

# Material Resource Planning (MRP): Will You Need MRP without the Customer?

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## Abstract

The objective of this paper is to introduce a new philosophy that when integrated with existing methodologies, will improve customer service within the manufacturing sector. This paper intends to provide the reader with an understanding that the entire operation has to be involved and collectively focused in order to continuously exceed customer expectations. Short falls of existing systems will be examined with a key focus on the importance of not tying all expectations on MRP, a historical algorithmic electronic scheduling system.

## Keywords

JIT MRP; Scheduling System; Continuous Improvement; TOC; CUF; BAM

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## 1. Introduction

The Material Resource Planning (MRP) process has become a cornerstone of the manufacturing industry that has been around for many years. In 1921, theoretical calculations were being utilized in the production process. Over the decades, it has been refined, and furthermore with the development of the computer, it has become a robust and complicated tool used in many of the manufacturing industries.

MRP has become so engrained in the manufacturing industry that one of the biggest challenges in improving customer service is the fact that not all users understand the complexity of the system. Due to this complexity, it is difficult to make changes to a process because the total impact may not be known. The dependency of how the consultants set up the forecasting tool becomes an obstacle in the mission of Customer Urgency Focus (CUF). Companies invest so much money into these systems that it is difficult to convince them that change will improve customer service.

The success of MRP is predicated on the ability to forecast when to start manufacturing a product to ensure that the finished product becomes available to the customer on the promised date to meet the customer's expect-

tations. MRP implies that for every end item, a master production schedule (MPS) is created to specify delivery times and order quantities from a forecasted demand [1]. The forecasting is both external and internal to the organization. Once the customer's need is determined, the forecasting on efficiency, utilization, and availability of the manufacturing resources begins.

The advocates for MRP suggest that the formulas will predict the customer's dynamic behavior. The complexity and persuasiveness of these forecasts and solutions, as highlighted in papers, leave the creativity of altering or melding different philosophies to a very limited amount of people. Once an MRP system is put into place, it requires significant resources to constantly feed the modified schedules and to distribute the new reports. Over time, the purchasing individuals become dependent on the MRP report of what to order next to meet the forecasted needs and become less receptive to the daily urgencies of the customer. In addition, a vacuum effect can occur where the purchasing individual continues to blindly order based on historical data and may not realize that the customer has departed. As a result, additional inventory is created and the time used in making this material will have negatively impacted all deliveries to active current customers, as well as to the company.

Another point to consider is that the MRP system plans stock orders. The item with the earliest delivery date gets the machine time because sold demand is not known. This scenario meets the definition of a bottleneck, any resource whose capacity is equal to or less than the demand placed upon it, and it is important to understand this particular scenario because it reflects loss for a company. The bottleneck in this instance is the manufacturing of a product that can potentially sit on a shelf to be sold in the future. Present money has been sacrificed for future money and cash flow has been negatively impacted [2]. These are just a few reasons why competitive systems have been developed and why new theories continually evolve.

The concepts of Just in Time (JIT), Theory of Constraints (TOC), and Bottleneck Allocation Methodology (BAM) have been developed over the years to address some of the short falls of MRP. The ideas in this paper are presented in a simplistic format to allow many readers to implement changes immediately to their own processes.

This paper will serve to present a position that MRP has caused companies to lose sight of the customer. This position is supported by references that focus on material planning and that state improvements in performance through utilization of MRP while never relating the performance to the customer [3]. The customer is referenced in most articles however, the main focus is prevalently on complicated theories of meeting forecasted requirements. It is not surprising that there are many philosophies in this area, many and most of which do not address the main issue at hand: to predict what a customer will desire in the future.

## 2. The New Manufacturing Philosophy: Customer Urgency Focus (CUF)

Manufacturing companies today are implementing the latest technologies without maintaining the customer's requirement as the primary focus. More specifically, companies have been placing a higher concentration on cost reduction as opposed to customer satisfaction.

The general belief is that one philosophy cannot solve every challenge presented, but harnessing the power of multiple methodologies will yield the best customer service, and thereby the motive for working hard, the profit. The first and foremost stressed point is: if cash is king, then how important is the customer who provides the cash? With that said, satisfying the customer must be the number one objective. To accomplish this daunting challenge, an intimate knowledge of the entire business must be understood. In lean manufacturing, the mantra is to remove waste and reduce inventory. Companies seeking to apply the Lean Enterprise approach are focusing on a value-added ratio goal of 1:10. This means that for each hour the material is processed, this material is allowed to be resident in the manufacturing process for 10 hours [4]. When this is accomplished, costs are reduced and lead times are improved.

