they can modify the software to their own customized needs and differences should be negotiated and compromises made. Involving the users in the decision about what changes to make can help keep the ownership process growing.

Good MRP II software embodies two frameworks. It describes the manufacturing operations such as product, inventory items, BOM, production centers, and part routings, creates the planning and controls the production process. This usually

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[4]Kamenetzky, Ricardo D. 1985, "Successful MRPII Implementation Can Be Completed By Smart Scheduling, Sequencing Systems", Industrial Engineering, October, 1985, Vol. 7, 10:44-64

differs from previously used frameworks. Many procedures and organizational changes are required.

McQuay and MarkHon were completely opposite in the methods they chose to implement their software. McQuay contracted out the development to a consulting firm. They wanted the same hardware and software implemented at the Spirit Lake facility, that was at the other four plants they had located throughout the Mid-West and South.

The preliminary needs were dictated by the corporate office and when the basics were ready, a consultant arrived at the Spirit Lake plant. His visit was to work with the management staff to customize procedures for the plant's particular needs. His next visit, which lasted months, was spent working with the DP people to help implement the software and train them.

During the implementation process, training was going on for the supervisory, material control and purchasing personnel. Accuracy was the key and was stressed very heavily. Once the factory and inventory control personnel were trained, the system went on line. The whole process from start to finish took a year and, as expected, was obsolete by the time it was ready. The process started again and was repeated for a third time the following year.

The important aspect of this was that the company implemented a process, watched it, and worked on it until they felt they had it right.

MarkHon purchased the software as a packaged deal. The two people who chose the system had little production experience. Customizing, once noted it was needed, was difficult. A consultant was hired to implement the system and train the staff. His contract was for six months and at the end of that time he left the country. He estimated that the entire process would take four months. At the end of six months, the system was only partially implemented and not being supported by the staff.

The biggest problem for MarkHon was the lack of ownership of the process or use of the system. The organization was new, but the employees weren't new to the business. No one attended to the much needed organizational changes.

IF SUCCESSFUL, WHAT YOU SHOULD SEE

There are two main functions of MRP II: planning and execution. The planning functions include Master Production Scheduling and Material Requirements Planning. These feed into the execution functions which include inventory control, production control and purchasing.

Looking at the benefits of successful MRP II implementations demonstrates how delicate the balance is between success and failure.

Improved Plant Efficiency

Production center availability. Four levels of capacity planning generally take place.[5]

1. Resource requirements planning.
2. Rough-cut capacity planning.
3. Capacity requirements planning.
4. Input/output planning.

MRP II uses a production scheduling technique known as infinite capacity scheduling. Infinite capacity scheduling ignores capacity constraints of the equipment. Because of this, it is easy to overload production centers because it is assumed that each job waits the "Average" queue time in front of the production center. While MRP II includes a function called "capacity requirements planning" which detects and pinpoints overload and underload conditions, it does not suggest alternative schedules. The user must do this by trail and error.[6]

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[5]Chong, Philip S., 1989, "Design an Effective Microcomputer Based Inventory Control System", Industrial Engineering, 1989, Vol. 21 ,1:36-8

[6]Kamenetzky, Ricardo D. 1985 "Successful MRP II Implementation can be completed by Smart Scheduling Sequencing Systems", Industrial Engineering, October 1985, Vol. 17, 10:44-64

As noted before, McQuay didn't change the way they scheduled products for manufacturing. There weren't bottlenecks to begin with. MarkHon, on the other hand, didn't have good history to support their efforts. Before being purchased, profit and efficiency weren't demanded. They only need parts available when the assembly area wanted them. It was falsely assumed they understood capacity planning, therefore training was not provided.

Reduced Safety Stocks

When a plant is short parts at production time, the production schedule falls apart. MRP is supposed to prevent situations like this. In ideal situations it should ensure the availability of items for production. MRP makes assumptions about the manufacturing world that are not always realistic, such as assuming that operations are consistent. In other words, it expects constants concerning lead and demand times, which are not always realistic. Fluctuating demand and lead times lead to variations in materials availability, disrupt production and force carrying extra inventory.

