

MATERIALS MANAGEMENT AND THE INTRODUCTION OF NEW PRODUCTS

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As world markets are becoming more competitive and international, so the need to successfully and promptly introduce new products is becoming of prime importance to every company. All too often new products have only been conscientiously pursued during recessionary periods, and have consequently been introduced too late or too haphazard to be a total success in sustaining growth and market penetration. Without an effective new product introduction plan, the time between conception and implementation is unnecessarily long.

It is worst the new business may be lost to better organised competitors; at best there will be a slower financial payback.

It is no accident that the most progressive companies who quickly and successfully introduce new products are also those whose customers see them as the 'leading edge'. The same is true of Countries, and tabulated below is the mean time between invention and innovation (in years) for a few selected countries.¹

Table A

Period	USA	Japan	WGermany	France	UK
1953-62	8.4	2	5.5	7.5	5.1
1963-73	6.4	3.6	5.6	7.3	7.5

²figure not available.

¹Source: Geliman Research Associates Inc, 1975, *Indicators of International Trends in Technological Innovation*

Coupled to this, product life cycles are decreasing as products become more technically complex and competitors introduce superior products with apparently increasing regularity. Consequently, any delay in introducing a product as promptly as the competition will lead to a proportionately greater loss of the total product sales.

Professional new product introduction has always been important to a company's success, but worldwide competition and shorter product life cycles will take an increasingly greater toll of companies that have not got their act together.

This article will consider the impact that Materials Management can exert on the introduction of new products from several fronts:

- Manufacturing equipment is becoming more expensive and specialised, and there must be pressure to maximise the utilisation of existing manufacturing resources by a greater involvement of non-engineering personnel at the design stage.
- In small to medium companies that cannot afford full-time Product Managers, the Materials Manager is probably the most qualified to coordinate the introduction of new products.
- Even if the Materials Management department has done its job well, the product introduction may still not be successful. However the Materials Manager is also one who will suffer from a poor product introduction - from a vendor who goes sour from successive design changes and/or cancellation, to an expeditor who can't possibly get the new product built on time because the component parts haven't even been received yet (or because they've been manufactured to the wrong drawing issue!)

In short, the introduction of a new product can bring out the best (or worst!) of a company and its' Materials Management operation.

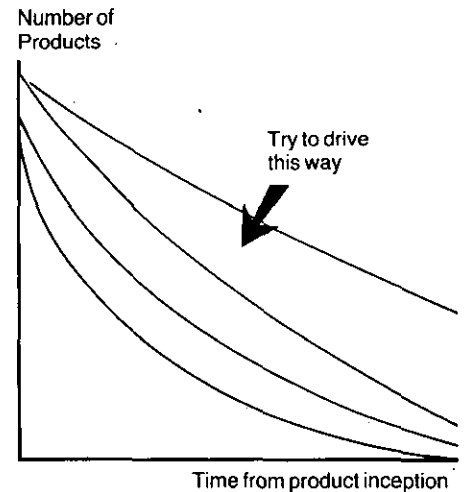
New Product Basics

Different organisations obviously have different approaches to the way in which they introduce new products. Typically though, the product concept is generated by the Marketing and R & D Departments, and then developed by the Design Engineers who determine the product design and choice of materials (and consequently the manufacturing method). Eventually all this is passed to the Manufacturing and Materials Departments as component drawings, routings and bill of materials.

This approach has often been followed because of the desire not to compromise the design for the sake of manufacturing inhibitions.

Obviously this must never change, but equally well the resources to develop new products are limited and as the pressure increases to introduce products sooner, so companies will need to examine the way in which they select and develop the most promising ideas. These will be allocated proportionally more development resources than other concepts, and some will eventually be steered through the prototyping stage onto introduction

into the market place. Evidently, impractical or uneconomic concepts must be identified and removed as soon as possible so that the limited resources can be concentrated on the most promising ideas.



This screening process will remove products from the new product programme for a number of reasons, including poor designs that are not technically feasible or which cannot be economically produced. It is so important to remove these non-starters as soon as possible, and the best way this can be achieved is by incorporating a greater Materials Management and Manufacturing involvement at the initial design stage.

