CIPS KNOWLEDGE

Material requirements planning (MRP)

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Material requirements planning (MRP)

Introduction

The term MRP was suggested by the three US-based researchers - Joseph Orlicky, Oliver Wight, and George Plossl - In the 1960s (Hopp and Spearman, 2004). Since then it has become a widely popular area of research. Alfred Sloan referred to his experience with MRP type calculations in his famous book, 'My Years with General Motors', published in the 1960s. In the 1990s the relevance of MRP was debated but it remains a relevant subject today as modern MRP systems continue to play an important role in reducing inventory and improving manufacturing (Schuster, 2000).

According to Browne et al. (1988), three assumptions are made while preparing the MRP schedule: (1) is there enough capacity to produce? Therefore, MRP is also known as the infinite capacity scheduling; (2) ensure the time taken for production can be estimated accurately; (3) the date of order can be taken as Day 1 when estimating the complete date of the order.

Modern ERP systems borrow from the MRP and MRP-II systems that acted as predecessors and were designed to generate a lot of data and act as the main database. In the 1980s technology was not fast enough and purchasing MPR systems meant considerable investment for businesses (Shum, 2003). The MRP II and more modern ERP have enabled companies to plan resources more efficiently than MRP. While MRP was used predominantly for material planning, MRP II endeavoured to plan as well as control all the resources of an organisation. In fact, it was so fundamentally different that it was renamed as MRP II, that is, Manufacturing Resource Planning by Wight (1984). ERP incorporated further functions of even planning, scheduling and managing resources from the supplier's end, based on the ever-changing nature of customer demands (Chen, 2001).

Definition

Material Requirements Planning (MRP) is a planning and decision-making tool in the production process. According to Browne et al. (1988), MRP is "a planning tool geared specifically to assembly operations. The aim is to allow each manufacturing unit to tell its supplier what parts it requires and when it requires them".

Successful Application

MRP sets the production goal and works backwards in order to assess the amount of material and work required to achieve the pre-determined task. In actual implementation, production planners use MRP the most. They base their decisions on work allocation, maintaining production schedules and planting foremen on the output given by the MRP. Customer service staff uses the MRP data to inform customers about the expected delivery date. Inventory managers and purchasing personnel are also regular users of MRP outputs (Encyclopedia of Small Business, 2002).

Main features of an MRP system

The Master Production Schedule (MPS)

This is based on the build or assemble programme, and is a statement of what final products need to be made, and when. It drives the entire MRP system. The MPS is based on sales forecasts or customer orders, production capacity and the prioritisation of work. It is a matter of some complexity and difficulty to get the MPS right, yet right it must be, as the whole planning process is based on this document.

The Bill of Materials (BOM)

This is a list showing all the raw materials or components required to make the final product. Usually it is a very complicated and formidable document. If we think about a tractor, we can see that it must be so because there are thousands of components. We can analyse parts of an imaginary Bill of Materials for a tractor, just to show how the document is constructed. It is arranged as follows:

1. The complete tractor is divided into major assemblies – say chassis, engine, transmission, steering, suspension, gearbox, electrical harness, etc.

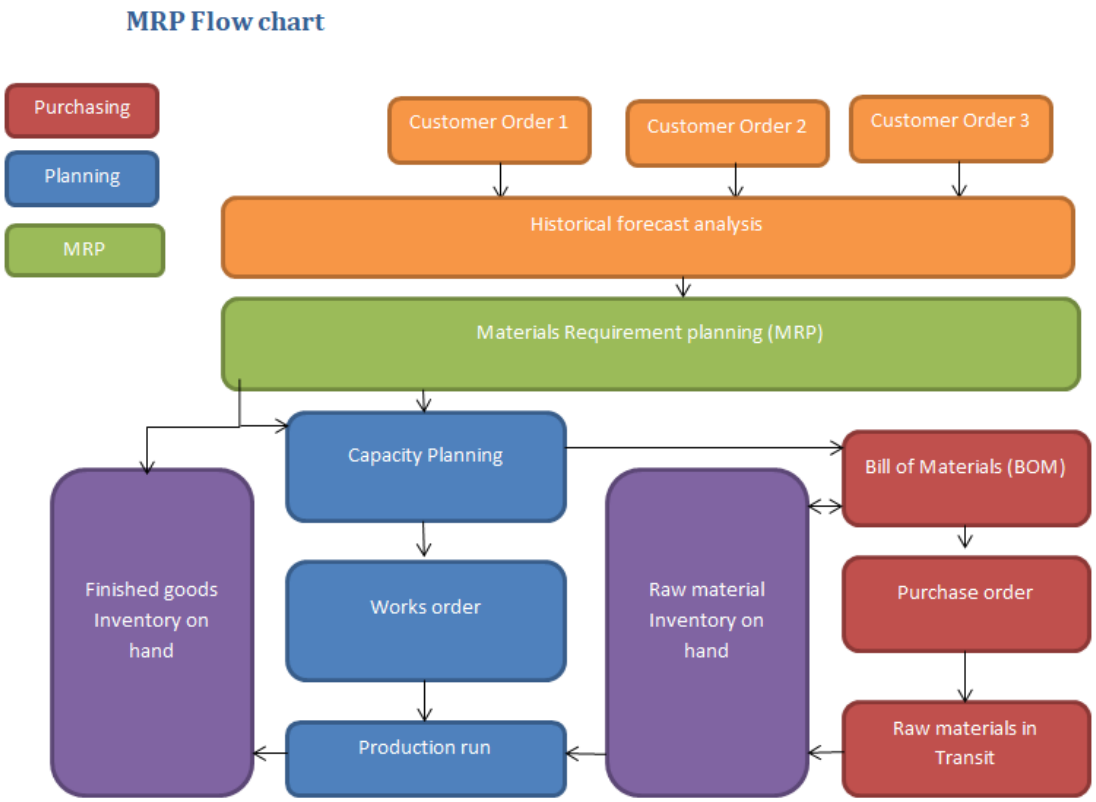
2. The major assemblies are split up into sub-assemblies. In the case of the engine, for example, that major assembly will divide into sub-assemblies for crankshaft, engine block, cylinder head, engine gear and so on.