The new manufacturing philosophy of Customer Urgency Focus (CUF) utilizes current cost reduction ideas and brings a new approach to business strategies. CUF is a philosophy for focusing resources to address customer urgency in all aspects of business; this includes, but is not limited to quotations, new product development, deliveries, and sales support response time. When combined with other methodologies, the end result is customer satisfaction with significant profits.

The CUF philosophy takes the stand that every task at hand needs to be evaluated in how it is assisting to successfully satisfy the customer's urgent demand. Likewise with all other techniques that are used, this philosophy has to be engrained as a mission that the entire company is willing and capable of undertaking. In this way, it becomes the mantra of how one department acts to other's needs. Furthermore, this philosophy uncovers the

waste and motivates the team. Departments, such as Purchasing and Manufacturing, cannot work in a vacuum where they are isolated from other departments, such as Sales and Marketing. The flexibility of the selected process will have a significant impact on attaining the greatest yield of high customer satisfaction, which directly relates to the proportional amount of profit that can be expected for the value added proposition to the customer. Using MRP as a cornerstone to the purchasing and scheduling process is acceptable as long as flexibility and creativeness are not hindered. The following are additional concepts recommended to complement the MRP foundation.

## 2.1. Visual Scheduling Techniques

MRP attempts to schedule based on a standard of resource expectations. The assumption is that the machines, the materials, and the operators will be present to produce the product. The dependence on labor standards, which are usually less than 10% of the production process time, initiates additional difficulty in predicting accurate, timely deliveries. Due to the erratic behavior of these parameters, it is recommended to breakdown the components and to create a flexible, visual type of scheduling system. This system can take the shape of cards, magnets, digital displays, etc.

Many production systems are still set up with indented bill of materials (BOMS), despite lean manufacturing concepts of simplifying and going cellular. Such BOMS can be taken advantage of through a visual system. It is essential to design the visual cards in a way in which both commonality of material and operation are easily identifiable, therefore allowing everyone on the manufacturing floor to partake in scheduling and to become part of the CUF philosophy. The cards can help offset the items that do not meet the minimum batch size due to lower sales. By combining like components through the ease of color coded cards, the dependency of the MRP system is drastically reduced. The cards can be used as a Kanban system that allows the scheduler to pull through specific jobs to balance the plant work centers. The bottlenecks can be reduced by moving operators to different work centers based on the work flow of the plant. Customer urgency can be communicated through this system, allowing continual expediting at every work center without any disruption to jobs on the machines. Such information can be presented live if the cards are electronically interfaced to the enterprise resource planning (ERP) systems.

The better the understanding of all aspects of this system, the more confidence each department will have towards its positive effects to flexibility, while opening up opportunities to CUF. Visual Scheduling will enable further practice of lean principles. The ability to reschedule planned MRP orders, which were based on forecasted demand, to items that have sold at a faster rate, will yield improved cash flow. The operator's understanding of this process is a barometer that can be used to measure whether it is designed correctly. It is crucial for the process to be dynamic, yet easy to follow. In other words, if the process cannot be understood, then the process must be simplified.

Feedback of the most recent transactions representing the customer's erratic behavior needs to be communicated real time. This type of communication will allow the production floor to react quickly to the customer's immediate need, and this tool will allow for immediate response to the deviations that can happen to every well-laid plan. The method used does not have to follow a specific format, but should enable operations to change priorities in a real time manner. Forecasts are estimates and a visual system allows the operators and planners to manipulate the schedule based on the latest customer transactions. A machine could fail, an operator could call out sick, a raw material could become damaged, or the customer could run out of material due to forecasting errors; these occurrences cannot be controlled. The ability to change the schedule and to quickly shift priorities will assist in the recovery to meet the demand of the customer with satisfaction in the shortest amount of time.

Operators assisting with the scheduling of items yield benefits such as high throughput and assurance of reliability, product availability/delivery. Jobs can arrive from different work centers at different times from what the MRP plan initially predicted. When the operator can start immediately or shift execution priorities (*i.e.* undertake a job that takes thirty minutes prior to one that takes two hours if there is waiting time from a different work center that is associated with the two-hour task), the CUF philosophy has been applied.

The visual scheduling system needs to be designed around the business strategy. The methods of prioritization have to be set and followed. The identification of scheduling priorities on the cards in a manner that allows all personnel to take part in is a key attribute to improved delivery. Being able to adjust schedules and send a partial or full order to a customer with the aid of a visual scheduling technique will demonstrate the value added propo-

sition as a supplier, and this practice will bring forth new business and higher profits.

