



Is It Time to Graduate from ERP Based Production Planning?

Article Abstract

*This article will delve into both MRP generally, and MRP as run from ERP systems. It will highlight how ERP based MRP limits what companies can do in production planning and scheduling – both on the basis of the MRP logic, and due to how MRP is implemented **within** ERP systems. Advanced planning & scheduling (or APS for short) systems not only provide superior methods of planning but many other attributes, such as user interfaces designed for planning and master data maintenance designed (which vary depending upon the specific software) to provide the flexibility manufacturing environment require.*

The right APS software can solve many of the limitations that companies face with respect to MRP. The comparative benefit of APS systems for production planning and scheduling can be modeled through a parallel test, which runs competition with the current ERP based MRP system and an APS system in order to predict likely gains in efficiency and costs. Although not commonly done, it is what the author believes to be the highest quality way of both benchmarking present performance and estimating benefits of making system changes.

Reviewing How Most of Manufacturing is Planned

The majority of manufacturing companies perform production planning and scheduling in their ERP systems. The primary reason for this is that most ERP systems have this capability, or ostensibly have this capability as part of their MRP functionality. MRP is the simplest supply and production planning method that is available and was developed in the 1960's and then became a commonly implemented application in the 1970s. By the 1980's there were very few stand alone MRP systems, as they had become subsumed into ERP systems, which by that time became the largest enterprise software category as measured by sales – a position ERP still maintains although it is shortly to be surpassed by CRM.



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Why ERP Based MRP Became Dominant

How ERP based MRP became the dominant method of performing production planning is an interesting story, however it does not have a happy ending. Essentially the sales divisions of ERP vendors convinced enterprise software buyers that their ERP systems had every functionality they would ever need. No one remembers this as of 2014, but particularly in the early stages of the growth of ERP, one of the arguments used to sell ERP systems was that they were the only systems the company would **ever** have to buy. It is a ludicrous idea, particularly when viewed from hindsight, but that is in fact what was proposed at the time. And, for whatever reason, ERP buyers with respect to this “single system” contention performed little research. I say this because it takes me around 20 minutes to go into SAP ECC/R/3 and run MRP, review the output, interact with the lack of any real user interface beyond triggering MRP and reviewing the output as a simple series of line items to demonstrate to an audience that any company that relies upon this solution for their supply and production planning is going to give up a great deal of efficiency and therefore money on a yearly basis. For instance, ERP systems lack even a place to put much of the data needed to accurately plan... things like changeover matrices, resource preferences, and varying resource capabilities. And that is before I review the mathematical limitations of MRP. Furthermore this should surprise no one. ERP vendors often attempt to put as much functionality into their applications as possible – however, they are not dedicated to pushing the envelope or maximizing the capabilities in any of the areas of functionality, production planning included.

ERP based MRP is the dominant form of supply and production planning not because it's good, but because it's convenient and is was already there once the ERP implementation was complete. More on this topic of planning output quality will be covered in the section *Running a Competition*.

Understanding ERP Based MRP

Several important things to know about MRP in ERP are listed below:

1. ***The Inherent Limitations of MRP:*** MRP does some things quite nicely. It explodes the bill of material, which prior to MRP (and before computers) had to be performed with manual calculations. This is still quite valuable, and even supply planning and production planning methods that are far more complex than MRP in terms of planning dates and locations for inventory and production still use MRP or MRP type logic for bill of materials explosion. There is not really a better way to do some of the things that MRP does. However, with the other areas of MRP logic such as when to schedule or source production or procurement, MRP is easily beaten by more sophisticated methods that have been developed since MRP was introduced. As an example, MRP logic assumes that all locations are independent from one another. It does this because it is more mathematically simple to model, and the MRP was designed to be run on hardware that was incredibly slow by today's standards. In fact the first MRP systems ran off of tape data storage. This assumption, which I refer to as the “each location as an island” assumption, is also not true. The reality is that the stocking position at one location should be influenced by the stocking position at other locations. A second important limitation