Researchers are looking into helping quantify the effects of uncertainty. There are four basic questions they are trying to answer:[7]

1. Which areas of uncertainty have the greatest effect on MRP performance?
2. How does a product's bill of materials (BOM) structure affect the performance of MRP?
3. Is one type of lot sizing rule more appropriate than another for a particular structure and uncertainty?
4. In a multi-product environment, how does the presence of common components in different levels of the BOM affect the performance of MRP?

Even though there were two assembly lines for the two markets they served, there was a lot of commonalty among parts at McQuay. As stated previously, their main problem was purchased parts. Large amounts of safety stock were required because of the difficulty of getting parts when the lines were down. Much effort was put into understanding and gaining accurate lead-times. The need for large amounts of safety stock could only be reduced when management was comfortable that the schedulers and purchasing department understood the importance of their roles. After 6 months of using the new system, careful analysis was made about where to start reducing stock.

[7]"Bringing more reality to MRP", Modern Materials Handling, September, 1987, 42:99

Because MarkHon only produced for customer orders and purchased few components, safety stock was not an issue. Sheet metal was the major raw material needed. The new plant was built next to a rail line to avoid problems.

Improved Competitive Position

Having a reputation for reliable delivery and service and being able to cut product costs while not losing quality are two key areas to improving and maintaining a competitive position. The Master Product Schedule (MPS) drives the rest of the MRP II system. The sales order is input into the computer, describing the customer, quantity of products, promised delivery date and firm order requirements. This feeds the MPS. Unless it is a monopoly, the effectiveness with which a company delivers on the sales order determines how well it maintains its competitive position.

Three Conditions must exist for sales quotas to be met.

1 Material must be available
2 Tooling has to be available
3 Production center has to be available and have the appropriate machinery and crew

MRP II has evolved from material requirements planning systems. It emphasizes the first condition at the expense of the other two.[8]

McQuay's air-conditioning and heating units went into buildings under construction. Because of this, reliable delivery and service was their most important commodity. Orders were placed on a need basis and stocking warehouses full of units wasn't economically feasible. Without meeting the three conditions mentioned above, they were out of business. They introduced new lines periodically. Before a new product was introduced, everything was planned and prototyped ahead. Part of the prototype stage was a dry run through the scheduling process.

[8] Grant, Hank & Christopher Clapp, 1988, Factoral Inc., "Making Production Scheduling More Efficient Helps Control Manufacturing Costs and Imporve Productivity", Industrial Engineering, October, 1985, Vol. 7, 10:44-64

MarkHon quoted jobs for customers other than Honeywell, they were based on drawings delivered from the customers' engineering facilities. Effort was made to simplify by using common material and available tooling. Allowances were made in the quote for design and delivery of new tooling. The dates quoted for actual production were based on estimated lead times by the engineering organization. Only when the order was received was the new BOM put in the computer. Production time was entered as the estimate given by engineering.

Reduced Inventory Levels

The most important aspect of reducing inventory levels is the accuracy of the bill-of-materials, inventory and routing records. These databases are considered the *heart and soul* of MRP II. Inventory is counted as long as it's in the plant. To be successful, a firm must first start with reduction in their raw materials inventory. This should be followed by a reduction in work in process inventory. To be certified as a Class A user[9], a plant should have inventory data records and routings at least 95% accurate and bills of materials at least 98% accurate.

When management treats the MRP II implementation like a DP project, they ask the DP department why the inventory records accuracy is only 80%. This is the kind of question they should be asking the storeroom manager. Just because all the records are in the computer, inventory control must be a company-wide behavior program.

Because inventory reduction can be such a large benefit of successful MRP II systems, this is a popular area to look at when doing a cost/benefit analysis to fund a MRP II project. The analysis report, to be accurate, must show all needed restructuring of the existing bills of materials and item masters for the computer database. Proper stock status and purchasing systems must also be developed. If management doesn't understand the cost involved, or even support and understand the need for these changes, the failure is catastrophic. The balance between these areas and a successful reduction of inventory is very delicate.

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[9]Class A is a rigorous measure of excellence in applying MRP II principles. It implies that a company uses a closed-loop system to run a plant in a formal manner, without using expediting or shortage lists.

