

We present the first in a series of articles on a systematic approach to process improvement - on how appropriate machine tool automation, together with a strong focus on process capability and control, can help manufacturers compete against lower cost economies. By Marc Saunders

Building the pyramid

WHATEVER you manufacture you cannot have failed to notice the enormous changes taking place in UK industry, driven by both local and global factors. There are huge pressures on businesses to remain competitive, and ‘The Productive Process Pyramid’, an eleven-layer systematic approach to process design, built on years of solid practical experience, addresses this. In the first article, I look at the value of this approach in underpinning the drive to profitability, how industry measures are a useful starting point in any process improvement programme, and introduce the basics of the Pyramid.

Whilst key sectors such as aerospace seek to drive down costs through global outsourcing and supplier consolidation, OEMs and subcontractors of all sizes are being driven to automation in the face of cost pressures, reduced lead times and skills shortages. The higher labour costs, more stringent employment legislation and sometimes less flexible labour resources in the developed economies present a distinct advantage to the developing world. However, a profitable future for UK manufacturers is possible by focusing on clear commercial advantages, and squeezing the maximum benefit from manufacturing investments.

A REALITY CHECK

Whilst I genuinely believe that there is a future for manufacturing within these shores, there have been, and will continue to be casualties. Let's be clear about this: in a bidding war for low-added value work, with a high unskilled labour content, the developing world will win every time – lower labour costs and lower overheads, together with access to low-price, good quality CNC machine tools represents just too much of a challenge.

Many subcontractors have realised this. They have

Fears of competition from Asian and other lower cost economies are well founded, but UK manufacturers can remain profitable by focusing on core strengths and adopting best manufacturing practices



either withdrawn from this end of the market; or through strategic alliances with low-cost economies, have continued to offer a service to existing customers, with whom they have more lucrative contracts. Meanwhile, the steady displacement of work to lower-cost economies continues, either transplanting entire manufacturing operations, or simply moving low-margin products ‘off-shore’. The latter route has also been taken by Renishaw, where market pressures on a small range of low-margin products has seen the set-up of limited production facilities in India.

A realistic assessment of business strengths and weaknesses has never been more necessary. Many of you will be used to a classic SWOT analysis, so I'll use this for a quick overview of UK plc manufacturing against low-cost economies (LCEs):

STRENGTHS

- Close to prime customers
- Experience
- Higher quality
- Innovation
- Customer relationships

WEAKNESSES

- Higher labour costs
- Legislative burden (eg. ROHS/WEEE)
- Skills shortages
- High costs of quality
- Poor machine utilisation

OPPORTUNITIES

- Faster response to customers
- Offer more flexible service
- Exploit innovative skills
- Maximise machine potential

THREATS

- Improving quality from LCEs
- OEMs moving factories to LCEs
- Supplier consolidation by OEMs
- Increasing access to technology for LCEs
- Improving LCE educational standards

This is clearly not a comprehensive assessment, but I have highlighted many of the major challenges that we face both now and in the future. Whilst some factors affecting competitiveness are beyond our control, the good news is that there are significant manufacturing process issues that can be tackled to reduce costs and increase flexibility.

WHERE TO START? BENCHMARKING PERFORMANCE

Many manufacturers know that there are problematic areas within their processes – scrap levels, re-work, machine downtime – each having a significant impact on costs and the ability to remain competitive. However, whilst these are commonly measured and obvious areas of waste, they are often merely symptoms of underlying factors such as inadequate machine capability and excessive process variation, which often results from operator intervention.

To give a real sense of the magnitude of these problems, a measurement that has gained wide credibility in recent years is OEE (overall equipment effectiveness), allowing companies to benchmark themselves against an industry standard, rather than rely on homespun measures.

Put simply OEE gives a holistic measure of manufacturing performance, as follows:

OEE = Availability x Performance x Quality

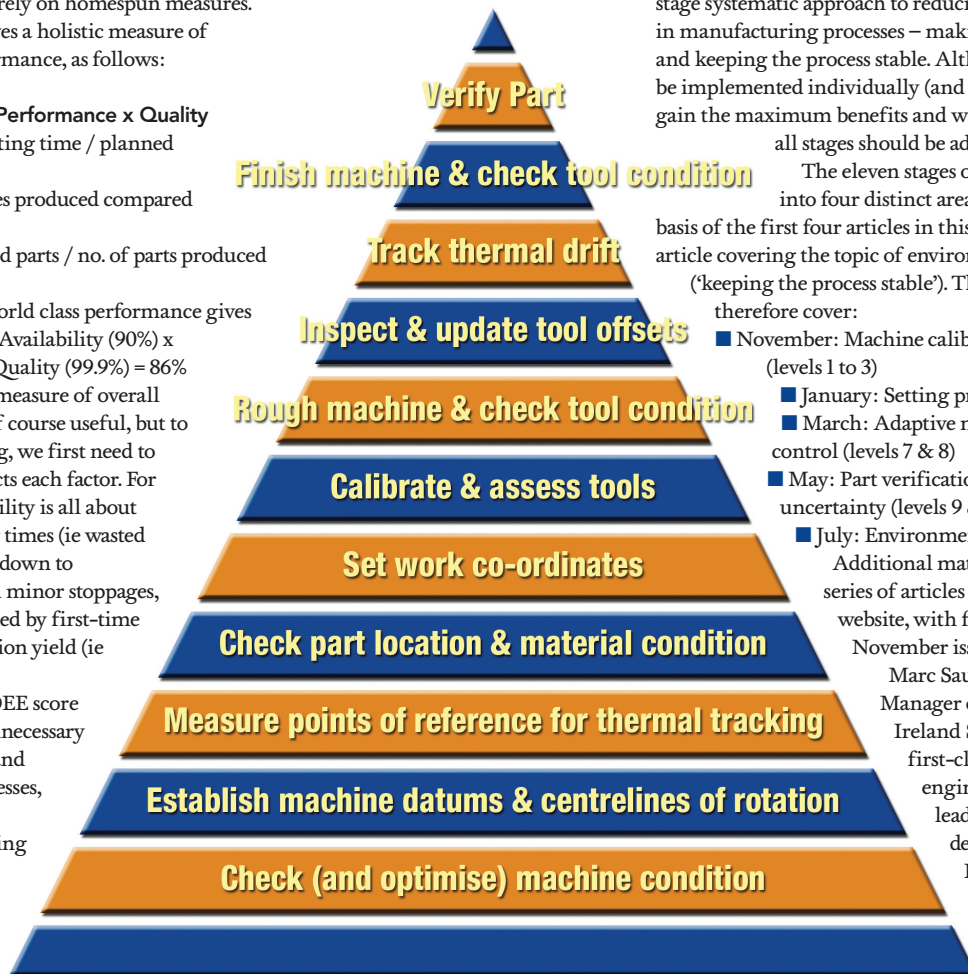
- Availability = operating time / planned production time
- Performance = pieces produced compared to an ideal rate
- Quality = no. of good parts / no. of parts produced

As a benchmark, world class performance gives the following: OEE = Availability (90%) x Performance (95%) x Quality (99.9%) = 86%

Giving ourselves a measure of overall process efficiency is of course useful, but to achieve a higher rating, we first need to understand what affects each factor. For machine tools, availability is all about downtime and setting times (ie wasted time), performance is down to machining speeds and minor stoppages, whilst quality is affected by first-time pass rates and production yield (ie variation).

Achieving a high OEE score means tackling the unnecessary costs caused by waste and variation in your processes, raising customer confidence by producing parts that are consistently in specification, having the ability to tackle high-added value

The Productive Process Pyramid was developed by Renishaw to underpin waste reduction, and to help control variation in its manufacturing processes



work, and maximising output on machines to offer quicker lead times. OEE, like many other industry measures, has its critics, but at its heart is a focus on the reduction of waste and variation, which are the cornerstones of many other efficiency programmes such as lean manufacturing and six-sigma.

TACKLING WASTE AND VARIATION

Experience gained within Renishaw and our wide customer base, suggests that any process improvement programme should address the following:

- automate existing manual processes to increase throughput and eliminate operator error
- systematically eliminate process variation to increase process capability
- introduce process control to ensure that any remaining process drift is compensated
- maintain a consistent operating environment to ensure process stability

It was our own struggles to achieve these four goals in our factory in Gloucestershire that led us to develop the Productive Process Pyramid, a unique reference tool that will be described in significant detail in my forthcoming articles.

THE PRODUCTIVE PROCESS PYRAMID™ (PPP)

Developed from years of experience within Renishaw's own machine shop, and through solutions developed for our global customer base, the PPP represents an eleven-stage systematic approach to reducing waste and variation in manufacturing processes – making the process right, and keeping the process stable. Although many stages can be implemented individually (and in various orders), to gain the maximum benefits and world class OEE ratings, all stages should be addressed.

The eleven stages of the PPP break down into four distinct areas, which will form the basis of the first four articles in this series, with a final article covering the topic of environmental stability ('keeping the process stable'). The future articles will therefore cover:

- November: Machine calibration and geometry (levels 1 to 3)
- January: Setting processes (levels 4 to 6)
- March: Adaptive machining and process control (levels 7 & 8)
- May: Part verification and measurement uncertainty (levels 9 & 10)
- July: Environmental stability

Additional material to support this series of articles will feature on a special website, with further details in the November issue.

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