DO YOUR BUSINESS SYSTEMS HELP OR HINDER YOUR COMPANY'S SUCCESS?

Part 2

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Part 2 of this series will primarily focus on the following issues:

- What do the acronyms MRP, MRPII and ERP etc. really mean?
- Is there any logic to the way in which solutions have evolved?

WHAT DO THE ACRONYMS REALLY MEAN?

The computer based solutions industry has developed its own set of jargon MRP, MRPII, ERP etc. and, as with all such jargon, the lack of a common, clear and confident understanding of it can seriously inhibit the willingness or ability of selection team members to ask questions or even to understand the answers provided and hence to perform the necessary objective evaluation.

The following 'potted history' of the evolution of relevant solutions and discussion of related jargon, should remove much of the mystique.

MRP VERSUS MRPII VERSUS ERP

The first of the relevant acronyms, MRP, first seriously appeared in the vocabulary of manufacturing industry in the late 1960's.

About 10 years later the related - and much too similar - acronym of MRPII was added to that vocabulary.

A further 10 years saw the addition of the third related but, thankfully, slightly less similar acronym, namely ERP.

While we might feel that intervals of 10 years should have eased the challenge of absorbing and differentiating the meaning of these acronyms, the reality is somewhat different, with significant levels of misunderstanding, confusion and even misuse commonly encountered.

What is perhaps even more surprising is to find such misunderstandings, confusions and misuses are at least as common in the global community of vendors who provide such business solutions as they are in the user community.

Cynical observers of the solutions market place have even suggested that such misuses and misunderstandings by some vendors may relate more to a desire to promote their particular solution, rather than a genuine ignorance of the true meanings.

To borrow some words from a popular TV series : I can understand why some may reach that conclusion, but I couldn't possibly comment.

The definitions and comments offered here are intended to provide sufficient understanding of what **should** lie behind these acronyms to enable the reader to differentiate and position solutions which they may encounter. Readers should however recognise that in the cause of brevity and simplicity only the main characteristics will be addressed.

Where confusion such as that between the names MRP, MRPII and ERP is encountered, it is often useful to return to basics, and in this case that means looking at the origins of the terms and at the business problems each such solution was designed to address.

THE BASIC ORIGINS OF THESE ACRONYMS

MRP Material Requirements Planning

MRPII Manufacturing Resources Planning
(the 'II' is used to differentiate it from the original MRP acronym which had the same letters - but from different words).

ERP *Enterprise Resources Planning*

Their names immediately identify all of them as relating to the **'planning'** (rather than to the **'execution'**) aspects of business management and, as a basic definition, most solution practitioners and commentators would readily agree that such planning is related to the identification, analysis and subsequent resolution of potential business 'constraints'.

Where fundamental differences occur between MRP, MRPII and ERP is in the 'type' and 'range' of constraints each of these approaches is designed to detect, in the techniques they employ in the initial process of detection and thereafter, in the support functions they provide to assist users in the analysis and resolution of the identified problems.

Basic **MRP** (sometimes called **MRPI**) as its name suggests, plans only **Material** Resources and seeks to identify and resolve actual or potential material constraints (ie. actual or potential shortages). The 'materials' involved would normally include raw materials, components, intermediates, sub-assemblies, semi-finished and finished products.

It performs a simple calculation of which raw materials, components etc. are required, in what quantities and when, in order to produce specified quantities of the finished product on specified dates, taking into account existing stocks, work-in-progress and purchase orders.

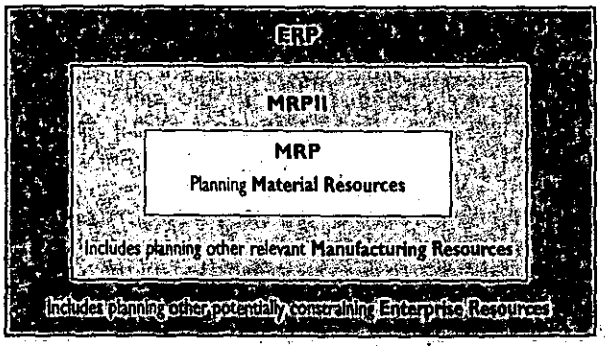
MRPII, on the other hand, looks at all relevant **Manufacturing** Resources - including machine tools, plant, operators, jigs, fixtures, space etc. **as well** as materials as defined above. MRPII is a 'superset' of the basic MRP approach. Most MRPII packages contain the basic MRP capability.