3. The sub-assemblies are again split into minor assemblies. Taking the crankshaft assembly as our example, one of the minor assemblies would be the piston.

4. Having arrived at the piston minor assembly, that is then detailed into individual components, such as the piston head, compression ring, scraper ring, small-end bush, small-end pin, connecting rod, big-end bearing, big-end nut and bolt, and tab washer. Thus we arrive at the final details of the individual components which either have to be made in the firm's own production areas or bought from suppliers. In the instance of the piston minor assembly, perhaps only the piston head and connecting rod would be manufactured internally and all the other components bought from an external source.

The inventory status file

This keeps records of what is in stock, and allows the gross requirements to be adjusted to net requirements by taking into account the current stock position. The idea is to avoid stocks if possible, but if inventories do come into existence, the system will ensure that they are used in the right sequence.



Source: S.Donaldson CIPS

Steps to Successful Application

- Preparing the MRP schedule. Step 1. Exploding: achieved by using the Bill of Materials (BOM), i.e. how many components are needed to prepare one item of manufacturing?
- Preparing the MRP schedule. Step 2. Netting: the net quantity of material calculated by computing the difference between the stock available in the factory from the overall, gross requirement. This figure is provided by exploding.
- Preparing the MRP schedule. Step 3. Offsetting: lead time is estimated for the entire operation that helps practitioners to compute the expected time for manufacturing. It also tells when the manufacturing process should begin so that items are available on the promised date.

Browne et al. (1988)

Hints and Tips

- Adequate training of staff is important for the successful implementation and running of MPR (Encyclopedia of Small Business, 2002).
- It is very important to identify those for whom MRP will be the most effective and convince them about its importance and efficiency (Sawaya, 1992).

- A way to generate motivation and improve the engagement of people in MRP implementation is to tailor their rewards in a way that reflects their performance on inventory management and production goals (Sawaya, 1992).

Potential Advantages

- The MRP system is widely credited for playing a crucial part in decreasing factory inventory. It also assists in manufacturing industrial products that are more complex in nature (Schuster, 2000).
- MRP focus is on what materials are required and when they need to be sourced. It is also helpful in product customisation (Plenert, 1998).
- MRP has historically been seen as giving additional advantage because it is known to schedule and track every order whether for production or purchase

Potential Disadvantages

- When there are many variables in the production process and there is even a slight change in the bill of materials, the entire MRP system needs to be re-run (Schuster, 2000).
- Companies that are more process-oriented turn to other available alternatives as MRP can encounter a lot of issues in the nature of production (Schuster, 2000).
- For a very long time MRP was neglected as an area of study (Plossl, 1994).

Performance Monitoring

- The MRP attempts to find out what is required? How much of it and when is it required? It is very measurable and has a scheduled, specified requirement of material to achieve the final outcome. (Encyclopedia of Small Business, 2002)

Case Studies

- At least 83% of companies were inflicted by at least one of these effects in their MRP systems: poor inventory performance, poor service level and high expedite expense. Some companies also reported all of these three effects (Smith and Ptak, 2010).
- In 1984 US$400m worth of MRP II was sold by 16 companies and the number went up to US$1.2bln in 1989. This accounted for almost one third of the entire software industry. In the late 1980s MRP II was converted into an even more efficient system called the Enterprise Resources Planning, or ERP (Hopp and Spearman, 2004).
- Sara Lee, a household name in personal care, implemented MRP II in 1994. It included the computer system CINCOM along with the forecasting package Logol. As a result the Bill of Material accuracy, that had been between 30-50%, operated at 99% post-implementation. Finished goods inventory accuracy also rose from 20% to 98.5% (Robinson, 1997).

Further Reading/Reference

Web Resources

- Advantages of MRP (1975 paper) http://hbr.org/1975/09/behind-the-growth-in-materials-requirements-planning/ar/1
- Examples of MRP http://people.brunel.ac.uk/~mastjjb/jeb/or/mrp.html

Books

- Material Requirements Planning, Joseph A. Orlicky, ISBN 978-0070477087
- Orlicky's Material Requirements Planning, Carol A Ptak & Chad Smith, ISBN 978-0071755634
- MRP, Terry Lunn & Susan A. Neff, ISBN 978-1556236563

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Video

Materials Requirement Planning by BizTraining
https://www.youtube.com/watch?feature=player_embedded&v=NllqvpWTRno