Involving the Materials Manager early on in the new product development will yield the benefits of:

- reduced design changes
- reduced product implementation times
- maximum utilisation of existing resources
- more cost-effective product

Conversely, the consequences of not rethinking our product development process are:

- Increased inventory levels due to a proliferation of new component parts.
- High level of Engineering Change Requests (ECR)
- Poor quality Control and Manufacturing effectiveness (as production struggles with an unprepared product and tight schedule).
- High level of obsolete parts.
- High 'emergency' costs such as express freight charges, set-up and premium payments.

This Materials Management involvement is not intended to be a panacea for all new product evils. It's just good old-fashioned common sense! A Materials Management input is the most appropriate because of its day-to-day responsibilities for procurement, factory loading and scheduling, storage and handling of material. This input should also be insisted upon by Materials Managers whose operating success will be strongly influenced by the product design.

Top Management will want a wider input at the early design stages too as:

- interdepartmental systems such as CAD/CAM are introduced. This will force a closer involvement.
- equipment becomes more expensive, and resource utilisation has to be maximised.
- better organised competition develops, such as the well publicized "Japanese threat".

Design

The number one rule must surely be to keep the number of new component parts to a minimum without harming the design and purpose of the new product.

For the Materials Manager, a proliferation of component parts means:

- larger data handling, with a corresponding increase in computing requirements and greater chance of data error.
- higher inventory levels and stockholding costs, with a potential for lower service levels.
- smaller buy volumes which, coupled to the larger number of buys, leads to higher procurement (or manufacturing) costs.
- more complex spares requirements.
- higher jig and tooling costs.

Despite all the good reasoning, there are still few companies that have completely overcome the problem of unnecessary new parts being specified for new designs. The problem is that the Materials and Manufacturing involvement often does not occur early enough in the design stage when the major design decisions are taken. Waiting downstream has a number of major disadvantages:

- (i) Changes to the design can be complex and expensive. This is because the more a design is developed, the greater an effect one component change will have upon other parts. Eventually the modification to one component drawing can involve changes to many others and the updating of higher level assemblies.
- (ii) Some major design changes, although beneficial, may be impossible to implement if a product has to be available at a date that cannot be

changed (eg. exhibition, start of an advertising campaign, or a major sales opportunity such as Christmas for a seasonal product). The design backtracking may just be too time-consuming.

- (iii) As the design develops it becomes more personalised to the Design Engineer(s), and suggestions for design improvements may not be constructively considered. The additional workload outlined in (i) above does not help either!
- (iv) Design changes must be handled by an ECR procedure. This will cause the number of ECR's to increase as the developing design is modified, and traditionally will occur as the product is gearing up for production. This is a big problem, and will be considered again later.
- (v) Changes made when the component has been in production (Value Analysis) can be costly in terms of the participating employees time and tooling modifications. Changing the design during the manufacturing cycle is a complex operation with a higher chance of component obsolescence (due to unmatched stocks), complicated spares requirements and potential interchangeability problems.

Prototyping

Prototyping is an important part of the design development, and will often require the purchase of components and perhaps the use of specialist in-house manufacturing equipment. For a Materials Management operation that is working hard on meeting the master schedule, any requests from the Engineering staff for prototypes or samples can be a real hindrance. The Buyer, for example, will usually get most job satisfaction from large purchases, while prototype buying on the other hand can involve a lot of effort for little (apparent) reward. It is also difficult, and will usually involve a combination of high prices, long lead times, difficult sourcing, and little negotiating strength.

The prototype, however, is a critical part of the product design process and must be handled accordingly. Even more importantly, failure to service the Engineering staff properly may lead them to deal directly with potential vendors. This is a relationship that many vendors will try to foster, and will lead them or their products to be specified on the Engineering Drawing.

