MRP R.I.P

Publish date: April 2006
Superfactory
www.superfactory.com

By Bill Waddell

When Joe Orlicky implemented the first MRP system at J.I. Case in Racine, Wisconsin, Dwight Eisenhower was president. Bill Gates was ready to begin kindergarten. Hand held calculators, personal computers, color monitors, FedEx, fax machines and most of the interstate highway system were still in the future. The last of the Ford Edsels were still on the lots, and no one but the most ardent car aficionados knew who Toyota was.

The year was 1960. OPEC had not yet been formed. "Made In Japan" still meant miserable quality. American companies manufactured, for the most part, in huge plants, bloated with inventory. Lead times were long. Henry Ford's "the customer can have whatever color he wants so long as it is black" had been replaced with General Motors "any color so long as you don't mind waiting two or three months".

Orlicky beat his friendly rival, Ollie Wight, to the punch. Not long after J.I. Case was running MRP, Wight and his associate George Plossl had the Stanley Tool Works in Connecticut up and running on MRP. In 1967 the three of them decided to take a run at using the fledgling American Production Control Society (APICS) as the vehicle to spread the MRP message. By 1971 APICS had officially launched 'The MRP Crusade'. The last tweaking to MRP took place soon afterwards when 'closed loop MRP' was available, which incorporated capacity planning into the original scheme.

With the exception of the capacity planning tweak, MRP has not changed since Orlicky flipped the switch for the first time 45 years ago. It has been added onto, for sure. MRP II tied accounting to the core MRP system in the 1980's; and a variety of other business functions were linked to create ERP in the 1990's; but the center of MRP remains the same as Orlicky and Wight conceived it so many years ago.

In the 1980's Copeland Corporation ran a highly evolved, home grown MRP system as well as anyone in the world. Their lingo at the time when talking about the system was 'Big MRP' and 'Little MRP'. Big MRP denoted the system as a whole, including all of the accounting functions and so forth. When someone talked about ‘Little MRP’, they meant the core manufacturing logic. That core logic was essentially the product of Orlicky and Wight’s efforts and was initially called Material Requirements Planning. ‘Big MRP’, or MRP II, had come to be known as Manufacturing Resources Planning.

That 'Little MRP', Material Requirements Planning - Orlicky and Wight MRP - is still the heart of MRP and it is far past its prime. It was conceived in an age of long lead times, marginal quality and big lot sizes. The assumptions upon which the system is based, although right on the mark at the time, are hopelessly off in 2005. It seems a pretty safe bet that, had Orlicky and Wight somehow been able to magically transport their system to Ford in about 1915, or to Toyota in about 1955 and offer it up to them, they would never have made it past the front door. To a manufacturer whose lot sizes are 1, and lead times are virtually zero, operating with almost no inventory, MRP simply would not make any sense.

Ironically, if either of those companies were to have had the chance to implement a modern ERP system, Ford and Toyota would be likely to have jumped at the chance so long as they could turn the manufacturing modules off. The expansion of MRP into the rest of the manufacturing

organization is enormously valuable. The problem is that it is built on a logical base that should have hit the scrap heap decades ago.

Proficiency with Excel and Access are rapidly becoming the most important tools in the materials manager's arsenal. They are essential in order to extract the data from an MRP system and put it into a form that enables him or her to plan and monitor a lean factory. The basic MRP tools are of increasingly little help. More and more articles are being published by supply chain folks who are willing to share the secrets they have learned to work around the MRP system. The ERP companies are trying to add bells and whistles to their systems in order to provide some lean assistance, but it is a losing cause. They are merely slapping duct tape on that Edsel bought while Orlicky was hard at work in Racine .

It is becoming painfully apparent that production and inventory planning and control professionals are hopelessly under-equipped when they go into a factory filled with state of the art automation and lean flow armed with Orlicky's forty five year old system.

It is past time to go all the way back to square one and create LRP - Lean Requirements Planning - that can act as a new core for ERP systems. For companies trying to become lean, it is a necessity. Too often, lean proponents on the factory floor are having to fight the MRP system because it simply will not support the way they want production to flow. The next system - LRP - should begin with lean manufacturing and make it difficult for someone to run the plant in the Wight and Orlicky batch and queue mode.

What MRP Is All About

MRP begins with batch production. If there were no batches, if everyone had been manufacturing with one piece flow, there never would have been MRP.

