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THE BENEFITS OF LEAN MANUFACTURING
What Lean Thinking has to Offer the Process Industries

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How many people in the manufacturing industry can truly say that they have not heard of LEAN? Not many. Yet how many of these believe in lean, have implemented lean, are the passionate change agents who have convinced senior stakeholders than lean is the way forward for their company? Less. Much Less. Lean is a revolution—it isn't just about using tools, or changing a few steps in our manufacturing processes—it's about the complete change of our businesses—how the supply chain operates, how the directors direct, how the managers manage, how employees—people—go about their daily work. Everything. So what is this revolution, and how is it impacting the process industries? The background of lean thinking is based in the history of Japanese manufacturing techniques which have now been applied world-wide within many types of industry.

Keywords: lean manufacturing; waste; value; flow; value stream; bottleneck.

A BRIEF HISTORY OF 'LEAN'

Mention 'lean' and most 'lean thinkers' will know that this is a reference to the lean production approach pioneered by Toyota but also the subject of *The Machine that Changed the World* (Womack *et al.*, 1990); a book which first highlighted Japanese production methods as compared to traditional Western mass production systems; it also highlighted the superior performance of the former. The follow-on book, *Lean Thinking: Banish Waste and Create Wealth in your Organisation* (Womack and Jones, 1996), is equally a key step in the history of lean as it summarizes the lean principles which 'guide action'. It also coined the phrase 'Lean Production'.

But let's go back to the beginning—the birth of lean was in Japan within Toyota in the 1940s: The Toyota Production System was based around the desire to produce in a continuous flow which did not rely on long production runs to be efficient; it was based around the recognition that only a small fraction of the total time and effort to process a product added value to the end customer. This was clearly the opposite of what the Western world was doing—here mass production based around materials resource planning (MRP) and complex computerized systems was developing alongside the mass production philosophies originally developed by Henry Ford, i.e., large high volume production of standardized products with minimal product changeovers.

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Taiichi Ohno had started work on the Toyota Production system in the 1940s and continued it's development into the late 1980s unhindered by the advancements in computers which had allowed mass production to be further 'enhanced' by MRP Systems. By the 1970s Toyota's own supply base was 'lean'; by the 1980s their distribution base was also 'lean'.

Key tools and techniques within the 'lean' system, included:

- Kanban—a visual signal to support flow by 'pulling' product through the manufacturing process as required by the customer.
- 5 S's—a visual housekeeping technique which devolved control to the shopfloor.
- Visual control—a method of measuring performance at the 'shop floor' which was visual and owned by the operator team.
- Poke yoke—an 'error-proofing' technique.
- SMED (single minute exchange of dies)—a changeover reduction technique.

However let us return to the 1990s and the two landmark works discussed at the start of this section.

The Machine that Changed the World (Womack *et al.*, 1990) compared and contrasted the Mass Production System seen in the US and Europe, with the Lean Production System, seen in Japan, within the automotive industry.

Table 1 is a summary of some of the comparisons highlighted by Womack *et al.* (1990).

- The mass producers were able to maintain long production runs using standard designs which ensured that the customer got a lower cost; they also got less variety

Table 1. Production Systems Compared.

	Mass production	Lean production
Basis	• Henry Ford	• Toyota
People–design	• Narrowly skilled professionals	• Teams of multi-skilled workers at all levels in the organization
People–production	• Unskilled or semi-skilled workers	• Teams of multi-skilled workers at all levels in the organization
Equipment	• Expensive, single-purpose machines	• Manual and automated systems which can produce large volumes with large product variety
Production methods	• Make high volumes of standardized products	• Make products which the customer has ordered
Organizational philosophy	• Hierarchical—management take responsibility	• Value streams using appropriate levels of empowerment—pushing responsibility further down the organization
Philosophy	• Aim for 'good enough'	• Aim for perfection

as did the workforce who found this mode of operation tedious.
- In comparison, the term 'lean' comes from the 'upside' of the production method which requires 'half the human effort, half the manufacturing space, half the investment and half the engineering hours to develop a new product in half the time'.

However, it is not difficult to see that the world of car-parts and conveyor belt production lines did not immediately grab the interest and excitement of the process industries. Apart from the packaging lines the analogies seemed hard to find.

However, *Lean Thinking* (Womack and Jones, 1996) helped us to understand the principles of lean:

- The identification of *value*.
- The elimination of *waste*.
- The generation of *flow* (of value to the customer).

It clearly demonstrated that this was not a philosophy or technique which was only applicable to the automotive industry.

THE BENEFITS OF BEING 'LEAN'

The benefits seen within non-process industries (see Figure 1), such as the automotive industry, are well documented:

- decreased lead times for customers;
- reduced inventories for manufacturers;
- improved knowledge management;
- more robust processes (as measured by less errors and therefore less rework).

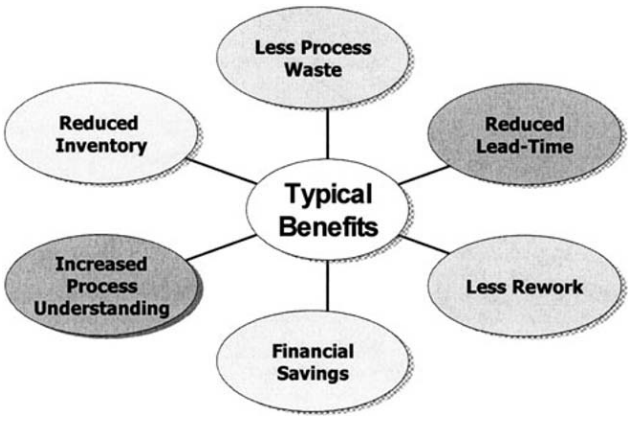

Figure 1. The benefits of 'lean'.

This makes lean a very real and physical concept—especially for manufacturing.

Lean production has now expanded and lean thinking has been applied to all aspects of the supply chain. There are many well documented examples of the application of 'lean thinking' to business processes such as project management (Melton, 2003); construction, design, and so on.

Lean can be applied to all aspects of the supply chain and should be if the maximum benefits within the organization are to be sustainably realized. The two biggest problems with the application of lean to business processes are the perceived lack of tangible benefits and the view that many business processes are already efficient. Both assumptions can be challenged (Melton, 2004):

- There are many tangible benefits associated with lean business processes. A lean business process will be faster, e.g. the speed of response to a request for the business process will be faster, and as most business processes are linked to organizational supply chains, then this can deliver significant financial benefits to a company.
- The perception that a business process is already efficient is all too often an illusion. Functionally, many business processes may appear very efficient, however the application of Lean Thinking forces us to review the whole supply chain in which the business process sits, and this frequently reveals bottlenecks and pockets of inefficiency.

But for now let us return to the world of manufacturing within the process industries.

WHAT'S STOPPING US?

With the benefits so apparently obvious the question has to be—what's stopping us?

For some in the process industries the answer is simple—nothing! There are good examples of the implementation of lean philosophies across the process industries. For example, PICME (Process Industries Centre for Manufacturing Excellence), an organization part funded by the DTI to specifically help manufacturing in the process industries to become more efficient and more competitive, quote estimated projected savings of over £75 million over their first 5 years of operation (PICME, 2004).