

# PROJECT MANUFACTURING

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## INTRODUCTION

Many companies are involved in manufacturing products to meet the demands of individual customer contracts. The products that they build in this manner may be unique, one-off engineering projects; they may be low/medium volume (and occasionally high volume) build of otherwise standard products; and most frequently they lie between these two. The fact that they are made against a specific contract or project, however, tends to add a level of complexity beyond that of normal manufacturing. This article looks at some of the issues that are encountered within such contract or project manufacturing.

## THE PROJECT MANUFACTURING ENVIRONMENT

Normal manufacturing is characterised by commonality of information. Stocks are held in common: an item in inventory is available for shipment against any sales order and may be used as a component in any manufacturing job. Costs are held in common: whatever method you may use for tracking the costs of your products, components and raw materials you will always tend to have the same cost for the same item at any given time. Planning is performed at an aggregate level: all requirements for the same item on the same date will be added together to give a single total, which can then be sourced according to your business rules.

Project manufacturing generally imposes walls between individual projects or groups of projects. These walls generally

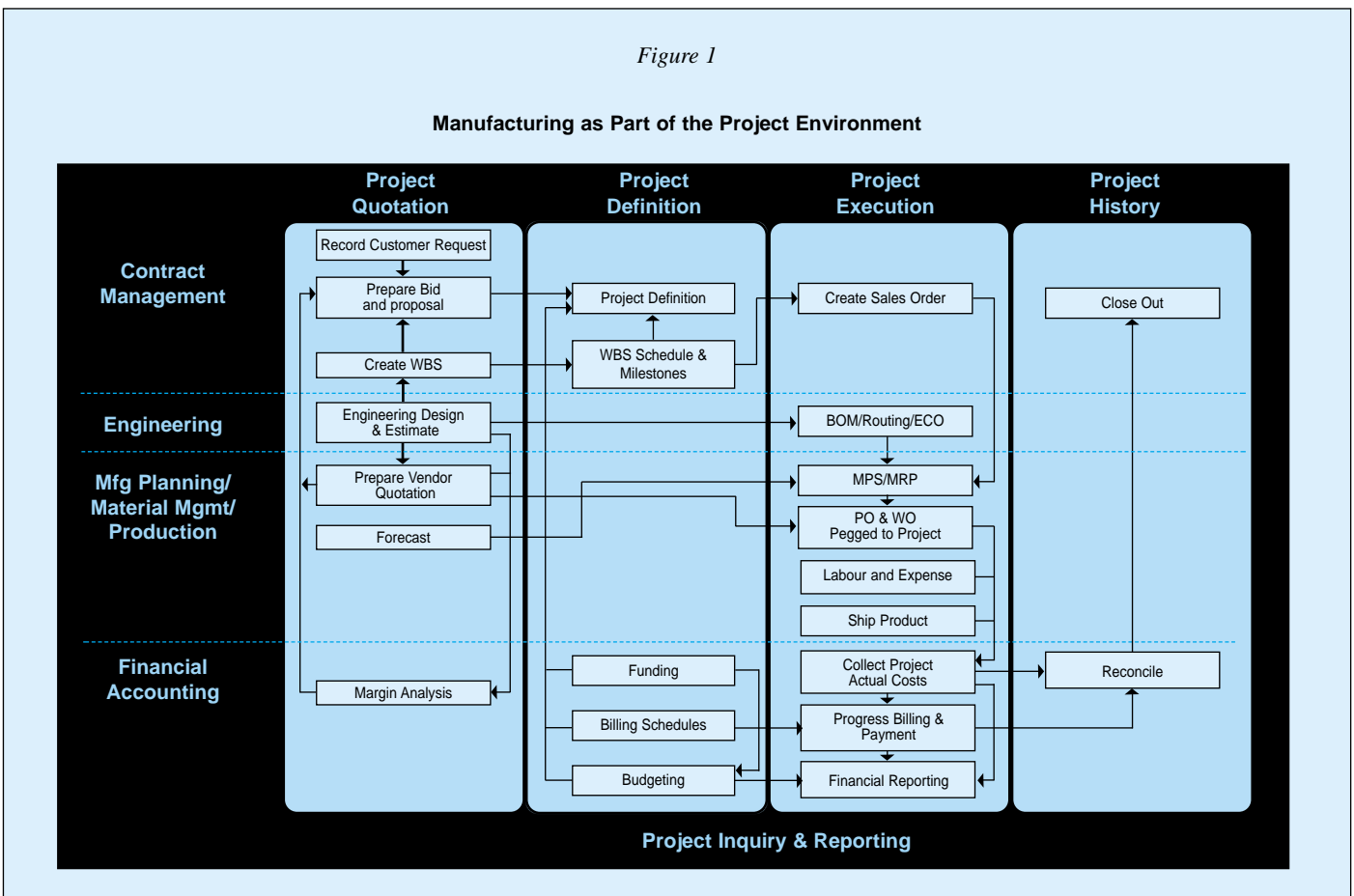
reflect the detailed terms of the projects themselves. Typically you may be required to justify expenditure incurred during a project. As a minimum the accountants will wish to see the profitability of an individual project. At an extreme, particularly if the project is on a 'cost plus' basis, you may be subject to external audit requirements. As a result, stocks tend to be segregated by project, as are costs and replenishment planning.

