

CONTROL? IS MANAGEMENT AFRAID OF THE UNKNOWN?

PART 1. SHOP FLOOR CONTROL - AN INTRODUCTION

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RATIONALE FOR SHOP FLOOR CONTROL

We have conducted a survey of articles in Control magazine since 1985. Since then, there have been approximately 90 articles on MRP, DRP, JIT, Planning, and Scheduling, but only 4 on Shop Floor Control, two of which were by one of the authors [1, 2]. Why is this?

If one looks at the availability of computerised systems they display similar proportions; perhaps 150 serious production and inventory control (PIC) systems, for example MRP and MRPII, a handful of which offer finite capacity scheduling; some systems that offer stand alone finite capacity planning and scheduling and finally very few systems that offer Shop Floor Control. Why is this?

Promotional activities associated with PIC systems suggest that these systems are the answer to a maiden's prayer, and provide the lowest level solutions necessary in order to solve most major manufacturing control problems.

The purveyors of finite capacity planning and scheduling systems, including concepts such as OPT, indicate that they have the solution, perhaps in conjunction with MRP. They provide the means to produce realistic and workable shop floor schedules. However, these approaches tend to lack the ability to create and execute a schedule, and simultaneously take into account the ever-changing state of the shop floor. Therefore, on their own, they do not constitute a complete control environment.

Savings often quoted for the use of PIC systems in industry typically suggest 30-40% reductions in finished stocks. These are once-off savings. However, documented successes in implementing shop floor control systems, suggest massive increases in productivity, reductions in work-in-progress and improvements in delivery performance. These usually far out-weigh the once off savings available through inventory reduction. These step improvements in output, obtained through productivity, are continual, and available forever.

Could it be that the shop floor is so complex that it has not been properly defined and that the control requirements are unknown? Do the systems available, and the designers of them, understand what really happens on the shop floor? Are management afraid to grasp the nettle?

OBJECTIVE

The aim of this article is to demonstrate why any business strategy for a manufacturing company must be incomplete unless it has addressed the key functional issues of the shop floor. This article is an introduction to the control requirements of the shop floor.

A number of points are relevant to introduce the discussion:

- The shop floor controls a manufacturing business, financially
- MRP is a planning system and offers little help to the shop floor

- Executed effectively, controlling the shop floor can increase the productivity of a manufacturing business by 50-100%, without increasing overheads
- Although the information that is required to effect shop floor control exists, and this information has not changed since manufacturing began, there are few available systems which offer serious shop floor control
- Order control is a critical functional area in shop floor control
- Finite capacity scheduling is a desirable, though not essential, element to a shop floor control system
- Shop floor control provides feedback, enabling planning systems to be aware of the realities of the shop floor
- The input to shop floor control is an external work-to-list or schedule, however derived. Shop floor control manages and executes the work-to-list, and ensures that control is maintained, EVEN WHEN URGENT AND UNPLANNED EVENTS OCCUR
- Shop floor data collection (SFDC) is NOT shop floor control
- The vast majority of SFDC equipment has never been used seriously by the users, in many cases never even installed.

WHAT IS SHOP FLOOR CONTROL?

We define the following :

Shop Floor - A colloquial term for those areas of a manufacturing company physically associated with the performance of manufacturing processes, including material and product handling.

Shop Floor Control - An amalgam of functions, enabling the progress of orders to be controlled, from and including their scheduled release, and continuing until their satisfactory completion, by a planned end date.

MRP's main assumption is that manufacturing takes place in the fairy tale world where due dates are met. At best, the interface with the shop floor from MRP can be an unrealistic and unachievable work-to-list. Even in situations where performance to due date is good (usually in companies that are paying for excess capacity), MRP-type systems do not offer the means to execute the work-to-lists, and are usually incapable of maintaining control when urgent and unplanned events occur.

MRP offers little to the shop floor. For further information and argument, the reader should consult [1].

Shop floor control takes over where higher level planning systems stop. These higher level systems include MRP, MRPII, and shop floor scheduling. Where shop floor scheduling is being used, the interface to shop floor control is a

work-to-list (schedule). If finite capacity scheduling is operational, then that work-to-list can be achievable and realistic, at the point of production. This is because finite capacity scheduling can take into account the constraints and flexibilities of manufacturing, most notably, that due dates may be unachievable.

Typically, the planning output of these higher level systems are out-of-date at the point of production, as they are snapshots based on data collected some time before, and are unaware of the dynamics of the shop floor. Shop floor control manages the schedules derived from these higher level planning systems. Because any schedule is a snapshot, additional functions are required to maintain control in the interval between snapshots, especially when unplanned or urgent events occur.

Even in the most dynamic systems, where shop floor control is not implemented, schedules are typically 12-24 hours out-of-date by the time they are released into the factory. The loading of the work from any new schedule then has to take into account work status changes that have taken place since the last shop floor communication. These changes include priority alterations and work that has been completed in the intervening period.