ERP is designed to widen the process to cover all of the relevant **Enterprise** Resources as a whole - ie. distribution, warehousing, personnel skills development, corporate

cash flow, supplier capacity etc. etc. - **as well as** the Manufacturing Resources addressed by MRPII. ERP is a 'superset' of MRPII.

FIGURE 1

RELATIONSHIP BETWEEN MRP, MRP II and ERP



It is important to recognise that not every package can support full ERP capability.

Whether or not this is significant to every company will be addressed later, but before attempting to answer that, it is helpful to understand in more detail the why's and wherefore's of these three approaches.

Progress from the original MRP concepts - through MRPII - to the current ERP capability was an evolutionary one, driven by the increasing challenges on manufacturing industry, which in turn demanded more effective business support systems capability.

Appreciating the critical aspects of the capability and relevance of each of these approaches is much easier if we understand the nature of the evolving environment and of the related business requirements these and other relevant approaches, were developed to address.

IS THERE ANY LOGIC TO THE WAY IN WHICH SOLUTIONS HAVE EVOLVED?

Prior to MRP, manufacturing industry was using computers to provide support in respect of Bills of Material and Inventory.

Such support, however, was primarily for the finance and, perhaps occasionally, the engineering function within industry, but rarely for the production functions.

The first real support for the 'production' functions within industry came not from MRP but in the application area of 'Capacity Planning and Scheduling'.

CAPACITY PLANNING AND SCHEDULING

This was the first real 'production' support application, and is an excellent example of the 'number crunching' capability of the computer being put to effective use.

Capacity Planning and Scheduling can be performed in several quite fundamentally different ways:

- finite capacity scheduling
- infinite capacity scheduling
- forward scheduling
- backward scheduling
- order scheduling
- network scheduling.

These different modes were developed to meet the needs of a variety of different user environments, so while some are right for certain environments or circumstances they can be equally wrong for others.

It is therefore important that prospective users understand the purpose, strengths and weaknesses of each approach and consider their relevance in the context of the needs of their own environment.

Finite versus Infinite Capacity Planning and Scheduling

Both finite and infinite capacity planning and scheduling calculate the expected start and finish dates and times of the individual operation on an order taking into account the work patterns of the relevant resources (ie. number of resources, hours per day, days per week etc.).

Where they fundamentally differ is that while the finite version takes into account the effect of any other orders which are competing for the same resource at the same time, the infinite version always assumes that the required resource will be available on the date and time required - ie. it does not take into account any other orders which are competing for the same resource at the same time.

A very simplistic, perhaps cynical view, of the differences between these approaches is:

- finite capacity scheduling will tell you what you can't achieve
- infinite capacity scheduling will tell you what you need to achieve.

The best solutions are usually those which support both approaches, with the user able to select which mode is to be used, where and when.

For example, infinite mode may be used to determine problems areas and to quantify the load versus capacity imbalances which management need to resolve.

Finite mode may then be used after all the possible or desired changes to capacity or planned orders have been applied, to identify and understand any remaining imbalances and to show the effect if no further action is taken.