Neither company had a serious work-in-process inventory problem. MarkHon would make extra parts to cover scrapped parts. If the extras weren't needed, they would be stored. Much of their business with Honeywell was repeat business. The MRP II system they used didn't accurately account for those parts and frequent inventory counting was required.

Reduced Component Shortages

At the lowest product structure uncertainty is the highest. As expressed in "Bringing more reality to MRP", companies should work to establish reliable delivery dates from their suppliers. This should be given priority over firming up the subassembly schedule. The more unique components there are in the lowest level, the more effect uncertainty will have. Therefore, there should be a strong focus on supplier relationships to help reduce the uncertainty[10]

This is one of the most important areas contributing to success. McQuay had a history with their suppliers. This allowed them to make stronger demands on them. MarkHon also had a history through the parent corporation. Neither company had problems in this area.

Better Production Scheduling.

While MRP II techniques are effective for longer term scheduling and order launching, they lack detail necessary for day to day production scheduling. The ideal production schedule has the following characteristics:[11]

1. Delivery due dates are met.
2. Inventory costs are maintained at acceptable levels.
3. Equipment, personnel and other limited resources are well-utilized and have balanced workloads.
4. Adaptations can be made quickly in the event of an unexpected change (equipment failure, raw material shortage, etc.)

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[10]"Bringing more reality to MRP", Modern Materials Handling, September, 1987, 42:99

[11]Grant, Hank & Christopher Clapp, 1988, Factoral Inc., "Making Production Scheduling More Efficient Helps Control Manufacturing Costs and Improve Productivity", Industrial Engineering, June '88, 20:54-6

It is not practical to expect all characteristics to be met. If there is a Master Scheduler, he or she usually chooses one to emphasize. The most common method of day to day scheduling is manually done by the department foreman or machine operator. The danger of this method is that it may not necessarily reflect business objectives.

The MRP II system should set the operation and delivery dates for manufacturing orders. There are many techniques to use in scheduling production, most are not part of the MRP system.

There are many dynamic lot sizing techniques: Least Unit Cost, Least Total Cost, Part Period Balancing, Wagner-Whitin Algorithm. All of these attempt to find optimal lot sizing so that inventory carrying cost plus setup cost is minimized. Lot sizing is tied to one product at a time and product requirements are not independent of each other, they are tied to the BOM.

Sequencing and dependent setup times refer to decisions concerning the sequence in which manufacturing orders will be processed at a given production center. This is usually not included in MRP II. Setup time depends on the job to be setup and previous job setups.

Another method is using alternate paths within a part routing. MRP II systems are best suited for tracking and scheduling jobs that follow a linear routing with all operations being performed in a predefined sequence. Most MRP II systems can accommodate information for alternate operations, but few can track or schedule alternate paths.

MRP should be complemented by smart scheduling and sequencing systems. Real-time sequencing decisions using AI techniques to build expert systems seem to be the best alternative. Maximum throughput should be the most important consideration.

At each supervising station at McQuay, there was a scheduler with his terminal. Each time a job was completed at a station, a pallet arrived with the next job to run. The scheduler directed the material from a staging area instead of allowing it to be stacked up at a station. Setup time at most stations was not a factor. They used a unique system design by Litton industries. To change the setup for the presses took a few minutes. The actual tooling setup was done prior to the job being run.

The schedulers at MarkHon didn't trust the new computer system. They didn't understand the benefits and continued to schedule manually. Because they ignored the computerized schedule, feed back about completed parts wasn't received until the entire order reached shipping. Shipping was pressured to accept the ownership that scheduling wouldn't.

Better Off As a Result of MRP II

This is the most important question a company should ask itself after implementation. MRP produces information that can help manage all the resources of a manufacturing company. First, the resources to be managed must be identified and understood. MRP is not an operating system and, by itself, will produce little payback. If a company answers *no* to the question above it needs to analyze what went wrong. The design should be examined to see if it hit all of the targets. The scope of this paper does not cover some areas such as engineering and drafting, however capacity planning should encompass the critical work centers in all areas. Managers should be accountable for hitting schedules and reducing lead times. One of the benefits of MRP II is the ability to replan, which is a valuable asset to engineering. Marketing and sales should also be educated to understand the system and how it works. Where engineering must be working on the right jobs, sales must be selling the right jobs.

