**Measuring JIT performance**

SIR—In a recent issue of the Production Engineer, you mentioned the difficulty of measuring how well an organisation is doing having embarked on a just in time (JIT) implementation (p3, September 1987). "Sales per employee" and 'stock turns' as you mentioned were examples of measures, but there is no single complete all embracing measure which covers all aspects of the business. This is obviously of some concern to managers who wish to establish their current situation and monitor progress from it. However, I consider there is a much more compelling reason stopping the majority of managers from going ahead with JIT.

To explain why the problem exists and offer a solution it is first necessary to set the scene by explaining how JIT is used in Japan.

Japanese success in manufacturing has been mainly due to a strategic attitude to managing the business. This can be divided into the following stages.

1. Market research—to identify a market where there are significant gaps between total customer satisfaction and the products on offer. The object of this exercise is to establish a market which can be totally dominated.

2. Product design—detailed market research is carried out to establish all customer needs to be met, and a product is designed to meet these needs. This provides them with a product capable of beating all the competition and achieving market domination.

3. Systems design—the factory or plant is designed around that product. This does not mean a 'green-field' site is developed. Japanese factories have made much use of group technology in designing product lines or 'cells'. Hence the part of the factory where the new product is to be made is laid out in the best line or cellular form for that product. This means the highest quality, lowest cost product is manufactured. (It is worth noting that great detail and effort is put into this stage, and is made possible by the plant not only possessing product design skills, but also manufacturing systems design skills).

As an alternative to the strategic view, there are large organisations in Japan, which specialise in marketing goods overseas, and hence through this specialisation are very professional at it. Small companies can use these organisations to successfully break into overseas markets. A major contribution to Japanese success that is not publicised by Japan is the massive effort put into very professional marketing. These efforts are supported by long term bank loans, which allow goods to be sold into markets at little or no initial profit margin, thus driving out all competition in that particular market. The banks tend to judge their borrowers on their market share. Back to manufacturing.

The methodology which sits over the market research, product design, plant design and subsequent plant management is total quality management.

This methodology has been developed to ensure the plant continually satisfies all the customers needs at lowest cost. It ensures that all the manufacturing support functions treat the manufacturing function as their customer and offer it a quality service continually and at lowest cost. It ensures that disruptions within manufacturing are minimised and cause the minimum impact when they do occur. The overall effect is that as problems are resolved, inventory levels (the safety buffers) may be reduced as production is smoothed. This is the point at which JIT may be implemented to really drive stocks down and hence reduce lead times (there is a one-to-one relationship between work-in-progress stocks and lead times) so that queues in front of machines are reduced, hence lead times come down and throughput goes up.

The most compelling problem facing managers who wish to go down the JIT route is how to start, given that the level of disruptions in the plant is a major barrier to be overcome.

The answer must be to implement JIT in the context in which it was developed, ie in a total quality organisation. The realisation of how do you implement total quality management is a knowledge of the subject is obviously a good foundation; and those who are new to it would find "How to take part in the Quality Revolution"—A management guide by Dr Steve Smith, of PA Consulting Group, an excellent introduction.

Having had a quality control and stock control background, my life became more interesting when I started learning about the reasons for the Japanese success, as both these areas were implicated. After a three year involvement with MRP, JIT and OPT, spending more and more time getting involved with total quality management, I moved to the TQM area full time.

Returning to the initial problem mentioned of measuring the effects of a JIT implementation, the question which must be asked is "do we need one single measure of performance?" We didn't use just one measure for monitoring an organisation's performance before JIT came on the scene, so, in spite of the desirability of a single measure, I would suggest continuing with a selection including, stock turnover, cash flow, sales per employee, throughput and the like. However, I would also suggest the measure of 'market share' must be the true measure of competitive edge.

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**Redressing the balance**

SIR—May I take the opportunity of replying to the editorial in the October edition of the Journal. Although your article raises some valid points, in my opinion it fails to give industry credit for achievements already made.

a) Manufacturing is now being recognised as an exciting place to work, far more so than say 10 years ago.

b) The importance of engineering, and particularly manufacturing and wealth creation, has now been recognised and good staff can command salaries that were unheard of only a few years ago. As with all supply/demand situations, this will draw the best graduates into the industry. The entry standards required for engineering courses are already higher which must herald a better calibre of graduate entering the profession.

c) I am disturbed by your comments concerning 'good old-fashioned production engineering'. I always understood the Institution and its members were firmly in the spectrum of manufacturing from the detail "nuts and bolts" through to the profitable management of manufacturing businesses. In overall company terms, surely management and manufacturing systems, whether CIM or MRP, or techniques such as JIT, represent the areas of opportunity and challenge for the future competitive companies. In this exciting environment there should be few problems in recruiting graduates to start their career in the fundamentals of manufacturing engineering.

Detailed production engineering may be important, but let us recognise that for the majority of engineers the area of manufacturing support functions such as JIT may be implemented to really drive stocks down and hence reduce lead times (there is a one-to-one relationship between work-in-progress stocks and lead times) so that queues in front of machines are reduced, hence lead times come down and CNC machines, and that every new or special-purpose product would require the full laboratory treatment?

In fact, very substantial improvements can be achieved in machines, with or without CNC, by tackling the sources of heat generation with good design.

For example, ball bearings mounted with built-in preload compensation will run much cooler than tapered rollers. Oil bath lubrication creates heat—cascade is better (and if the sump is thermally isolated from the headstock or column, it is better still). Tining belt drives are inherently cooler running than vee belts, and PTFE seals also help.

There is actually an equally important aspect of this matter which is concerned not with the magnitude of thermal distortion, but with the direction in which it takes place. For instance, vertical shift in a lathe spindle is of no great consequence, but a horizontal component would be quite inadmissible. So why not research to establish whether a headstock or a column distorts more acceptably with its aperture at the top, the bottom, or on one side, or on both sides?

There must be some question which is concerned not with the magnitude of thermal distortion, but with the direction in which it takes place. For instance, vertical shift in a lathe spindle is of no great consequence, but a horizontal component would be quite inadmissible. So why not research to establish whether a headstock or a column distorts more acceptably with its aperture at the top, the bottom, or on one side, or on both sides?

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**Good design is the key**

SIR—It is well known that acceptance tests for machine tools mainly verify that a machine is accurate when it is doing no work, and before it is distorted by its working temperature patterns. Therefore, in November issue of Production Engineer that research work, carried out by AMTRI, has succeeded in reducing thermal distortion by two thirds by compensating the errors via the CNC software.

One might well ask the question: whether this is the best way in which to address the problem; considering that the technique is applicable only to