Backward Versus Forward Scheduling

FIGURE 2

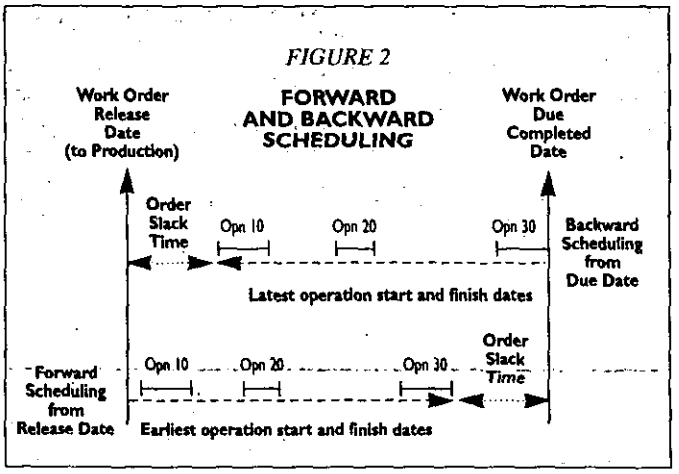
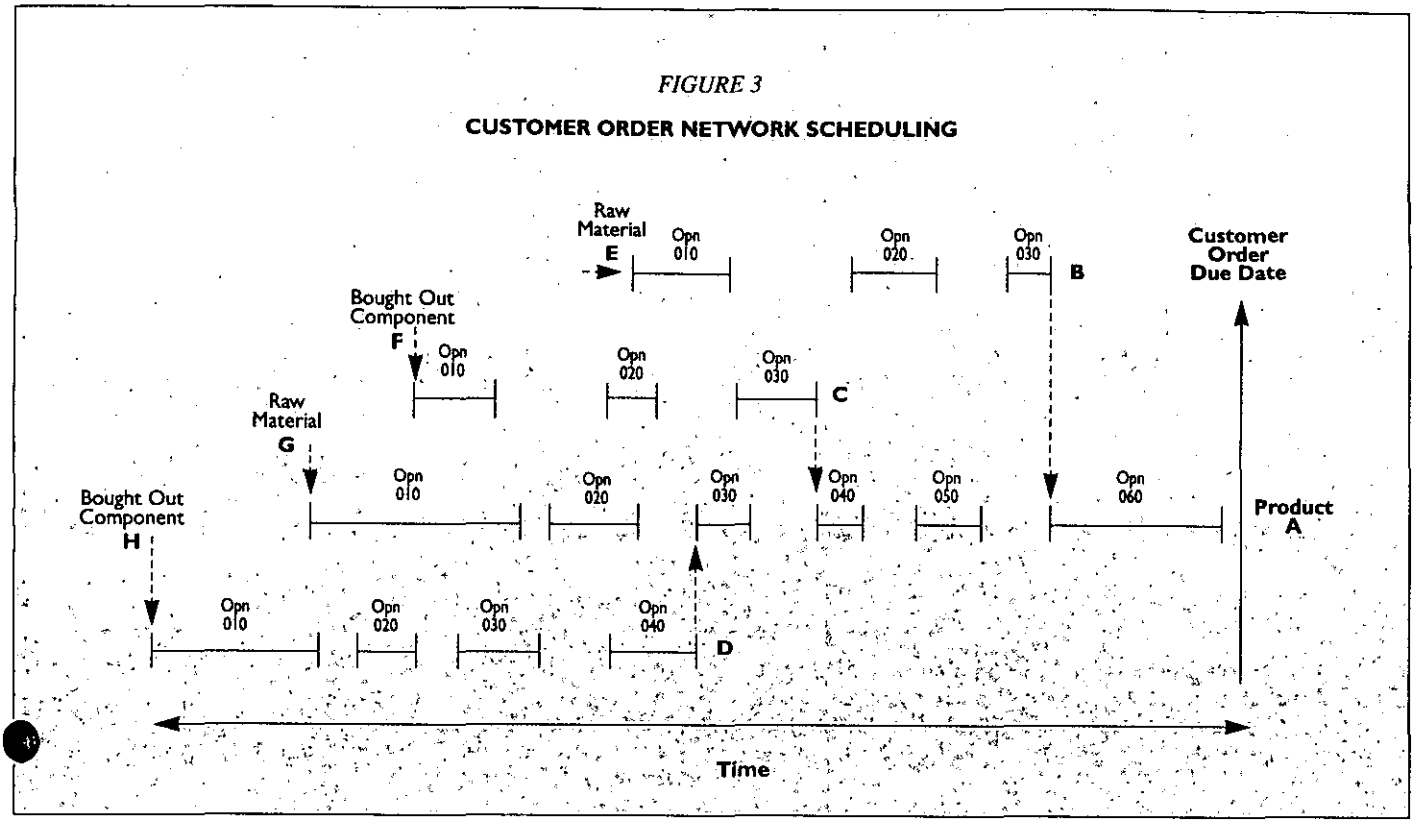


FIGURE 3

CUSTOMER ORDER NETWORK SCHEDULING



Backward scheduling, as the name suggests, will calculate backwards from the **due date** of each work order to determine the latest start and finish dates and times for each production operation to be performed - ie. Just-in-Time scheduling.

Forward scheduling calculates forwards from the **earliest start date** of the work order (usually based on availability of required materials) to determine the earliest start and finish dates and times for each production operation.

While backward scheduling is usually appropriate when everything is going to plan, forward scheduling can become essential when the production operations are not performed when planned - ie. when operations still to be performed are now past their previously calculated latest start dates - and new realistic completion dates are needed.

