SOFTWARE IN MANUFACTURING

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Introduction

The selection and appraisal of suitable software for a manufacturing company is a challenging task requiring clarity of purpose and objectives. The software that is available is often complex and has functional boundaries that overlap with other products which perform different functions. The selection and implementation of suitable software therefore requires detailed and accurate planning to ensure that objectives are met, that other existing products functionally integrate with it and that all aspects of the initial financial justification are fully realised.

Definitions

Available software for manufacturing covers such departmental functions as manufacturing, planning, purchasing, sales order processing, marketing, accounts, design, engineering and personnel. No single product can hope to satisfy all of these requirements although some products attempt to cross many of these boundaries. Knowing the scope of what needs to be achieved is therefore important so that the type of product can be defined. The remaining functions that fall outside the scope of the specification then become the subject of integration considerations.

To define the scope and understand some of the terminology used in the software industry, the following definitions will be helpful in clarifying which types of software products are worth considering.

MRP

Materials Requirement Planning (MRP) describes the first generation of manufacturing management software products which encompass sales order processing, simple works order management, Bills of Material, inventory control, purchase order processing and accounting.

The prime function is that of an accounting system which provides a means of planning material purchases to balance inventory and sales order requirements.

MRP2

The next generation of manufacturing management software was developed to address the problem of planning manufacturing capacity and manpower as well as materials. Manufacturing Resource Planning (MRP2) therefore has

additional functionality in terms of providing a means to balance manufacturing resources against a sales plan.

This software gives more planning flexibility, allows for sales forecasting and for building against a plan rather than sales orders. Inventory management is also more controlled due to the ability to plan material purchases against resource availability to prevent bottlenecking.

ERP

Enterprise Requirement Planning (ERP) describes the latest generation of manufacturing management systems. The software provides greater scope and encompasses other aspects of the business such as warehouse management and E-commerce. It accommodates multiple sites, distributed warehousing and a mobile sales force that requires access to centrally held information.

CRM

Customer Relationship Management (CRM) software is often built into the later ERP software packages but there are also many companies that specialise in this particular type of software and who also provide the tools to integrate it to the more popular ERP systems. CRM provides a means of managing customer information such as credit limits, order status, sales representative, records of conversations and transactions etc. It is particularly useful for customer service departments, the sales force and marketing personnel who are able to gain immediate access to all information regarding a customer and thereby avoid miscommunications and making erroneous commitments.

All of the above addresses the execution processes of a manufacturing enterprise. The design, engineering and technical production operations are not covered by this kind of software. Computer aided design and manufacturing software, mathematical and simulation products, Product Lifecycle Management (PLM) software and workflow (document management) packages have a scope of their own and only need to be considered in terms of the degree to which the execution software needs to be integrated with these packages. These boundaries across which data needs to seamlessly pass are an important aspect of Information Technology strategy and cannot be overlooked.

Selecting appropriate software

Before creating a detailed specification, a general overview of what is required of the system needs to be generated so that the search for suitable systems can be targeted. There is so much software available that this targeting is an

important step to ensure that unsuitable packages are quickly eliminated and that suitable packages are not overlooked.

Manufacturing software forms the heart of operational management in an enterprise and the most fundamental aspect of this is the accounts package. Therefore the first requirement is that the appropriate software must have at its core a strong, reliable accounting system that fulfils all of the accounting requirements of the company. In addition to this, the following aspects should be considered:

- The type of industry needs to be defined. There are software packages that are suited to specific industries (eg chemical processing, fabrication, light assembly, continuous flow-line production)

- Does the company manufacture based on orders or is it a plan-based enterprise which relies on forecasting? Some software products have very strong forecasting and advanced planning features which would be of little value to a company that manufactures high value items based only on firm customer orders.

- The way the software is to be used within the extended enterprise needs to be considered by answering questions such as:

    - Is there a network of sales branches or agents?
    - Are there multiple manufacturing locations?
    - Does the company purchase internally between divisions?
    - Are warehousing and distribution managed internally or through a separate company?
    - Does the system need to be operated across international boundaries?