In addition, project manufacturing is manufacturing that takes place within a project. It may be only a small part of the overall project – perhaps the majority of the project is concerned with design, installation and commissioning of equipment, with manufacturing merely a phase between design and installation. In this case the manufacturing activities have to fit into the overall project plan. So, in addition to having to monitor progress in the normal way against a manufacturing plan, the project manufacturer has additionally to track the effects of progress against the larger project plan. This can lead to interesting discussions when several projects (and maybe some standard manufacture) all require simultaneous use of the same scarce manufacturing resource!

Figure 1 illustrates how manufacturing may fit into a project.

## ESTABLISHING THE PROJECT

When the project is initially established a number of contractual and administrative issues are determined: the Work Breakdown Structure (WBS), the overall project plan, the project budget, invoicing points or milestones and payment



terms, external and internal reporting requirements. This is not the place to discuss professional project management and administration, but we do need to recognise that the manufacturing activities are placed within the project and so must fit into the contractual and administrative framework of the project.

The project will have an overall plan into which the manufacturing activities fit. Our first requirement, therefore, is to be able to map the manufacturing activities into the project plan in such a way that manufacturing progress can be reflected in project progress with a minimum of extra effort. This requires the project managers to open a dialogue with their manufacturing counterparts at the earliest opportunity.

The next requirement is to establish, again at a very early stage, the financial environment. Manufacturing incurs costs. These costs have to be passed in an appropriate fashion to the project as part of the overall costs of the project. Generally, project manufacturers require costing to be performed using 'actual' costing techniques (or as close to this as can be achieved) rather than standard costing. Nevertheless there are still many questions to be addressed, such as: What to do about manufacturing overheads? Are costs to be maintained separately for this project or are they to be amalgamated with the costs of other projects (or sub-projects) for the same customer?

Other rules may need to be applied: Is any special approval needed for purchase orders (or requisitions) raised against the project? Is there any special sourcing to be applied as part of replenishment planning for this project? Are there any additional quality requirements (for products, sub-assemblies, components or raw materials) imposed by this project?

## PLANNING FOR MANUFACTURING

As part of planning the project there will need to be planning for the manufacturing content. Indeed, as with all manufacturing, this planning will undoubtedly need to be ongoing, reflecting actual events – just like the project plan should. In many ways the manufacturing planning is identical to any manufacturing planning – with or without any project involvement.

General manufacturing planning tends to consider all available stock, demands and supplies. Project manufacturing planning, on the other hand, tends to segregate these things by project and to plan accordingly. In this scenario, if you have non-project supplies and demands then these 'common' requirements are treated generally like another project.

This segregation is where the planning piece can get tricky. While it is fairly clear that the stock belonging to one project should not be seen as available material for another project, how is the 'common' stock to be handled? There is a need to be able to include rules on the use of such 'common' stock within the parameters considered by the planning engine. Then there is the subject of excess stock within a project. Should it be made available for other projects' use? Whilst this may also be addressed by planning parameters it is more common to address this issue manually – of which more below.

Of course, as mentioned above, segregating the planning by project implies that you have segregated all the demands and supplies by project too. So we need a means of recording the project number on sales orders, purchase requisitions and orders, manufacturing jobs, etc.

The other practical aspect of planning for projects is that it tends to focus on the MRP family of techniques at the expense of Min-Max and Re-order Point methods. This is less a reflection of complexity than a recognition that projects tend to be at the lower end of the volume spectrum, with a high degree