In addition, there is usually a lot of effort involved in shop loading, prior to the manufacture of each operation. Job loading includes preparing work, arranging materials, tooling and resources. It is to the suffering of shop floor personnel, the detriment of shop floor schedules, and the loss of credibility

FUNCTIONAL DEFINITIONS OF THE SHOP FLOOR

Over the years we have developed functional definitions of the source and location of shop floor data for any manufacturing company. This is represented by 11 data flow, or communication, diagrams, and is supported by the functional requirements specification necessary to achieve shop floor control within any manufacturing enterprise.

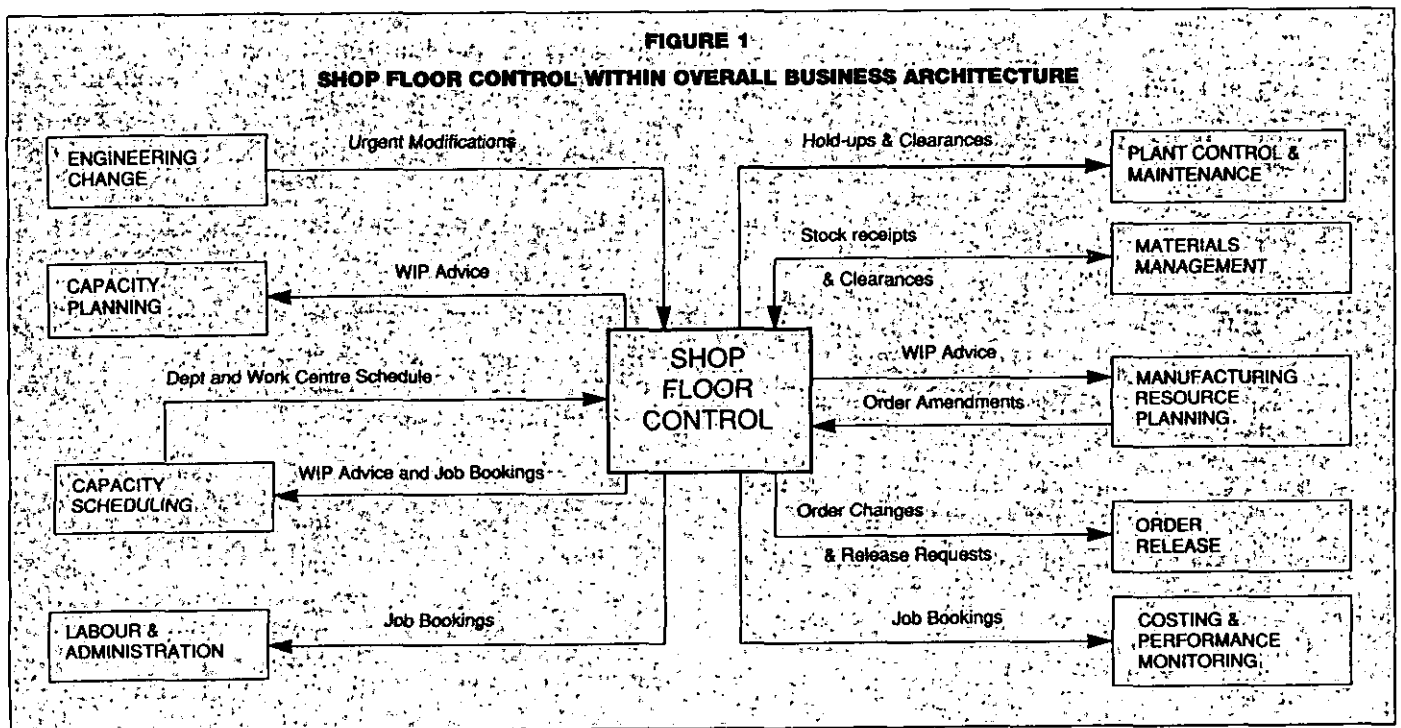
This work has determined that the total control requirement for the shop floor comprises 120 functions.

FUNCTIONALITY MISUNDERSTOOD

Functions take place in a business whether or not they have been recognised formally. Most companies do not recognise the functionality of their business.

In shop floor terms, the functions identified in the lower level diagrams must take place, in order for products to be manufactured. It is likely however, in cases where functionality has not been recognised, that operational (on-the-spot and invariably unplanned) decisions will be taken at the wrong level in the organisation. These decisions may be taken a number of times, at a number of levels, and at the wrong level(s).

The result is that responsibilities become blurred, and accountability diminishes.



of the whole process, if this information cannot be taken into account when the new schedule arrives. It is unrealistic to tell the shop floor "Drop that, here's your new schedule".