- Are there other software packages that are used within the company that need to be integrated with the manufacturing system? Examples would include shipping systems, barcoding software, personnel systems (such as time and attendance), customer relationship management packages and design systems (which hold information about parts which will necessarily have to be shared with the manufacturing execution software).

- Does information need to be transmitted externally by electronic means? The most common examples are:

    - Electronic Data Interchange (EDI) whereby purchase order information is transmitted electronically between suppliers.
    - E-mail interface – for example shipping notes, order status etc. can be transmitted through the companies e-mail system.
    - BACS payments (for personnel or suppliers)

  - E-commerce – for example allowing orders to be placed through the internet or for product information and for finished goods inventory levels to be displayed on the company web-site.

- The level of planning needed is important in determining the type of system required. If a simple system to plan materials is required then this will demand less functionality, sophistication and cost then if manufacturing capacity and manpower also needs to be planned.

- What are the critical success factors of the company? The standard reports and measurements available from the software need to cover these essential points.

Budget considerations

As with any significant purchase, manufacturing software needs to be planned in the budget and the cost financially justified. It is unlikely that such a purchase could be funded from existing budget forfeitures or as an unbudgeted expense and so all the relevant cost factors need to be considered when planning the budget.

Having selected an appropriate level of system requirement, it is relatively easy to assess the cost implications of it since a number of potential suppliers can be contacted and quotes received. There are implications for both capital expenditure budgets and for operating expense. The main factors are as follow:

- Software purchase costs (capital)
- Hardware requirements – additional computer equipment, communications infrastructure and peripheral items (capital)
- Software annual licensing agreements (normally expense)
- Hardware and software maintenance agreements (expense)
- Training of personnel (expense)
- Consultancy costs (expense)
- Implementation costs (capital)

The most difficult costs to determine are the consultancy and implementation costs as suppliers are reluctant to be specific in this respect. They will often quote a daily rate and an estimate of the time required. They will qualify this by explaining that the time required will depend on the detailed planning and level of co-operation by the client company. There is a significant potential for costs to escalate rapidly in these areas.

Cost justification is based on many factors, the most significant of which are:

- Improved inventory control – Having a controlled and well-managed planning regime in place has significant, measurable impact on inventory which provides the biggest payback in most companies.
- Improved equipment and manpower utilisation based on systematic resource planning.
- Improved customer service in terms of better delivery performance, faster turnaround and improved cash flow.
- Improved management reporting, timeliness and quality of decisions.

Objectives

The objectives in most cases for implementing a manufacturing control system are broadly similar, that is to gain greater operational control and to provide better customer service. However, to comply with the original cost justification for the project and also to be able to measure the effectiveness of the implementation, it is important to be more specific. In this respect, the detailed functionality of the software needs to be considered.

Broadly, manufacturing systems provide information about what to do and what to buy. It bases this on an input plan which can be a sales forecast, sales orders, a sales plan or a stock plan. This is the output of the factory and is the starting point. The software calculates what materials need to be purchased and what manufacturing operations need to be performed during a specified period. The calculations are performed on the basis of material content (Bills of Materials) and operation sequences (Routings).

Each aspect of this planning cycle needs to be considered in the objectives before considering other peripheral aspects:

Input plan

What is the system expected to do with the demand and what is the expected source of that demand?

This is a crucial question to answer because different software package handle demand in different ways and some are better at handling, say, forecast demand whilst others are more aligned to a process driven by order entry. This question will inevitably lead to an examination of the company's demand cycle which may lead to process changes being made which in turn will influence the objectives and choice of system.

Material purchases

If the decision to purchase was simple, no-one would need an army of buyers, vendor analysts, procurement engineers and materials managers. Similarly, the purchase triggers within the manufacturing software is not a trivial matter of subtracting stock and lead time from demand and purchasing the balance. Inventory, safety margins, value analysis, obsolescence and vendor lead times also need to be taken into account. It is necessary to know what factors

are important and how the company wants to manage inventory and purchasing decisions.