Without buy-in from the entire corporation, a company will not be better off because of the implementation of an MRP II system. All departments need to be educated to insure that MRP II becomes "our system". Only then can a company wipe out the "we're unique" syndrome that destroys the unity and ownership needed.[12]

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[12]Goddard, Walter E., "Design it to hit all of the target", Modern Materials Handling, April 1985,40:63-5

CONCLUSION

Failure is imminent if a company doesn't pay attention to the delicate balance of their entire operation. Management commitment and support at the onset of implementation is crucial. Their level of commitment is interpreted by their reliance on the MRP II system. Choosing the right software and database is important, but without involvement from the entire staff, there will be no ownership of the project. Without ownership, the level of accuracy needed to make the system work won't exist.

Communication in the planning process is necessary to ensure tooling availability. MRP II can't do it all. A lot happens outside the system, and without communication between the customers of each process, failure once again is imminent. Sharing of information is important because common components and different levels of BOM affect the performance of MRP for contributing to the success of day to day manufacturing operations.

If the above doesn't happen, then nothing else matters. No amount of effort into cost saving scheduling techniques, bottleneck optimizing algorithms or forecast planning will help. McQuay understood this from the onset of their endeavor. The implementation of the new computer system created new jobs. They hired from within and spent over six months training before implementation began. They held meetings and classes and stressed the importance of 100% accuracy. Everyone bought into this as a personal goal. MarkHon was another story. They were never able to ship a product on time and closed their Phoenix division after two years.

While implementation times of 3-5 years were common in the early 80's when a company did their own software. With a good purchased software package, chosen to fit the companies needs, some implementation processes were taking 12-18 months.[13]

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[13]"Firms are 'better off' with MRPII, survey says", Modern Materials Handling, April, 1988, 43:7

MarkHon, on the other hand, scheduled the entire process to take 6 months using a Programmer as a consultant, not an experienced MRP person. Both of these, as described previously, are indications that chances for success are minimal.

Typical MPR II users spend up to $1 Million for mainframe and mini-packages. Training, education, and consulting fees are on top of this. This is to large of an investment to waste. The probability for success can be increased by looking at what it takes to be successful and build the implementation plan based on those facts.

REFERENCES

Chong, Philip S., 1989, "Design an Effective Microcomputer Based Inventory Control System", Industrial Engineering, 1989, Vol. 21 ,1:36-8

Foley, Mary Jo, "Post-MRPII: What Comes Next?", Datamation, December 1, 1988, pp 24-36

Foley, Mary Jo, "The Winds of Change are Blosing for MRP II Users", Datamation, Febuary 1, 1988, pp 19-24

Funk, Paul, "Throughput Planning Instead of Capacity Planning Is Next Logical Step after MRP II, Industrial Engineering, January 1989, Vol. 21 1:40-4

Goddard, Walter E., "Design it to hit all of the target", Modern Materials Handling, April 1985, 40:63-5

Grant, Hank & Christopher Clapp, 1988, Factoral Inc., "Making Production Scheduling More Efficient Helps Control Manufacturing Costs and Improve Productivity", Industrial Engineering, June '88, 20:54-6

Kamenetzky, Ricardo D. 1985, "Successful MRPII Implementation Can Be Completed BY Smart Scheduling Sequencing Systems", Industrial Engineering, October, 1985, Vol. 7, 10:44-64

"Bringing more reality to MRP", Modern Materials Handling, September, 1987, 42:99

"Firms are 'better off' with MRPII, survey says", Modern Materials Handling, April, 1988, 43:7

"MRP succeeds with user involvement", Modern Materials Handling, March, 1986, 41:11

"MRP II delivers 2,000% ROI for Digital", Modern Materials Handling, December 1988, 43:77-8

"Tips for MRP II implementation", Modern Materials Handling, January 1987, 42:13

"Total commitment makes MRP II work," Modern Materials Handling, April, 1985, 40:63-5