Shop floor control is pragmatic, allowing the realities of the shop floor to be monitored and fed back to higher level planning systems. Usually, these higher level systems cannot actually do anything with this information. Shop floor control manages the shop floor and allows something to be done with this data. The realities of the shop floor must be made known to management so that they can plan based on what is ACTUALLY HAPPENING. This allows management to control the shop floor.

We call this management function Order Control.

There are many examples of this, and it is not only confined to the shop floor. Often, this arises when companies have grown above a certain size, and functions which have historically taken place informally then have to be formalised. For example, in some companies it is common for sales to maintain key manufacturing data such as re-order levels, but without the responsibility for ensuring that they are correct. When companies grow, or roles change, newly-recognised tasks are off-loaded onto the nearest willing pair of hands. This stores up organisational trouble for the future.

The result can be key individuals, at the wrong levels in the company, making strategic decisions. The functioning of the organisation will then start to break down when those individuals are unavailable. We know many examples. It is fairly

common in smaller companies for Materials Managements not to be recognised as a formal function. The result can be a stock control clerk, making key materials decisions, at too low a level in the organisation.

The converse can also take place, where managers have failed to delegate tasks, and they end up using their time ineffectively.

By recognising functionality, companies can ensure that key resources are backed up, their work is recognised and documented, and accountabilities and responsibilities are clearly defined. It ensures that tasks are executed at the correct levels.

When functionality has been recognised, if change is considered, then the effects of the change can be assessed prior to implementation.

AVAILABILITY OF SERIOUS SHOP FLOOR CONTROL SYSTEMS, OR LACK OF IT

When we evaluate products for clients, we usually find that the shop floor functions, offered by the popular manufacturing packages, are lightweight. Many suppliers think that shop floor control begins with the printing of works documentation, and ends with the reporting of operation completion. We have concluded that there is a possible requirement for 120 functions on the shop floor.

The most serious exclusion, in our view, is that it is often very difficult to report things that go wrong. It is impossible to maintain control, unless this is recognised. This is a question that often brings glazed looks to the software suppliers.

Since the total requirements for shop floor control have been defined, this indicates its value as a system development tool, as it means functions that are not appropriate are excluded. Most software products are applications, not packages, which means that users' requirements tend to be compromised, when applying standard systems. If the users' requirements do not fit the "package", then addressing these may mean fundamental changes to the systems being applied, or even worse, fundamental changes to the business to make the business fit the software.

Usually the base data available from the shop floor cannot actually be used by the PIC system. In these cases, the result is that these systems ignore the realities of the shop floor. If the data is being collected using SFDC equipment, this begs the question of why collect the data, if it cannot be used? The loop is not closed by purely collecting actual job times, and posting back to performance monitoring, as many people believe.

Often the software available with SFDC equipment is rudimentary, lacking in features, and unable to link to other systems.

These systems can therefore easily fall into disrepute. This argument could explain why so little of the equipment sold has ever been used seriously.

CONCLUSIONS

The shop floor provides a significant opportunity for both users and suppliers. The benefits are high, and will enable companies to cut costs and be responsive in the market place. The use of SFDC equipment by users is constrained by the available systems, and this offers a new market for hardware and software suppliers, with applications in every manufacturing company.

This is certainly a worthwhile nettle to grasp. Shop floor control can be applied without jeopardising the investments

made in other types of planning system. Most important, controlling the shop floor does not rely on those other systems, but supplements them if they are already in place.

Shop floor control is as essential to a manufacturing business as the telephone, it is the primary medium of communication. Any business strategy must be incomplete unless it has addressed the issues of the shop floor.

Shop floor people are keen, and in our experience, become committed to the solution. There is no need for management to be afraid of the unknown.

WHERE DO WE GO FROM HERE?

In this article we have introduced the subject of Shop Floor Control and described some of the shortcomings of other manufacturing planning systems. We have not however, provided the detailed information that is required to control the shop floor.

In the next issue, we will begin to explore this information, and will describe in detail the concept of order control, and introduce two of our high level data flow diagrams.

REFERENCES

[1] N.G. Norton, "Breathe New Life into your MRP System", *BPICS Control*, June/July, 1988.

[2] N.G. Norton, "Capacity Management and the Control of Bottlenecks within a Shop Floor Control System" : Case Study, *BPICS Control*, June/July, 1992.

About the Authors

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Ian Skinner, CEngMIEE FBPICS MBCS. A computer professional of 25 years' experience, having spent 20 years with British Aerospace (14 years in DP). During this time he led the development of all major production and manufacturing systems. He pioneered the Distributed Real-time Manufacturing, Monitoring and Control system in the Commercial Aircraft Division, completing his time with them as the Manufacturing Systems' Group Manager.

Since leaving BAe, Ian has continued to be involved with the development of manufacturing systems in various industry types, including electronics and cabling. He has taken a variety of roles, from systems development manager to board-level consultant.