An example is the balance between responsiveness and stability. In an operation with a high turnover of orders, it is common to find rapid fluctuations in purchase demand. No sooner has a buyer responded to purchasing requests than they change causing frustration and confusion. In this environment, a more stable approach to material planning is required but one that does not compromise inventory targets. Some software packages allow for multiple material planning environments so that materials that are likely to have rapid fluctuations in requirements can be planned more smoothly. An example of this is to use kanbans, a self-regulating planning environment whereby demands are automatically triggered by stock levels, material movement or a system of tokens. In this environment, when demand changes, material movement changes correspondingly.

Similarly, the material ordering process may be varied according to material value or likelihood of engineering change. In this respect, if a component is of particularly high value or if it is subject to customisation the implications of holding inventory are more damaging and so tighter control is required. Conversely, in the case of low value consumable items, the consequences of running out are worse than those of holding excess inventory.

Another aspect of material planning that is often underestimated and sometimes even overlooked, is yield. Every manufacturing process suffers losses and these losses need to be accounted for within the planning system. However, applying “yardstick” yields leads to unnecessary increases in inventory and so the system reports need to provide information about variances between actual and planned yields so that adjustments can be made as necessary.

Bills of Materials

The Bill of Material is the part content of the ordered item that is being planned. The structure of the bill of material determines how the contents are planned and there are certain factors that need to be considered when creating the objectives for the software. Examples include:

- Is the ordered item configurable or standard (ie are there options)?
- Are material costings based solely on bills of material or on other factors? (This will determine content and yield factors)
- Can sub-assemblies, field replacement units or components be sold separately?
- Are sub-assemblies stocked or only finished materials?

Manufacturing operations

What aspects of the manufacturing operations need to be planned?

Manufacturing capacity is a constraining resource which needs to be adequately planned. Many software capacities assume infinite capacity and plan activities regardless of constraint. If the methods used to manufacture are simple, require little cost, lead time and training, this is perfectly adequate but of course it is rarely the case.

In most operations, the ability to commit an order to a customer is based on the availability of constraining factors, whether these are long lead time materials, manpower or a process.

Routings

The resource equivalent of a Bill of Material is a routing which describes the method of manufacture, times taken and sequence through equipment. For this to be valuable, it needs to be combined with a parametric appraisal of the equipment used, for example cycle time and availability. For the software to be able to plan against constraining resources, all of this information must be available and accurate.

Specification

The specification for a manufacturing system needs to be a formal, structured document that can be used as part of the development and implementation of the system. It is a detailed account of the system requirements and as such is invaluable. However, developing the specification needs time, dedication and some knowledge of what to ask for and what to expect. Sometimes the vendor of the selected system can help with the specification but this is likely only to be an exact match of what they can provide. In this respect, it is better to approach an independent source for a template or for help in the specification creation.

When writing the specification, input should be solicited from all departments and should start life as a ‘brainstorm’. From this, the document will be refined into something tangible and achievable.

The headings within the document should correspond as broadly as possible to functional area, for example:

- Sales order entry
- Forecasting
- Works order release
- Works order completion
- Purchase order entry
- Accounts Payable
- Accounts Receivable
- General Ledger
- System Administration

Within these headings, as much detail as possible should be provided regarding what the system is expected to perform. It is also useful to prioritise this by appending each item with a code representing what is crucial, expected or desirable.

Implementation

Successful implementation can only be achieved in the context of a thorough plan. The software supplier will have been through many such implementations and will know many of the common pitfalls. The vendor must therefore be an intrinsic part of the planning process.

Based on their knowledge of the operation, the vendor must provide an implementation concept that clearly states what is required. It is then the duty of the company to provide the timeline for this to be achieved based on current commitments and forecasting disruption along with the necessary plan variations for this to be acceptable.

The basic implementation steps are roughly sequenced below although there is necessarily an overlap between some of these activities:

- Personnel training
- Hardware installation
- Population of base data (or migration of data from an existing system)
- Maintenance of base data whilst two systems are populated
- Operational procedure changes where necessary
- Operation of trial database and debugging
- Population of live data (or migration)
- Switch over to the new system

Once the new system is being used with live data, it needs to be constantly monitored for whatever period is necessary until stability is reached. This will necessitate some further training during its operation.

An important part of the post-implementation activity is to assess the system performance in terms of the general objections that were set, the detailed specification and the original cost justification that was made.