

A COMPLETE DEFINITION OF THE TECHNIQUES OF CONTINUOUS IMPROVEMENT

LEAN production

Lean, Lean Production or Lean Manufacturing describes a methodology aimed at reducing waste in the form of overproduction, lead time or product defects.

Lean is thus about doing more with less: less time, inventory, space people and money.

The term was born out of the production systems established by Toyota in Japan in the 1950s and was to a large extent inspired by KAIZEN the Japanese strategy of continuous improvement. Lean production is characterised by operations with low inventories, small batch runs and just-in-time delivery of supplies. It is supported by a quality management regime based on prevention, and by team-based working. The final element is a set of close relationships with suppliers. Though the concept arose in the manufacturing sector, it has since spread and has been applied successfully to other sectors.

Thinking lean involves:

- Identifying and eliminating waste, or activities that add no value through continuous improvement efforts
- Focusing on continuous improvement of processes - rather than results - throughout the entire value chain
- Achieving continuous product flow through physical rearrangement and revision of system structure & control mechanisms
- Single-piece flow / small lot production: achieved through reducing equipment set up time; attention to machine maintenance; and maintaining an orderly, clean work place
- Pull production / Just-in-Time inventory control.

Pull production is based on orders rather than forecasts; production planning is driven by customer demand or pull; its aim is not to suit machine loading or inflexible work flows on the shop floor.

KAIZEN

KAIZEN is a Japanese word meaning gradual and orderly, continuous improvement. Adopting KAIZEN involves the creation of a culture of sustained continuous

improvement focusing on eliminating waste in all systems and processes of an organization.

There are two essential elements that make up KAIZEN:

- improvement/change for the better; and
- ongoing/continuity.

A system/culture that lacks either of these is not true KAIZEN. Thus, maintaining existing ways of working (good though they may be) lacks the essential 'improvement' element, though it ensures continuity. Similarly, breakthrough improvement, not backed up by effective ongoing improvement, lacks the element of continuity. KAIZEN should contain both elements. KAIZEN is not consistent with the saying "If it ain't broke, don't fix it".

KAIZEN achieves its effects by working through people. All are expected to be involved. Managers, for example, are expected to spend about half their time on improving what they and those for whom they are responsible do.

Traditionally, a Japanese Samurai carried seven tools into battle. After World War II the Japanese adopted quality as a philosophy for economic recovery and, in line with this traditional approach, sought seven tools to accomplish the economic rejuvenation. The seven tools chosen were:

- Histograms
- Cause and Effect Diagrams
- Check Sheets
- Pareto Diagrams
- Graphs
- Control Charts
- Scatter Diagrams

These tools were largely developed as aids within the process of statistical quality control. All personnel are trained to use them - and the resulting charts and diagrams are displayed prominently.

KAIZEN recognises that improvements can be small or large. Many small improvements can make a big change - so KAIZEN works at a detailed level.

The principles/approach behind KAIZEN are:

1. Discard conventional fixed ideas.
2. Think of how to do it, not why it cannot be done.
3. Do not make excuses. Start by questioning current practices.
4. Do not seek perfection. Do it right away even if it will only achieve 50% of target.
5. If you make a mistake, correct it right away.

6. Throw wisdom at a problem, not money.
7. Ask "WHY?" five times and seek root causes.
8. Seek the wisdom of ten people rather than the knowledge of one.
9. Don't ask workers to leave their brains at the factory gate.

KAIZEN is thus a (relatively) low cost, simple, team-based approach. Teams are trained in the techniques and tools of KAIZEN. They then brainstorm improvement ideas and vote on them for priority action. They then create an action/implementation plan which is submitted to management for approval. Assuming it is approved, the team then sets about implementation (with professional help if appropriate). The team then meets weekly to review progress, identify/overcome barriers, celebrate successes, and document the resulting changed processes.

Continuous Improvement

Continuous improvement is not a tool or technique as such; more a way of life or at least a cultural approach to quality improvement and the concept of continuous improvement has to be set in the context of the quality "movement".

Quality as a business issue in the way we know it now arose with labour specialisation, mass production and automation techniques; techniques which moved away from the traditional expert craftsman approach to quality.

In the new world of factories and mass production, quality was obtained by inspecting each part and passing only those that met specifications. This was true until 1931 when Walter A. Shewhart, a statistician at the Hawthorne plant at Western Electric published his book *Economic Control of Quality of Manufactured Product* (Van Nostrand, 1931). This book is the foundation of modern statistical process control (SPC) and provides the basis for the philosophy of total quality management or continuous process improvement for improving processes.

With statistical process control, quality inspection of each individual part produced is no longer used; the process is monitored through sampling. Depending on the results from the sample, adjustments are made to the process to ensure quality production.

W. Edwards Deming worked as Walter Shewhart's assistant and protégé and helped further develop this radical approach to improving quality. At about the same time, Shewhart also developed a never-ending approach toward process improvement called the Shewhart Cycle (also known in Japan as the Deming cycle) : Plan-Do-Check-Act.

This approach emphasizes the continuing, never-ending nature of process improvement.

The cycle is really a simple feedback loop system.