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- is that MRP cannot intelligently search through the supply network to find the best place to create the production order. However, there are applications that can do this as part of the standard planning run. The dependency between locations is accounted for both with multi-plant planning functionality (which is fully explained in my book [*SuperPlant: Creating a Nimble Manufacturing Enterprise with Adaptive Planning Software*](#)), as well as multi echelon planning, which is explained in my book ([*Inventory Optimization and Multi-Echelon Planning Software*](#)).
2. **ERP System Limitations:** As was just stated MRP has a number of well known limitations – however, companies that run MRP from their ERP system cannot expect to even achieve the full benefits of MRP. One reason for this is that the way MRP is implemented in ERP systems tends to be a black box. It is a rare ERP system where much thought has gone into making the MRP screens usable, where the system’s output can be reviewed efficiently by planners. However, there are important criteria for how well the system can be used. When I perform diagnostics of SAP ECC/R/3 it is quite easy for me to find master data maintenance issues which are negatively affecting the MRP run – which should be no surprise as these parameters are time consuming to change. For instance, in one specialized supply planning system, which runs MRP, the parameters (things like lot size and reorder points) can be altered for a group of plant and material combinations simply by filtering the plant and material database. The changes applied then only apply to that subgroup. I have never seen any ERP system with this functionality and I have exposure to most of the larger ERP systems on the market, and even a number of the smaller ones.
 3. **ERP based MRP & Excel:** MRP from within ERP systems is not flexible enough to provide planners with what they need, so the most accurate representation of how production planning is performed in companies that lack a specialized production planning applications is that they use a combination of MRP and Excel. This means shuttling data between the ERP system to Excel for analysis, and then either uploading the data to ERP or making the changes in ERP manually. This means that companies that run ERP based MRP take a productivity hit as their planners are consumed with data manipulation. For complex forms of planning such as rough-cut capacity planning, it is quite common for companies to have highly complex spreadsheets that no MRP system can come close to modeling. This is another time-consuming activity, and at several clients I have seen custom adapters that then pull in the spreadsheet into the ERP system.

Unless the production environment to be modeled is a combination of an exceedingly simple supply network with exceedingly simple production planning and scheduling requirements, those that rely exclusively on MRP will predictably lose out on efficiencies versus other alternatives. And that is if a company uses an impressive application for running MRP, such as with a specialized supply/production planning application. However, if they use ERP based MRP, which takes a considerable step back from a specialized system they will lose out on even more benefits. For the majority of companies, they are nicked in both dimensions when they choose to continue using ERP based MRP. Strangely, few seem to know how much they are missing out on by sticking with what is known.



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MRP and Production Scheduling

MRP run from ERP will generally do a poor job of creating the initial production plan. After the planning run, the production plan will have to be manually adjusted on a continual basis, which is the role of the production planner. However the story takes a turn for the worse when one moves to production scheduling. MRP is truly an inappropriate tool for production scheduling; just a few of the reasons for this are listed below:

1. **Mathematical Limitations:** The mathematics of MRP is quite simple, and cannot account for the detailed work required to manage a production schedule unless the environment is extremely stable.
 - a. Algorithms don't take production realities into account at the same level as in APS systems, often ignoring things like: simultaneous resource usages, material production and consumption rates, resource preferences, and alternate routing trade offs to name just a few.
 - b. Schedule changes made by users require massive, rapid recalculation to determine the impact on other orders. ERP databases were designed for transactional work like order entry and therefore are architecturally incapable of doing the job.
2. **Dimension Limitation:** MRP has no other objectives aside from meeting dates. This means it cannot prioritize – however, when two production orders vie for the same capacity, who receives this capacity? MRP cannot answer this question intelligently because it will simply allocate the capacity to the first production order it processes.
3. **Unconstrained Output:** MRP cannot constrain, so it assumes that the plant is an infinite bucket where for example five production orders can be scheduled on the same line at the same time. Optimization with constraints will only allow the load to be placed where there is capacity. This is extremely detailed work, and because MRP requires the **manual movement** of the production orders to create the production schedule and to schedule to the hour with as few open gaps as possible. This means that companies that exclusively use MRP end up nearsighted – that is they only create a production schedule for as far out as they absolutely need to for the needs of the factory floor.

APS and Production Planning and Scheduling

The right APS systems have functionality to account for many of the limitations of MRP systems. The mathematics of APS systems can account for simultaneous resource usages, material production and consumption rates, etc. Second generation APS based optimizers allow for multiple dimensions to be accounted for, and some dimensions emphasized over other dimensions during the planning run.¹ If a company is more focused on keeping costs

¹ “First generation optimizers” in supply chain planning are cost optimizers. During the mid 1990’s, which was the period of the first adoption of commercial software with optimizers for supply chain planning, costs almost exclusively used for the various supply chain domains where optimization was employed. These domains include supply, production and transportation planning.



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down, an optimization scenario can be created for this. If a company would like to test the effect on the production schedule from emphasizing machine utilization or setup times, all of these things are possible with the right application. There is even an application that can optimize the plan based upon **financial key performance indicators**. In terms of constraining capacity, when a company uses an APS solution that automatically moves production orders to where they can be produced, the length of the scheduling horizon becomes a simple matter of computer processing capacity. At one production planning and scheduling vendor, their clients often create a production schedule for **three months**, which is called the schedule horizon. The production-planning horizon is often created for a year. Will the schedule change? Of course, however, it is quite beneficial to have at least a first cut production schedule for a three-month horizon, because the production schedule serves more than the needs of the factory floor. Constrained production planning and scheduling provides the foundation for implementing one of the most desirable functionalities in the supply chain planning and order management space; capable to promise.