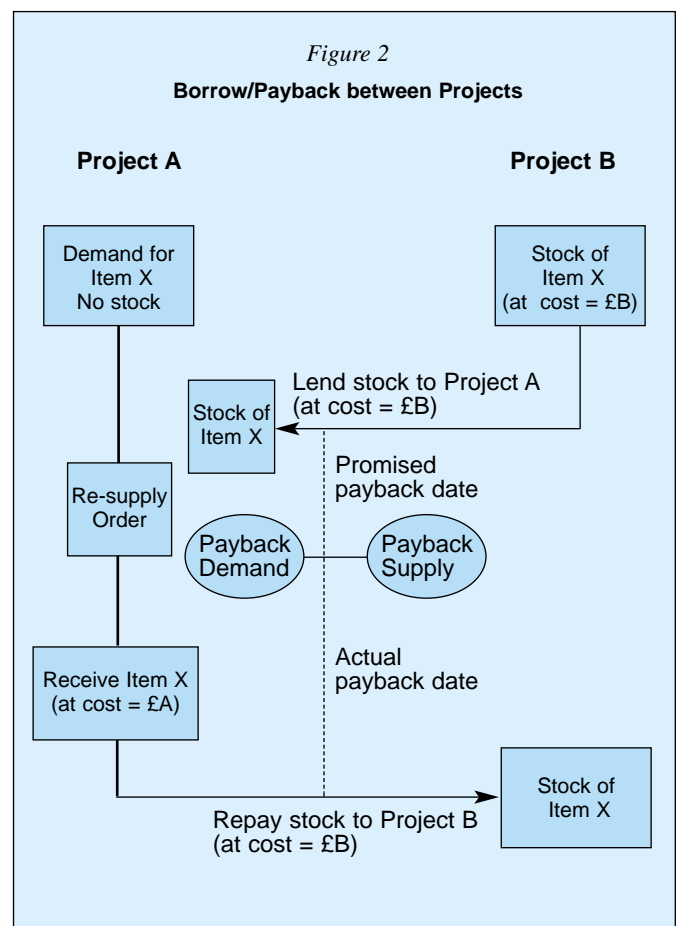
of forward planning and cost control: an environment to which the MRP (and similar) techniques are better suited.

Material planning is not, of course, the full extent of the planning that is required. Project manufacturing uses non-material resources just as much as common manufacturing does, often more so as the projects move towards the low volume, design to order market place. However, it seems more common that manufacturers can segregate material by project than that they can segregate resources by project. After all, production machinery can be very expensive and on long lead times – too much so, in many cases, to acquire for, and dedicate to, a single project. So these resources have to be shared across projects (and with common manufacturing) more often than not. The result of sharing may well be conflicts between projects. There is, therefore, a premium on including manufacturing capacity planning and checking at an early stage in the overall project planning and negotiation process, as well as validating the resulting plan as the project progresses.

## EXECUTION OF THE PLAN

Again, undertaking manufacturing within a project does not significantly change the way that the plan is executed. Providing, that is, that every transaction clearly identifies the project that it belongs to (and any required lower level plan information, eg. the task or activity within the overall project's WBS structure). This means all purchases, sales, stock, manufacturing, transfers, receipts, issues, adjustments and so forth.

In addition, there are usually some extra transactions - only encountered in a project manufacturing or inventory environment – particularly to enable the transfer of stock from one project to another or between a project and 'common' stock. Permanent transfer may require a formal buy/sell transaction set. Temporary transfer (loaning the stock) may be permitted so long as there is no adverse financial or practical



effect on the lending project. Figure 2 illustrates such a borrow/payback scenario.

Project A requires a component (Item X) that it cannot source quickly enough. Project B has a temporary excess of stock. This stock is borrowed by project A with a promise to pay the quantity back when the re-supply is received. The payback promise is formalised by creating a payback demand in project A (so that the re-supply can be planned and not promised elsewhere) and an equal payback supply record in project B (so that they can see when it should arrive and can monitor this). These payback supply and demand entries should be visible to the planning processes of the two projects. Of course, project A borrows the item at the unit cost that project B held against the item. So the payback transaction will be at the same unit cost, leaving project A with any gain/loss due to the supply cost and project B unaffected by the transaction.

## **REPORTING RESULTS AGAINST THE PROJECT PLAN**

Generally, reporting follows the normal pattern: tracking costs, usages and efficiencies against the standards for the items being bought or manufactured. Additionally, there is a need to report against the project plan. This is where the alignment of manufacturing activities and the project plan pays dividends. If these are synchronised, reporting is simplified and may be automated.

Provided that the product to be manufactured is well defined – Bill of Material, routing, etc – then progress can often be determined by the simple measures of quantities completed vs. planned, or hours expended vs. planned. This is harder to do

for external activities – purchases, subcontract manufacture, etc – and the progress on these has often to be manually estimated.

Costs should, of course, follow closely behind physical activities. In the case of project manufacturing costs it is necessary for them to reflect the project's accounting structure as well as the WBS. Frequently this is achieved by having a rules-based engine to re-distribute the costs to align to the project's structure. Again, good preparation and planning when the project is initially defined pays dividends in enabling the automation of cost reporting.

## **CONCLUSION**

Project manufacturing involves simultaneously meeting the needs of a project management environment and a manufacturing one. This adds some additional requirements to each side of the equation. The single most important of these requirements is to plan for both aspects simultaneously and early, and to keep these plans aligned as the project progresses.

### **About the author**

**John Paramore**, MIOM graduated from King's College, London University in 1972. Since that time he has worked in a range of manufacturing companies and software consultancies, designing, implementing, supporting and managing systems to address the needs of the manufacturing communities. John has been with Oracle Corporation since 1995, in pre- and post-sales consulting roles and as a trainer. In addition to membership of the IOM, John is a Chartered Mathematician and sings tenor (an unrelated activity!).