Machine set up costs (driven by the time it takes to do the set up) and material handling costs (driven by plant layout and handling procedures) add to the cost of the product. By producing more parts at once, the costs of set up and handling can be amortized over more parts. Since accounting has defined inventory as an asset, the only perceived cost of producing many more parts than are needed are the minimal costs of money and storage.

Orlicky and Wight lived in a batch manufacturing world. Whether they thought that batch production was unavoidable or they simply figured that it was not production control's problem to solve, they conceived MRP under the assumption that batches were a fact of factory life.

Most manufacturing professionals are familiar with Taichi Ohno's analogy of inventory as the water level in a river that covers the rocks, which represent costly production problems. Production batching was the traditional American manufacturing solution to the rocks. Batches were sized to assure that the cost and delivery impact of long set ups, poor material handling, uncertain quality and so forth were minimized. For much of the 1980’s production control literature centered on increasingly complex and sophisticated algorithms for setting batch sizes, or Economic Order Quantities. The starting point for MRP is that a fundamental objective of the production planning and control system is to be sure that there is always just enough water in the river to cover the rocks.

The belief that inventory is an asset with negligible cost impact even allows for disjointed lot sizes. If a product requires one of component A and one of component B, MRP allows, and even facilitates, plans to build 100 A’s at a time, and 200 B’s, if someone thinks that those quantities result in the lowest unit cost. MRP will keep track of the inventory mismatches and help drive the factory back into balance as best it can.

The inevitable consequence of batch manufacturing is extended manufacturing cycle times. It stands to reason that, if the batch represents two weeks worth of requirements, for example, then the cycle time will be two weeks or more. Once a series of batch operations are strung together with unavoidable transportation and other delay time between processes, the two week cycle time for individual operations can easily extend to several weeks for the entire process.

If suppliers had similar lengthy cycle times, the overall lead time, from deciding to make a batch of product to having that product available to sell, could run into several weeks or months. That long lead time environment was also such common practice in Orlicky's day - as it only could have been given that everyone was batch producing - that it too was assumed to be a fundamental reality of manufacturing with which MRP had to contend.

Scheduling long lead time, batch manufacturing can be accomplished through one of two ways for a repetitive manufacturer: Either an inventory of finished product can be kept and a sort of re-order point established to trigger telling production to conjure up another batch; or a forecast can be prepared and the factory can build to the predicted demand. In the second case, the inventory necessary is only enough to protect the factory from forecast error. That "Plan B" makes more sense than the mountain of inventory needed to "pull" at a reorder point, so preparation of a master schedule, based on a forecast, was logically next domino to fall. A job shop, or make to order manufacturer, has no alternative other than to build to a schedule..

Based on those core principles - batch production is most economical, and batch production entails long lead times, and long lead time production must be scheduled out into the future - the MRP planning process came to be. The Master Schedule was the primary product of MRP, and it would constitute the heart of the business plan, spawning budgets and capacity decision making.

Having built the master schedule from 'Forecast X Batch Sizes X Lead Times = Master Schedule' logic, MRP then breaks the schedule down into discrete production orders slating specific quantities of specific part numbers to be made on specific machines on specific days. The production control function in an MRP environment is one of collecting actual production data and reconciling it with the schedules, constantly tweaking and nudging the factory to keep to the master schedule.

All things considered, the system though extraordinarily complicated, is effective, as long as the basic assumptions about manufacturing are correct.

ToyotaTook A Different View

The problem with MRP began the day Shigeo Shingo knocked the props out from under it. While MRP, run properly, enables the plant to circumnavigate all of Ohno's rocks, lean manufacturing - the Toyota Production System - exposes the rocks and compels manufacturing to get rid of them.

When Shingo reduced set up times to minutes and poka yoked quality, then other Toyota people worked similar magic on machine reliability and factory layouts, and Ohno kanbaned the whole thing, Orlicky's manufacturing model came unglued.

Instead of batches, the optimum lot sizes equaled one. When lot sizes became one, batches disappeared. When the batches went away, manufacturing lead times - production cycle times - went away with them. The entire basis for MRP went out the window when the Toyota Production System came to be. Without lead times to worry about, master scheduling took on a completely different hue. There is always a need to plan - but not every operation for every item. Just planning the broad strokes was good enough, such as capacity and general statements about critical materials.

Pressure on forecast accuracy drops once master scheduling is loosened up. Forecast volume is important so that capacity can correlate with demand, but the mix of products to be sold is not terribly significant. Of course, the inventory planning and control tasks become minimal.