## 2.2. 80/20 Principles to Set Priorities

Managing to the collective priorities will provide the best opportunity for meeting the majority of the customer's expectations. The 80/20 rule can be used to analyze which products to spend time on creating multiple preferred lot sizes. Applying the principles can lead to the discovery of bottlenecks or common process issues, and this discovery will improve decisions made on where to allocate the limited support resources. Thereby, focusing on these areas will yield the most significant results to customer satisfaction and profit. Most importantly, this type of application allows the priorities to be established on 80% of the business by only addressing 20% of the items. More often than not, great ideas are not put into place due to the amount of time needed to reach 100% task completion and the unfortunate lack of necessary time. Occurrences, such as these, can be mitigated by dividing a large idea into individual projects that have great potential. After all, 80% accomplishment of a great idea is better than nothing ventured.

## 2.3. Expediting Process

Expediting process is a commonly used term, but it holds a multitude of meanings. A system that is tied to the customer through sales can lead to many behavioral benefits. A simple tool that can be used to do so is a spreadsheet shared by employees that captures all orders requested by customers. By incorporating this simple tool, team work between the sales team and the production plant will become closer. The sense of urgency and the understanding of the pressures of dealing with the customer are more easily, quickly, and effectively communicated. The closer this information becomes real time, the more successful the company will be in servicing the customer. It is recommendable to set differences among expedited line down, expedited running low, sold, low stock, and stock orders. When this type of information can be accurately communicated to the production floor, customer satisfaction and level of service will increase.

The MRP process does not react automatically to these conditions. It makes a deterministic calculation at the time of preparing a production planning schedule for the plant. Once these orders are put into the plant, the timelines are set. The dates are then locked in and the performance of the company becomes based on an expectation that other events are frozen until these products are produced. If two customers have sold orders and one is very large, but arrived earlier than the customer who has a line down, it will be difficult to change the operation to be proactive to this unfortunate state.

As can be seen, having a real time method of communication between the customers and the operators will improve the response time to the customer's urgent needs. Understanding terminology, such as "expediting line down", means that this item will take precedence over any stock order and customer order that is currently ahead of schedule in the plant. This is a methodology that has to be set and enforced through the philosophy that any order the customer is calling for must take a higher priority.

## 2.4. Lot/Batch Sizing

Using lot/batch sizing in conjunction with reducing the ordering costs has been shown to reduce overall production costs. It is now widely accepted that process hatching involves a convex relationship of the lead time as a function of the processing batch. As a consequence, there exists an optimal process batch minimizing lead time. If management decides to deviate from this optimal process batch, the effects can be substantial especially under circumstances of high utilization and stochasticity [5]. The difficulties of forecasting hinder the use of batch sizes.

MRP uses Economic Order Quantity (EOQ) as one of the baselines for ordering material. These values are typically determined by measuring the carrying cost of inventory versus the ordering costs inclusive to set-up times. From this, the lowest batch size is determined. Two common errors are likely to occur in the process. The first error is in the calculation to determine lot size; typically includes historical sales. These sales values are used to determine how many times a year a product should be made to satisfy the customer and to produce at the lowest cost. The second error is that material handling is not taken into consideration as a cost. It is advisable that the plant has multiple lot sizes for each item, and these should include the minimum size that the plant can run through all operations with the least amount of material handling and the least amount of setups or pass

changes that can cause sub-setups. If a material handler has to move more than one pallet or tote from one operation, then this creates more pieces or lengths at the next operation with the presence of sub-setups.

Example: The first operation can fit 22,000' on one reel. The second operation can fit 20,000' on one reel. The operator at the second operation will have to run the first 20,000' and then do a sub-setup to put 2000' on the next reel to complete the batch. This second reel now only contains 10% of what fits. The operator at this operation and any following operations will have to handle this short reel. The material handlers will be moving a reel through the plant that is 10% utilized, which utilizes as much of their time as a full reel. This is supported by other studies that state 90% - 95% of the manufacturing lead time in the MRP production process is composed of wait, queue, hold and transfer times [6]. The minimum lot size in this example would be 20,000'.

The maximum lot size should be determined with regards to ensuring flexibility and the information of historical sales. Based on the example above, the maximum batch size may be 3 multiples of 20,000' totaling 60,000'. While the operator will have sub-setups, the material handler will be moving 100% of the utilized reels. A recommendable guideline to follow is that the lot size run time should not exceed 15 times the largest setup time in the process.

It is easy to fall into the mindset that one setup for any size is better than doing multiple setups later. In order to maintain the flexibility necessary to react to customer demands, it is best to have reduced lot sizes. Even if the customer demand is 120,000', it is better to have two jobs in the plant as this streamlines the ability of changing the line-up without having to break out of a job. The scheduler can place an expedited job in between the two 60,000' jobs and still have material moving through for the first customer. Besides continuous movement, this can also prevent a negative psychological effect from occurring to both the operator and management when the partial material has to come off the machine and wait to be used again at a later time.