Using standard parts where possible on a new product will obviously reduce the number of prototype parts required. Prototypes that require some form of tooling should be manufactured using a technique where changes can be made cheaply and quickly. Some examples would be:

- Investment casting, or other soft-mould casting processes
- NC/CNC techniques including sheet metal "nibbling"
- Spray metal processes
- Aluminium tooling for mouldings
- photoetching
- modification of existing products
- fibreglass, superplastic metal or vacuum-formed plastics

Engineering Changes

The control of engineering changes is of vital importance to successfully introducing any new product. Materials Requirements Planning (MRP) uses the Bill of Materials (BOM) data files to generate purchase/works orders, and any inaccuracy in the BOMs will cause erroneous MRP output. This bad output can take several forms:

- orders may be generated for parts that have been removed from the design, or may not be amended if there is a design change. This commitment to produce obsolete parts will result in high stock write-offs and order cancellation charges.
- Component parts may be omitted from a BOM, or the quantity per assembly may be wrong. Shortages may only be discovered when the assemblies are built by manufacturing.
- Use of MRP to produce dispatching lists will cause poor manufacturing efficiency and increased lead time if the BOM is incorrect.

It is obvious therefore that all BOM data must be accurate and that data files are updated immediately the effect of any ECR is known, i.e. when an Engineering Change Order (ECO) is raised. There is however a potential problem here as products become more complex and companies larger. ECR consideration becomes more difficult and time consuming, and there is a greater chance that ECO documentation could be lost or delayed. All this time orders are planned, released and received . . . and yet the parts may be of no use. A better approach is to ensure that a copy of the ECR is sent directly to Data Control (or the Materials Manager) before it is even considered by Engineering. If the ECR listed all the components that might be expected to be affected, any MRP output for these components and assemblies could be appropriately marked for manual override before resource commitments are made.

An Alternative Approach

Having discussed the shortfalls of some existing new product schemes - now a possible solution!

For reasons outlined already, it is important to introduce a Materials Management input early on in the

design process. This is probably best accomplished by regular review meetings of new products and concepts, at which the Design Engineer, Production Engineer and Materials Manager must be present. Different companies will have different job responsibilities, but these functional areas must be represented at a minimum.

This team (or teams) will review the progress of new product concepts and development, and be responsible to:

- (i) recommend which concepts should be aborted or placed on hold. Those that are selected for further development should be ranked in order of importance.
- (ii) Set deadlines for all milestones, and regularly review progress against these. Minutes of the meetings must be circulated, and progress charted.
- (iii) Suggest a Development Specification for each new product. This is a very important stage and must be carefully defined. It will determine what the product is and how it will perform, and will specify the functional, physical, performance, cost, reliability and manufacturing requirements of the product.
- (iv) Develop the design by considered use of existing resources such as personnel, equipment, vendors, components and assemblies, etc.
- (v) Recommend at an early stage the Make/Buy choice for each component or assembly. Although this could be reviewed later, an early decision is necessary so that preparations and consequences of each course of action can be considered. This could vary from new capital expenditure to a planned reduction of the workforce.

A higher-level management committee (consisting of the General Manager and Head of Departments) needs to be regularly briefed on the progress made, and will act on the recommendations or suggestions made by the working group. In particular, the high level committee will set major milestones, decide upon which product concepts will be developed, agree a Development Specification, and take appropriate action on major resource changes.

One additional function that must be introduced to the working group (perhaps not regularly) is marketing. This is necessary so that a selling price can be estimated, the Development Specification compiled, and service levels set (eg. make to stock or order). Consequently forecasts can be prepared on the impact that the new product will have on profitability, capital expenditure and personnel requirements. Marketing will also

forecast sales volumes, and this very important data must be approved by the high level committee. It will determine the most effective method of manufacture, and will form an input to the Production Plan and Master Schedule.

MRP and the Master Schedule

The new product forecast will be added to existing forecasts, and used to prepare the Production Plan. This is a long term plan that sets the overall level of manufacturing output and determines the major resources necessary to carry it out. It also forms an input to the Master Production Schedule, which is itself a detailed statement of what items are to be manufactured. The Master Schedule is a shorter term plan, and takes into account material and capacity availability. It must be realistic because it forms the sole input to MRP, and will consequently provide the parts and assembly requirements (by due date) the Capacity Requirements Plan (CRP) and dispatching lists.

(See Chart C)

Evidently, the new product sales volumes must be regularly reviewed at all stages during this planning procedure. The forecast and production plans will influence major resource decisions; the Master Schedule will, via MRP, commit the company to labour and material expenditure.

To the Materials Manager, the Master Schedule is the most important to constantly review. The new product may be a success, or a failure, or even may stimulate a competitor to take action that will cut demand. Whatever the outcome, lack of control of the Master Schedule will cause unforgivable errors to factory efficiency and procurement costs. It is also a good idea to use what/if computing features to prepare a course of action if the new product is either hugely successful, or an abysmal failure.