Capable to Promise

Capable to promise is the ability to connect the sales commitment process to production schedule and the production plan. Capable to promise is not feasible in ERP based MRP because of the manual adjustment required to an unconstrained system. This means it is simply too much manual work to create a production schedule very far out into the future. However, once a three-month schedule horizon exists, one now has the data to implement capable to promise functionality. Capable to promise is tricky and very few software vendors have mastered it, and just as importantly few provide this functionality in a way that creates a reasonable overhead to maintain. Therefore, buyers should be careful to check this functionality in detail as many software vendors have been marketing their capable to promise functionality for years without ever having taken a client live. However, if designed properly, the functionality can be quite straightforward. The functionality is used in two primary ways:

1. **Within Application Usage:** As soon as the plan has been created, one can attempt to submit a sales order (which is converted into a production order) in real time within the application.
2. **Integrated Usage:** Sales orders can come over to the production planning application from the order management application through an interface. If the sales order is confirmed, the production order is created. These production orders

Second generation optimizers learned from the limitations of the first generation of optimizers, and a small number of vendors customized the optimizer to use an objective function that was the most suitable for the planning domain.

However, some software vendors even improved upon this by allowing the objective function to be adjusted by other factors or key performance indicators (machine utilization, financial metrics, etc.). This allows for a much more efficiently implemented and more controllable solution because it provides the buyer with far more “levers” by which to control the optimizer.



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can be made “more firm,” than orders that are not connected to a sales order (as it makes sense to prioritize sales orders over the forecast)

Capable to promise is a highly desirable way to interoperate with sales, and it allows the sales orders to automatically adjust the schedule. This moves the company closer to what is often considered the holy grail of supply chain management, which is make to order planning. Unfortunately, companies which use ERP based MRP are in no way positioned to do this. Instead they have to do things in a dated and time consuming manner, with sales calling up production planning, and then asking if the order can be met. As the production planner does not have sufficient information, they are often not sure themselves and must check on several things and possibly move another order in order to accommodate this order. This simple query from sales “can we take the order?” is actually a complex question. This is so because of the interaction between the movements of orders with the procurement orders that must be placed in advance of when the finished good is to be scheduled for production. Simply put, the question has too many factors in too many dimensions and is not the type of problem the human brain is particularly good at to solving. However, it is exactly the type of processing at which computers excel. We are lucky to live in a time where the hardware to compute such questions is quite inexpensive. However, of course, one has to have the right software package and hand the problem off to powerful hardware. From the business perspective there is little doubt that the company with a longer and optimized production schedule horizon has a serious advantage over a company running ERP based MRP.

Running Competitions

I have spent a great deal of time analyzing the decision making process in the enterprise software field. My conclusion from this research is that there is often much less evidence supporting many decisions than meets the eye. Companies often tell me they have made a commitment to a particular vendor or that they are able to “get by” with ERP based MRP and that it is “good enough.”

However, what does good enough actually mean, and how can they be so certain that it is in fact good enough? Is it good enough if a company is running software that costs them more in lost efficiency (lost orders, low machine utilization, high recursive manual analysis costs, etc.) if the same company can make an improvement which saves them money above and beyond the cost of the change and makes them a more efficient and capable entity? That does not seem to be good enough, but evaluations of many clients tell me this scenario is quite common.

This brings up the topic of how one makes decisions regarding enterprise software. Of the many implementations I have worked on, I can't think of a single instance where the software was run in parallel with the current system in order to prove out the results. However this can be done, and the benefits are quite high for doing this. By running a parallel system for a representative sample of the problem, the company can estimate what the expected benefits of the system will be. This approach would allow companies to keep away from bad investments, and allocate their limited software purchases and implementation budgets to applications with a high potential for a strong return on investment.



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A Recommended Approach

My recommendation for companies running ERP based MRP is to test the hypothesis that they systems are good enough. At Software Decisions we have begun offering parallel run “competitions” using software, which is both powerful and relatively fast to setup, and which competes against the client’s present system. We do this for demand planning, supply planning and production planning. As we don’t sell software, we have no financial bias that might influence us to construct the test to favor any application or approach, and we conduct the competition the same way as we would any of our other research initiatives.

This process has several benefits, with a major one being that the company can come out of the process actually knowing not only where they are in terms of the quality of their planning output, but also how much they could stand to gain if they made a change. In fact, our competitions tend to underestimate the benefits of the competing applications because all of the tools we use provide a higher degree of automation than anything available within ERP – and this means the company benefits from the ability to use their resources for high value added activities over moving production orders around. Secondly, companies tend to find ways to improve the usage of systems the longer that they use them. However, we don’t even count those benefits, and this allows for a large margin of error in the benefits estimation.

Conclusion

Manufacturing companies are constantly looking for ways to save costs and improve operational efficiency, however, most manufacturers are still relying upon MRP based ERP for production planning and scheduling. MRP is not the best method, and ERP is not the best application in which to perform these activities.

Companies can have the efficiency of their present MRP based ERP tested against highly capable production planning and scheduling systems. These tests can be run at a reasonable cost, with reasonable timelines, and companies can receive the quantified results of how their present system compares to more advanced systems. From this they can know first if they are actually missing out on tangible benefits, and if so, how large those benefits would be.



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