Setting up for a new job is just part of doing business and should not be perceived as double work. Now, when the customer calls and is out of material, the systems are in place that allows schedule changes without significant disruption. Lot sizes set to levels that create the highest throughput while running the smallest lot size will satisfy most philosophies. Adding the reduced material handling concept will drastically improve the throughput of material. If an expedite call does not come from the customer, the plant can schedule the next job behind the first and take the benefit of a sub setup. To further refine the WIP lot size, it can be compared to raw material lot sizing. Practitioners commonly use the same lot sizing for WIP and raw materials, and this may lead to inappropriate lot-sizing solutions [7]. Combining multiples of raw materials to the WIP multiples can assist in determining new minimum and maximum lot sizes. The idea that a lot size should be set up once and then not changed is damaging to CUF. If the need for less than the minimum lot size is required due to the business strategy, this position must be mutually agreed upon by sales, manufacturing, and management.

Combining concepts of visual manufacturing and demand prioritization through the use of lot sizing practices will maintain the shortest lead times within the capacity that the factory can support. Intimate knowledge of the business philosophy by all personnel along with a synchronization of this team is required to provide commitments that will yield positive performance. Without utilizing these different strategies, a buyer/planner using MRP can run the factory ineffectively.

Careless acknowledgements of large orders without understanding the impact to the operational flow can be damaging to the overall performance to many customers. Large orders can lock up valuable resources to fulfill one customer's demand that may sit in inventory at the factory due to the MRP forecasts. Accepting a large order without careful consideration of all current business conditions can immediately increase the factory's lead times and negatively affect the business' flexibility. This can create a domino effect into poor performance and lost customers.

While taking large orders is the goal of any organization and delivering when stated is the expectation of any customer, releasing the order into smaller production batches may be a safe and conservative practice. While a large customer order can be satisfied on a planned scheduled date, there are greater chances that acceptable delays may happen, thus negatively impacting other orders. The flexibility in taking in other demand orders without disrupting the plants' objectives requires simplistic tools that talented people can utilize. An additional benefit of reduced batch sizes is that it allows portions of the job to continue through the operation versus the entire job waiting as another expedite is run through the work center.

### 3. Conclusions

In summary, the company that can pull its resources together to service the customer demands will outperform

the competitor that masters the use of MRP. One thing is certain, forecasting what the customer will need and when it is needed will remain a challenge in a capitalist society.

A common theme that is indirectly suggested in all theories given is to improve performance. The CUF philosophy will become a high-level management conceptual tool that will add onto all existing and future ideologies to achieve performance improvement. It will provide a common sense barometer to the logic of these complicated tools that is needed as a foundation to the business entity. Lean thinking states that every task should be looked at in how it adds value; CUF suggests that every decision, in all aspects of the business, should be questioned from the angle in which whether it is the quickest way to satisfy the urgent need of the customer. This strategy will open up other alternative options based upon lean. Cost may not always be the lowest alternative, such as holding more raw materials to ensure a quick delivery. The question is not what the lowest cost is, but what the shortest time is to satisfy the need of the customer. In business, profit is the litmus test of whether the business entity, as a whole, is making the correct decisions.

There is no question that if everything happened according to the schedule with no changes in external demand and the same expected lead times, then MRP would be the ultimate method. MRP, however, is a deterministic model over a stochastic reality and simulation studies have shown that MRP has difficulties in handling variations in demand and lead times [1]. Applying the MRP process with concepts of visual manufacturing, demand prioritizations, lot sizing, 80/20 principles, and other lean manufacturing methodologies will increase performance that yields high profit. By exceeding the customer's expectations, the ability to charge more is granted.

The company that has a desirable product at a lower cost has an advantage, but this does not mean that a company with a philosophy of CUF cannot compete and win against the lower cost competitor. In most cases, the tie breaker is the customer service or perception thereof that can influence the customer. Cost reduction will always be important for one to stay in the game, and therefore, melding the lean principles and new production control philosophies must not be overlooked. Viewing and considering the entire value stream from a CUF perspective will drastically change the company's position away from being dependent solely on MRP to meet the customer's expectations in product delivery and service.

Continuous improvement on communication tools that are able to deliver the customer's concerns directly to the operator on the floor will enable a company to be more profitable. Thus, it is imperative for a company to have a fluent system that can modify the material flow with changes in the customer's demands. The leading company of tomorrow will continually strive to combine and balance the latest production control philosophies with a dynamic communication system that presents customer's needs, demands, and requirements to the operator level.

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