If backward scheduling is applied in these circumstances it will arrive at operation start dates which are in the past - ie. which are clearly inaccurate, but many companies choose to operate on this basis - arguing that 'dates in the past' indicate relative priorities.

There are many deficiencies in this approach, not least that it may further incorrectly plan and allocate related materials and give false expected availability dates for the items being produced on the order which is late.

Forward scheduling is also the right approach where the order is required on an 'as soon as possible' basis (eg. an urgent spares order as for 'Aircraft on Ground' (AOG) or Vehicle off Road (VOR) etc.)

Some scheduling solutions only support one of these options.

Order Scheduling Versus Network Scheduling

In 'make-to-stock' environments raw materials, components, sub-assemblies etc. are usually procured or produced in economic batch quantities which are put into stock and then issued sometime later for use in producing the next higher level in the chain.

In this environment, scheduling of each individual production order - ie. the component, sub-assembly and end product orders - without reference to each other is usually perfectly adequate. This is 'order scheduling'.

In make-to-order environments however, such raw materials, components and sub-assemblies are usually procured or produced only when required for a specific customer order.

Here the need is to be able to schedule all the individual items within the customer order as if they were a single entity, facilitating the more effective planning of both production and related procurement. This is 'network scheduling'.

Many scheduling solutions do not support network scheduling.

WHY DID CAPACITY PLANNING AND SCHEDULING COME BEFORE MRP?

The initial demand for such capacity planning and scheduling capabilities was largely driven by increasingly common problems in manufacturing companies - namely reducing production output, increasing backlogs and falling plant utilisations and efficiencies.

Finite capacity scheduling was usually seen as the answer - and the speed and accuracy of computers made it possible in terms of providing an answer quickly enough to be of value.

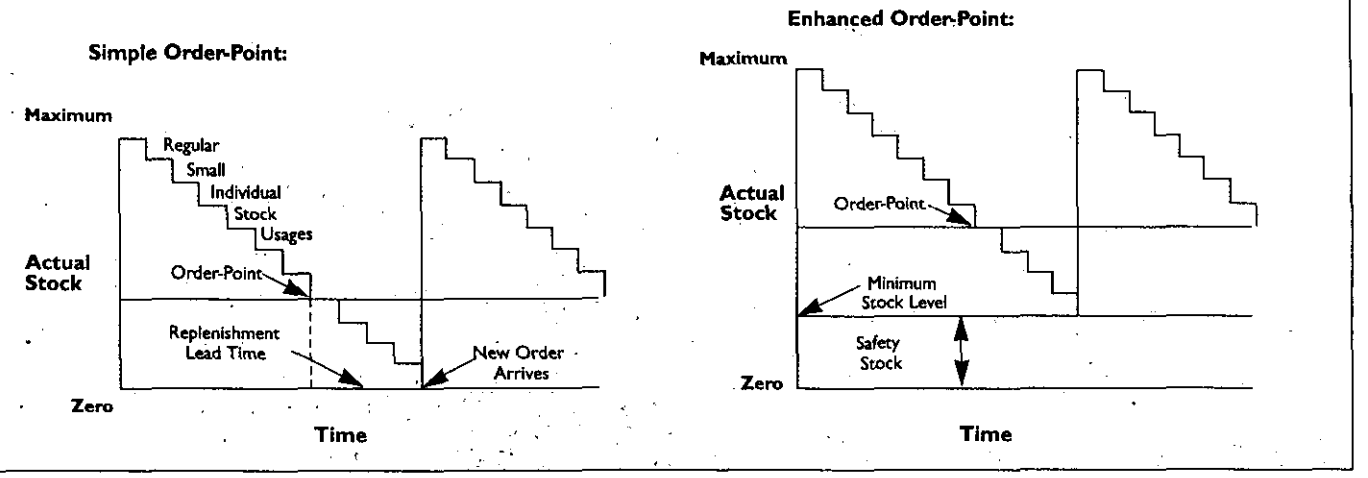
Hindsight, with its usual 20:20 vision, enables us to know that in many companies this was only addressing the symptoms rather than the basic disease.

To really understand this we must look much more deeply into the 'cause and effect' aspects of the problem.

We should remember that 're-order point' was the de facto inventory planning and replenishment technique in general use at that time.