Equally as important is the control of pilot production by the Master Schedule and MRP. Early use of standard production controls and techniques will eliminate many of the 'bugs'. Failure to remove these at the early stages will only result in far greater problems arising later during production build. For exactly the same reason, all prototype and pre-production build should be by standard production techniques.

MRP can also generate cost data and materials requirements, and together

with CRP determine the effect of the product introduction on cast flow, personnel requirements, resource loading and production bottlenecks.

Procurement

Probably the greatest temptation to resist is placing large purchase orders for any new product. The temptation is a great one too; the MRP shows regular scheduled call-offs (based on the new product forecast being input to the Master Schedule) and the Buyer is under pressure to meet the budgeted costs (based on volume purchases) and beat delivery deadlines. However, over enthusiastic purchases at this stage can lead to liabilities because the product forecast may have been overstated, or because the prototype/pre-production build was not properly done and further engineering changes are needed. Knowing exactly how much to order at this stage is extremely difficult, and may only be resolved by a General Management dictate on expenditure limits for new products. Similar difficulties will also be experienced when setting batch sizes and order quantities for in-house manufacture.

All new product purchases require a fast and confidential liaison between Vendor and Buyer. Good, accurate communication between the two is extremely important, and must be documented as both are unlikely to be familiar with the new product.

Product sourcing will also be a major part of any new product programme. Sometimes this will involve the Buyers investigating new sources of supply for products or technologies with which they are unfamiliar. A decision also has to be made to single-source or multiple-source the part. Multiple sources will provide greater 'insurance' and capacity, but will usually involve higher tooling expenditure and a higher unit cost than a single source. If a single source is selected, it should have sufficient capacity available to handle even the most optimistic forecast, so that product experience can be retained and large increases in parts requirements handled with ease.

Inspection parameters will need to be considered at an early stage and discussed with the Vendor. The inspection method, sampling plan and documentation all need to be agreed in advance so that everyone knows what is required, and has the correct inspection equipment to do it.

Materials Handling

Every new component and assembly must be carefully examined to find the best way to store and handle the part.

Particular attention will obviously be required if the part is heavy, voluminous, hazardous or valuable.

An important point to realise is that the way in which a product is stored and handled will have a profound effect upon manufacturing efficiency. Some of the contributory factors include:

- The quicker a part can be moved from one operation to another, the shorter the lead time becomes (assuming that the queue remains unchanged).
- The handling and orientation of a component prior to an assembly operation can be a major part of the operation time (and hence the manufacturing cost). This becomes a greater element as parts are smaller, or larger, than that which can be comfortably handled by human operators.
- Most robotic and automatic assembly processes cannot pick and orientate the workpiece. Where this is accomplished, the machine usually randomly holds the part and then tests to see if it is orientated correctly. Any that are not are rejected for another random pick-up. Some machines cannot even do this, and have to rely upon human operators to correctly orientate and place the component. Good Materials Handling can help here because most manufacturing processes produce the component orientated in the

same position at the end of the operation. Typically, storage and transportation will lose this orientation, but careful handling can retain this ready for faster pick-up at the next operation.

- Efficient storage and handling of materials will lead to fewer inventory errors, faster material retrieval and reduced inventory damage.

The materials handling aspects must be considered early during the product development. Design changes may be needed to make component handling easier, and assembly lines or capital equipment has to be planned early because of the long lead times involved. Expenditure is usually high, and plenty of time is needed to ensure that the right choice is made.

Summary

The introduction of any new product is a complex, once-off task involving the coordination of a large number of events between nearly every Department in a Company. This complexity is further compounded by the little (usually zero!) slack time that is built into the plan, and the new processes, vendors and technologies that are required.

All of this demands

- good communications, not only between departments but with vendors too.
- good cost-effective design and drawing control.
- preparation - lots of it!
- constant monitoring of forecasts and the Master Schedule.

Failure to control the product introduction process can be very costly in terms of manufacturing efficiency, poor margins, low sales and a bad reputation. Good management and the introduction of a Materials Management input early in the product development will turn these problems into successes, and help develop a company that stays ahead of the competition.

References:

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