Plan

A plan is developed to improve a process.

Do

The plan is tested in a small field test.

Check

The results of the test are assessed.

Act

If successful, the plan is implemented.

The improvement process then begins again and the cycle is repeated. The repetition of the PDCA cycle, with each cycle producing improvement, leads us to the term 'continuous improvement'.

Six Sigma, 6 σ

The ideas behind the Six Sigma concept arose from a realisation that technology changes the way we should think about quality and especially about manufacturing non-conformance rates. When automated processes are responsible for much of current manufacturing, quality levels should be very high. Thus, a change was required in the way organisations think about what is acceptable in terms of non-conformance to agreed quality levels. That change was to move from expressing and measuring quality levels in percentages, or parts per hundred to one of adopting parts per million or even parts per billion.

From this concept and statistical underpinning Six Sigma has developed into a highly disciplined process used to help an organisation focus on developing and delivering near-perfect products and services. The basic approach is to identify and evaluate a defect, analyse the causes, make improvements, and then control those improvements.

Many of the tools of Six Sigma (and the concept of lean manufacturing with which Six Sigma is most closely identified) can be found in statistical process control, total quality management, statistics, process improvement, inventory control and operations management textbooks. However, it is not just the tools that deliver Six Sigma performance - it is the logic, discipline and practical application that drives the search for perfection.

Six Sigma has a customer focus

The aim is to ensure that all outputs meet customer specifications. This is very intuitive for manufacturing and industrial businesses; but as Six sigma is extended to new sectors, this can potentially be a new concept for transactional businesses. Customer needs must be understood down to the 'tolerance' level.

Six Sigma is data driven

Data is necessary to identify input, process and output areas for improvement. Quality improvements are not haphazardly implemented. Instead, resources are assigned to projects where it can be shown through data analysis that the customer will feel a difference. With Six Sigma, statistics provide objective evidence on which decisions are based. So a common approach is to identify a practical problem, convert it into a statistical problem, derive a statistical solution and then transform that to a practical solution. (This is the basic modelling approach.)

Six Sigma is inclusive and participative

The entire company must back the concept to make it work. Often employees have improvement ideas but not the skills to 'sell' their idea or the resources to translate it into production. Those practising Six Sigma are awarded 'belts' as in martial arts to recognise training and experience and a Six Sigma black belt is highly prized both by its recipient and by the employer of that recipient.

Six Sigma is proactive

Six Sigma has moved from the 'problem consideration' to the 'design' phase. The aim of many Six Sigma programmes is to design and engineer quality into the process as a proactive approach to defect elimination.

Six Sigma is spreading

The application of the basic Six Sigma concept now goes beyond its original area of defect reduction to emphasise business process improvement in general. Thus Six Sigma programmes may include cost reduction, cycle-time improvement, increased customer satisfaction and any other metric important to the company. Thus, Six Sigma now implies a whole toolbox and a whole culture of improvement using a variety of tools and statistical methodologies to improve the bottom line of companies.

Sigma (σ)

is a letter in the Greek alphabet used to denote the standard deviation of a Normal distribution. The outputs of a process usually form a normal distribution so 'sigma quality levels' can be used to describe the output of a process, expressed as the deviation of the process from its quality norm. A Six Sigma quality level is said to equate to 3.4 defects

per million opportunities. This is actually a little strange since if a normal distribution table is consulted (very few go out to \pm six standard deviations or six sigma), one finds that expected nonconformances are 0.002 parts per million (two parts per billion). The difference between this figure and the 'official' six sigma figure of 3.4 defects per million parts is because, when the concept was established, it was assumed that a typical process mean could drift 1.5 sigma in either direction. The area of a normal distribution beyond 4.5 sigma from the mean is indeed 3.4 parts per million. Because control charts will easily detect any process shift of this magnitude in a single sample, the 3.4 parts per million represents a very conservative upper bound on the nonconformance rate.

Five S

Five S (or more commonly 5S) is a Japanese approach to organising a workplace. It is often one of the early techniques used as organisations move towards becoming 'lean'. This is because it offers 'quick wins' that help to build momentum.

The 5S's are:

Seiri (or Sort)

Define what is actually needed (and how much of it) in an area. Anything that is not needed should be got rid of – or stored in its right place (elsewhere). Identify where everything should be placed to maximise effectiveness.

Seiton (Straighten or Set in Order)

Follow the old adage 'A place for everything and everything in its place'. Lay out logically, label and colour- code to make sure everything stays in place.

Seisou (Shine or Sweep)

Keep things clean and tidy – already ready for the 'VIP plant tour'. When a plant/office is well-laid-out and is clean and tidy, it is easier to recognise something out of place, and to identify possible sources of contamination/defect.

Seiketsou (Standardise)

Define standards to ensure that things stay tidy, orderly and clean.

Shitsuke (Sustain)

Develop a system of constantly assessing performance and challenging for improved methods.

The 5S process aims to create and maintain an organised, clean and efficient workplace that supports the highest level of value-added performance. This means eliminating search, travel, transporting materials, and inventory by introducing organisation and orderliness, eliminating unneeded materials and establishing self-discipline.