FIGURE 4

ORDER POINT TECHNIQUES FOR INVENTORY CONTROL



We should also recognise that '(re)order point' techniques use historical usage to determine the (re)order level (ie. average rate of usage during the duration of the replenishment lead time) and rely heavily on consistent replenishment lead times.

While customer demand was stable, and production and procurement lead times consistent, this approach was perfectly adequate for many companies.

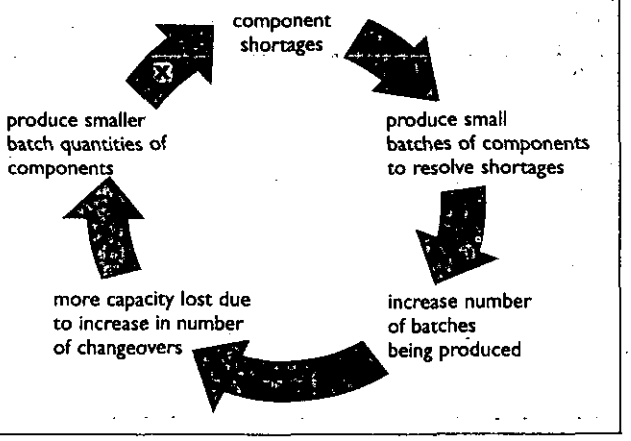
The mid 1960's was, however, a period of significant growth in many industries and the 're-order point' based levels of inventory and related replenishment plans often proved insufficient to accommodate increasing customer demand and squeezed lead times.

Companies were increasingly forced to ignore carefully calculated 'Economic Batch Quantities' (EBQ) for both production and procurement, and to make or buy what they could in the time available and/or the quantities available.

This usually resulted in the production of small 'batch quantities' of items urgently required to complete a customer order and hence more individual batches - the world of 'split' batches and 'send ahead' quantities.

FIGURE 5

THE VICIOUS CIRCLE OF SHORT TERM COMPONENT SHORTAGE RESOLUTION



Instead of resolving the problem this short term relief only made it worse.

Even more time was lost on 'set-ups', 'tear downs' and 're-set-ups' - which meant even less time for planned production and hence to even smaller batches and hence still more batches and more lost production time tightening the vicious circle still more.

Finite capacity scheduling was seen as a means of providing more time for production through improved plant utilisation and efficiency.

It was expected that by applying the same scheduling rules to all orders the right operation would be planned at the right time, minimising the need for 'firefighting' activities and hence minimising the lost production time which usually resulted from such firefighting.

It was also expected that scheduling systems should be able to sequence production to minimise the time lost during the necessary changeovers by taking advantage of any similarity of set-up between different orders.

For example, by choosing the next item to be made on a particular machine tool based on the minimum time and effort to make the necessary adjustments to the machine tool set-up. Such factors might relate to the length, width, thickness, colour, or temperatures required.

In some companies significant benefits were undoubtedly delivered - but in the more astute environments the analysis capability it provided enabled management to recognise that poor plant utilisation was often merely a symptom, and that poor material planning was the real culprit.

MATERIAL REQUIREMENTS PLANNING (MRP)

The availability of even simple MRP packages in the late 1960's enabled companies to begin to address the base problem.