Trying to schedule and control a factory with a system built on Orlicky's assumptions, while trying to run the factory under Shingo and Ohno's principles is the proverbial square peg in a round hole. It simply does not fit. At the very least, it creates extra work and confusion. At worst, it exerts constant pressure on production to revert to the old ways.

The Problems

No matter what production control attempts to do with MRP in a lean environment, there is no avoiding the fact that lean is not schedule driven - it is reactive. Lean manufacturing responds to actual demand, rather than a schedule. A lean manufacturer does not *want* to attain a master schedule. That manufacturer wants to attain actual demand.

That leaves the production control person with limited choices. Either the master schedule can be simply ignored, turning the function off, or a generic sort of schedule can be created with no intention of attaining it. In any event, the heart of MRP is the master schedule and master scheduling has little bearing on how a lean manufacturer operates. The only aspect of master scheduling of significance in lean manufacturing is capacity planning and, perhaps, an order of magnitude projection of some of the critical components required. There certainly is no expectation of discrete compliance with the schedule in the manner envisioned by Joe Orlicky or Ollie Wight.

It is on the shop floor, however, where MRP must be stretched the furthest to force fit itself to lean production. A pull system is by its very nature self-scheduling. Yet MRP requires that production be applied to discrete orders. There is no end to the creativity of production schedulers to find ways to create shop orders that can correlate with kanbans. Everything is used from blanket production orders to a blizzard of discrete orders, in essence inserting MRP into a production event that has already scheduled itself. Often there is a spreadsheet scheduling system that parallels MRP with the two coming together only when final production is entered into inventory.

At some point the obvious question must be asked and answered: Why are we attempting to create scheduled orders, or any schedule, for production that schedules itself? The only solid answer is that it is not scheduling at all, but for accounting purposes. In a lean environment, the shop floor needs nothing from the MRP system. The insertion of MRP onto a lean factory floor can only be because accounting needs to collect cost and production data.

While accounting's needs are very real, using a 45 year old MRP system for the sole purpose of collecting costs simply does not make sense. The only value MRP has to lean manufacturing is its data base. Bill of material and router information is important for a variety of reasons - but scheduling is not one of them.

A New System Is Needed

While lean production does not need a scheduling system, it does need information and production planning support. There is a very real need for a system that provides accurate capacity availability, cycle time and production status information.

Lean manufacturing thrives on having marketing aggressively selling available capacity; and capacity is always changing. In most cases, continuous improvement translates into continuous

additional capacity and that improvement is best seen at the bottom line when marketing can take advantage of it to increase sales volume.

Lean manufacturing is also cycle time driven, rather than direct labor cost driven. Rather than track direct labor efficiencies and machine utilization rates, a lean system must track cycle time and rates of improvement.

Production status encompasses a broad area, including communication with all factory stakeholders. Suppliers and customers need much better visibility than MRP typically provides. MRP was designed around the idea that factories move in daily, weekly and monthly time buckets. Lean manufacturing is perpetual motion in small quantities. Things happen too fast for anyone with a stake in the factory to wait for a report tomorrow, let alone next week.

An LRP system will be a manufacturing planning and communications system, rather than a scheduling system. Its planning function will be centered on capacity planning, with continual monitoring, rather than production planning. It should facilitate the movement and tracking of pull production demands, not merely record what happened. The LRP system will have data structures that look more like process maps than routers, with all cycle time consuming elements embedded in them, not merely the value adding or direct labor operations. Finally, the LRP system will make the factory virtually transparent to suppliers, customers and management.

MRP made perfect sense in 1960 and for many years afterwards. The basic assumptions about good manufacturing have undergone a radical change since then, however. MRP should have been overhauled into a configuration that supports lean manufacturing long ago.

It is thanks to Joe Orlicky, Ollie Wight, George Plossl, Walt Goddard and the other visionary leaders in Production and Inventory Control in the 1960's and 1970's that MRP came to play a pivotal role in American manufacturing. It is thanks to them and to APICS that I have had an opportunity to become APICS certified and knowledgeable enough in the details and theory of the core manufacturing system to earn a good living, and to make a contribution to the companies for which I have worked. All of us who have reaped the benefits of the 1971 APICS MRP Crusade have an obligation to the next generations of materials management and supply chain professionals to do for them what Orlicky and Wight did for us. There are certainly lean visionaries who can define the Lean Requirements Planning System and support APICS into and through the LRP Crusade that is overdue.