

Improving Manufacturing Productivity

By Bill Ferme

WITH increasing prices of raw materials, the rising Australian dollar and the brutal competitive pressures from China, and large powerful retailers plus fragmenting market segments; Australian manufacturers are reeling.

Australia's response must be greater improvements in productivity. Some recent research includes two McKinsey reports; 1993 and 2002.

The '93 study examined productivity in the US, Germany and Japan and nine industries. The principle findings were:

- Large differences in productivity exist at the industry level- generally not resulting from mere differences in capital; and
- Corporate managers could significantly improve manufacturing productivity in all three companies by adopting "best practice" processes.

An interesting point was that labour productivity is a good proxy for total productivity. The most interesting point made was that most of the things that determine productivity come down to managerial choices!

The '02 study on UK manufacturing found that "management practice" is the key to improved performance. The investigators also found that over the years they noticed a common set of techniques being deployed by high performers:

- Lean Manufacturing which aims to minimise all waste in the manufacturing process plus that high performers took a holistic view of the production system design and demonstrated continued commitment to being Lean;
- Performance Management which sets relevant goals at plant level for each manager, monitors their performance against these goals and provides incentives for attainment; and
- Talent Management, which attracts, develops and retains high-calibre people.

Finally, the study found that there was a direct link between manufacturing management practice and financial performance, specifically from the deployment of the above three techniques.

Measuring Productivity

How does a company measure productivity? I prefer the "Value Added" method which measures the wealth created by a company. It is equal to the income from sales of the product less the expenditure on purchased materials and services. In short, Value Added measures the net output rather than the gross output of the business enterprise. An analysis of the Value Added can be used to assess the efficiency of the company.

A company can measure its Labour Productivity by: value-added per employee, this can vary according to mode of manufacture. A good batch manufacturer should be about \$80,000 per employee.

A company can measure its Capital Productivity by: Value-Added Per Fixed Assets and Value-Added per Operating Capital, these can also vary but a good batch manufacturer should be about 250 and 200 respectively.

With regard to partial measures there are many. One of my favourite measures is a plant's labour utilisation. This can be measured by using "activity sampling". For metal trades companies I have found the following averages:

- jobbing, about 35% direct labour;
- batch, about 50% direct labour; and
- flow-line, about 70% direct labour.

These figures should give the reader an idea of the efficiency of labour skills, scheduling, management supervision and material supply.

Another partial metric is the Manufacturing Cycle Efficiency (MCE) this compares the actual processing time in value-added manufacturing functions to total time a part spends in the factory. Automotive manufacturing often averages about 5%, aerospace about 3%. Batch manufacturing plants can have a value of about 1.5%!

The supply chain is another important function for measurement with the world's best companies having reduced their total supply management costs to between 4 to 5% of sales. Another metric is the best-in-class performers who now operate with less than 40 days of inventory across the supply chain.

Another important partial metric is inventory turns per year. This is a major metric as inventory management impacts all the functions in a company. The US is still the world's top manufacturing nation, in 2004:

All Manufacturing Industries: Median Value of 8.0 upper quartile 13.0

Automotive Industry: Median Value of 12.0 upper quartile 22.0

Australian Industry: Median Value of 4.0 upper quartile 7.0

Where To Begin

My experience, and major consultancies, is that a company should commence with a strategic plan.

I will assume that Lean is the major operational improvement approach. Lean has been sold, especially by the US as suitable for all manufacturing. However, Lean has made little impact on jobbing shops, and there is little information on implementing Lean into small manufacturing companies.

The main point is that any productivity improvement scheme must be tailored to the individual company; ie. size and mode of manufacture.

The second activity after the strategic plan is to hire an experienced Lean consultant who will commence a major training program for the company in Lean. If he or she has not gained the commitment and leadership from the top management, do not start!

The third activity will be the creation of a Lean strategy, plan and objectives for Lean plus the setting of "performance targets" for the management team.

The fourth activity is the realignment of the company's demand with the inventory using the "ABC" analysis and reviews the range of products; in order to examine to prune non-performing products.

The fifth activity will be to examine the design process, which is the only step in the product cycle where values and profit can be created. Product design, which accounts for about only 5% of a product's total cost, actually dictates about 80% of the total manufacturing cost.

Dramatic improvements in the product and the products's profitability can only be enjoyed if the organisation takes a holistic view of the design process. If this is done, products manufacturing cost reductions of 20 to 50% are not unrealistic, in fact they are common. Another benefit is improved product quality/ reliability due to significant reduced variation.

Studies indicate that 75% of all faults in products come from the design function and 80% are detected in test and in use.

Productivity Improvements

The sixth activity will be to investigate the manufacturing operation by using both industrial engineering flow process tools and the new Lean Value Stream Mapping (VSM) tool.

The latter approach looks at the flow of major products/product families manufacturing operations, materials flow and the flow of information to make the products. VSM is also useful to determine both the value-adding and non-value-adding steps in the products flow from the customer to the materials suppliers.

At this stage, the mode of manufacture becomes important:

Jobbing Shops - the VSM can be used to look at the pre-manufacturing steps like quotation preparation, design, purchasing, process planning and scheduling. The job shop laid out in a functional way needs the work to be scheduled either by manual or computer scheduling. Generally, most companies do not like reorganising their job shops; consequently, to improve the flow of work, it is worthwhile to look at good IT scheduling systems available in the market.

Batch Manufacturing - this mode of manufacture is more suitable to Lean. Again use the above tools to map out what goes on. This mode is more suited to using "U-shaped cells". First of all reduce batch sizes dramatically then design your cells based on the "Nagare Cell" design where the worker takes a piece to the next process, leaving the previous process running. Introduce the "Pull" system with Kanbans to control production, develop a continuous flow that operates on takt time, introduce levelled schedules; eg, sell-weekly, make-weekly, attack the cell operations set-up times, establish standard working, have visual controls in place, set-up a

materials supply operation to match the cells and introduce planned preventative maintenance for the cells. If the company is big enough, look at the economics of having a value stream manager for each major product range. Finally, establish an industrial engineer per six cells who will work with the cell operators on continuously improving the cells performance.

Flow-Line Production - again use the VSM tools to see if improvement can be made. If the line is scheduled by a forecast look at a Pull system as an alternative. How flexible is the line; can it handle multiple products? Look at Mass Customisation where multiple lines are used and each is set-up for a range of products and the employees move from line to line. Finally a reliable supply of material is crucial in these operations.

Process Plants - again use the VSM tools. Look at the possibility of introducing smaller runs, reviewing set-up/changeover times, better scheduling of the mix, better process control, improved preventative maintenance and better quality control procedures.

The seventh activity is to examine the crucial supply chain which can contain between 30 to 70% of the sales cost of the product for an improved performance. Attack the supply chain with VSM tools, build relationships with key suppliers, evaluate supplier performance, help develop your suppliers capabilities, monitor customer complaints and develop good IT systems.

There have been many reports on productivity but what is coming out is that improving productivity is in the hands of managers. With increasing globalisation, manufacturers of all sizes must reorganise their operations by using the Lean approach, better performance measurement and the employing of talented people; in order to survive.

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