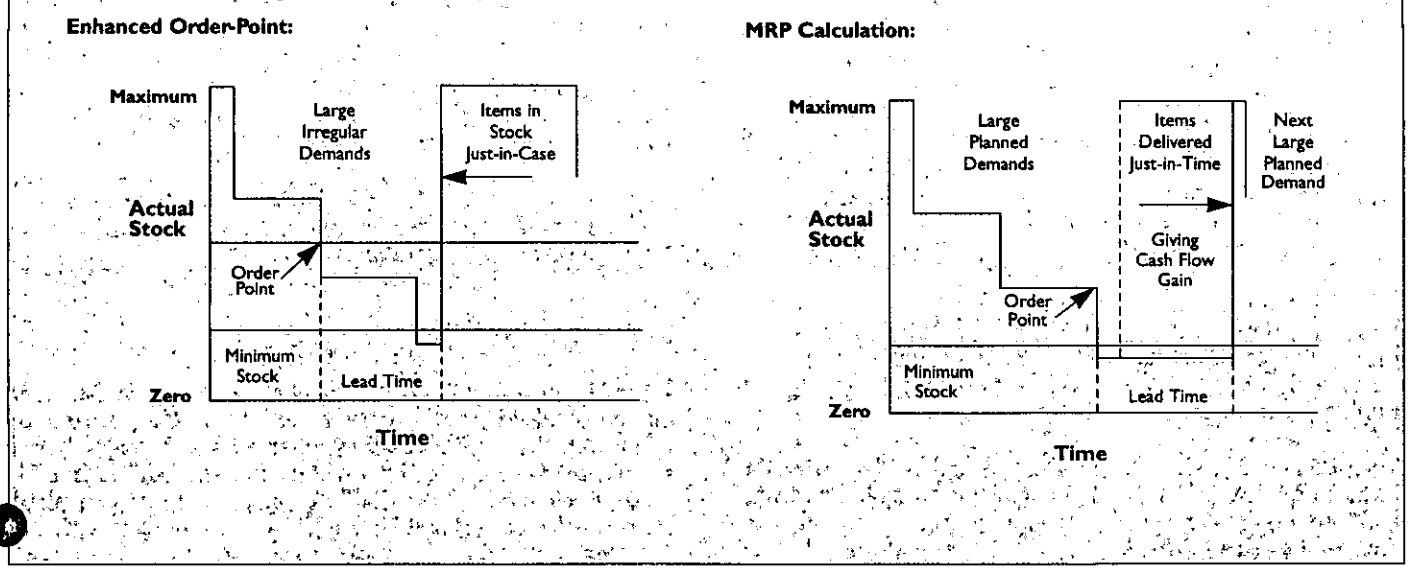
This despite the restrictions imposed by the limited computing power available at that time, which often constrained the MRP calculation to being performed as infrequently as once per calendar month.

Significant early success stories, with great business benefits being achieved, were common place.

In too many companies the MRP euphoria did not last more than a few years - and tales of failed MRP implementations,

FIGURE 6

WHERE AND WHY MRP IMPROVES ON EVEN ENHANCED ORDER-POINT TECHNIQUES



sometimes closely linked to the failure of the companies, began to hit the headlines. Common symptoms included:

- full and growing customer order books
- warehouses full of materials, components etc.
- the factory floor full of work-in-progress
- high levels of overtime and sub-contract
- few customer orders being produced on time
- cash flow problems leading to bankruptcy.

Such failures were usually attributed to poor implementation planning and/or lack of management commitment and/or bad working practices and for several years no one attempted to ascertain (or admit) that there might be some other fundamental deficiency.

The late and widely respected US consultant - Oliver Wight - is generally attributed with offering the first meaningful alternative assessment of why such failures occurred.

In simple terms he attributed the blame to three root causes:

- inaccurate Bills-of-Material (often multiple copies and not maintained by the design function)
- inaccurate inventory records (banks 'count' penny coins but industry 'guesses' on even high cost items)
- MRP being driven by plans which greatly exceeded the available capacity.

While the first two could be addressed by changes and improvements in working practices and procedures, the third required much more drastic changes, and involved two quite different but equally important changes:

- enhanced computer based applications to complement MRP
- changes in management thinking.

Enhancements to Basic MRP Systems

This involved the design and creation of additional computer based applications to identify and assist in the resolution of, potential resource constraint issues **before** the plan was committed to MRP.

The objective was to prevent scarce or expensive capital being spent on materials and labour which, due to unresolved 'resource constraints', could not promptly result in finished products which would earn the necessary revenue from customers.

Changes in Management Attitudes

This required executive and middle management to recognise that attempting to drive up plant utilisation by accepting orders and delivery dates far in excess of the realistic capability was potentially the shortest route to failure and bankruptcy.

MANUFACTURING RESOURCES PLANNING (MRPII)

The enhanced computer based application - Manufacturing Resources Planning (MRPII) - provided a key new function - generically referred to as Master Production Scheduling (MPS) or Master Production Schedule Planning (MPSP).

This supported the testing of a proposed 'master production plan' against all potentially 'constrained manufacturing resources' with help for the user in adjusting either the plan or the available resources to eliminate the problem in a 'non-crisis' cost effective manner.

In many instances the capability for 'what-if' simulations was provided so that the consequences of possible changes could be evaluated before being applied 'in anger'.

