Anyone who has visited and worked in a number of manufacturing facilities will have noticed several factors which are holding back our ability to achieve world-class levels of performance.

In particular, relatively few manufacturing engineers consider the manufacturing process from raw material supply, through machining, fabrication and assembly into the distribution chain. The traditional functional organisation structure typically extends into our thinking in the way we design new products for manufacture. Manufacturing engineers tend to be task orientated, focusing on discrete processes required to produce component by component.

Following tradition, manufacturing engineers focus attention towards the labour content of each process element; a historical attitude, as the labour content is frequently a small and declining proportion of the overall cost of manufacture. Too much effort is placed in developing estimated machining and assembly times, with little attention paid to the non-value-added activities between processes. It is not surprising then that commonly the value-added proportion of the total manufacturing lead time is a small percentage, quite often in single figures.

Even less effort seems to be taken in improving the manufacturing performance of key suppliers. When one considers that the bought-out content of many products is now the major cost contribution, the most beneficial use of manufacturing engineering skills is surely in improving the supply chain.
Yet very few companies exploit in-house skills in working with their suppliers.

Many of our overseas competitors, particularly Japanese companies, seem more able to engineer high performing manufacturing facilities. This has not been achieved primarily through heavy investment in automation and overly sophisticated technology, but through a structured approach to the design of the whole manufacturing process. The concepts used are simple and concerned with:

- rhythm — the cycle time of the factory or drumbeat;
- tone — the quality of products achieved through good maintenance and total quality;
- harmony — the synchronisation and co-ordination of all resources to achieve an integrated drumbeat.

How is it, then, that our manufacturing engineers are to emulate and better our overseas competitors? The first step is to consider the manufacturing process as a single integrated chain designed to meet the primary operational characteristics of:

- drumbeat — the number of units to be produced per interval of time;
- lead time from start to finish;
- targeted inventory turn to satisfy best in class performance;
- planned levels of work in progress;
- maximum allowable time in tool and systems set-up/changeover;
- targeted value-added percentage.

In calculating the inventory turn, for example, it is often a revelation to manufacturing engineers to learn how small the work in progress level has to be to meet best in class performance. It is these key parameters that dictate, for example, the:

- degree of close-coupling;
- time limits for tool changeovers;
- engineered levels of work-in-progress;
- batch sizes.

From this high-level requirement a clear definition of the manufacturing architecture can then be devised to describe the interrelationships along the whole process.

Each subset of the manufacturing architecture is an integral part of the whole chain, and is engineered to meet the requirements of design performance, quality and reliability, target cost and drumbeat. The structured decomposition or separation of each element of the manufacturing architecture continues down to the lowest level — the bench layout. By following this route one can be assured that the individual process elements underpin the overall business requirement. Importantly, by focusing on the process flow, non value-added activities will be minimised.

Manufacturing engineering as a profession has a significant contribution to make to the continuing success of UK industry. If only many more engineers realised and appreciated the basic, and often simple, concepts underpinning best practices, we would have a much stronger industrial base.

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