The more sophisticated MPS solutions supported several other new capabilities which overcame well recognised deficiencies in basic MRP systems:

- automatic 'blending' of real customer orders with forecasts of demand (eg. automatically reducing the balance of the forecast remaining in a given period by actual quantities ordered by customers)

- on-line visibility and allocation of time phased 'available-to-promise' finished goods inventory (ie. the quantity in stock at present, plus the day-by-day projected future stock based on planned receipts into finished goods stock and which was not already committed to other customer orders)

- two-level planning (ie. the ability to plan overall demand for optional components or assemblies which were at the second (or even lower) level on the product Bill-of-Material usually on the basis of a percentage based representation of the likely demand).

The challenge of changing management attitudes should have been the easiest to achieve, but the macho image attached to driving the plant (too) hard, proved a major stumbling block in many environments - even where the new MSP capability was implemented.

Too often - even today - the Master Schedule which drives the basic MRP calculations remains unbalanced and 'shortages' and 'progress chasing' - often by the same senior executives - are still the order of the day.

ENTERPRISE RESOURCES PLANNING (ERP)

The extension of MRPII to ERP was largely driven by the increasing vertical integration aspects of industrial evolution.

In such environments it became necessary to include potential constraints in all elements of this integrated supply chain in the 'plan validation' process.

ERP enables such companies to look beyond the resource constraints of 'manufacturing' (ie. as supported by MRPII), and to take into account all other possible constrains which could effect the viability of their overall 'master plan'.

Such possible constraint aspects include distribution capability, warehousing capacity and skills development, and it requires little wit or imagination to see why the costs associated with the physical moving and warehousing of finished goods or raw materials should influence the overall master plan and hence the master production schedule.

The relative strength or weakness of an ERP system largely depends on its ability to examine all such business considerations in an integrated and co-ordinated manner.

Unfortunately however, the term ERP has also 'attracted' additional 'technical qualifications' with some industry and solution commentators. For example the technical 'pedigree' of software engineering tools with which it is developed, the hardware and systems software platforms on which it will run and its use of database architectures.

Such 'technical' considerations are extremely important when considering the overall viability of potential solutions, for example in respect of protection of investment, or the ready availability of complementary applications from other vendors.

However, suggesting that such technical considerations are an **essential pre-requisite** of achieving the ERP label, or indeed that they only apply to ERP solutions rather than to **any** long term business application investment, adds further and unnecessary confusion to an already confused and confusing subject.

When buying a house, for example, we usually start with defining our requirements in terms of the number of rooms we need, the approximate location where we want to live and the price we can afford to pay.

When we have located a suitable candidate property we will of course employ a solicitor to ensure that there is nothing adverse about the site and a surveyor to ensure it is solidly built using suitable materials.

Such considerations are at least equally important as size, location and price etc. - **but they are quite separate considerations and deserve to be treated as such.**

The same rules should be applied to business solutions and the technical considerations should not be a pre-requisite to qualifying as an ERP solution.

WHO NEEDS ERP?

Before rushing to discard what may be an entirely satisfactory and adequate MRPII system just because it doesn't have, or claim to have, an ERP label, companies are strongly advised to objectively determine their real need for the additional ERP capabilities such as Distribution Planning, Management of Remote Warehouses and Human Resources Management and Development.

Other questions which are of at least equal importance relate to the 'fit for purpose' aspects of any solution. The current solution, and any possible candidate alternative solutions, should be looked at from this viewpoint.

This is particularly important where a company is seeking to change and improve its business processes and procedures, or is making significant change to either its products or the methods by which these are produced.

The degree of 'fit for purpose' must take into account the current and planned future business support needs of the company, which will mainly depend on the nature of the products and the basis on which these are produced and sold.

Having a solution with functionality designed to support **your key business processes** and **critical business success factors** should remain the prime objective.

Do not allow vendors to focus on the technical strength of this or that feature - force them to prove what it will **contribute to 'the bottom line'** on **your** balance sheet in the short, medium and long term.

For reasons of continuity this article has focused on only the evolving main techniques and applications. However, no such discussion or understanding would be complete without reference to, and consideration of, other key techniques including Just-in-Time, KANBAN and the many and varied forms of costing. These will be addressed in the next article in the series.

About the author

Ernie Stene for many years a senior IBM Consultant, now also with his own consulting business, has more than 30 years experience of providing advice and guidance in a wide variety of client environments ranging from aerospace and defence through to food and drinks.

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