

[1] In the Mercedes Benz truck factory production is managed in a way that will completely satisfy individual customer needs. Successful customisation is achieved by using well established 'lean manufacturing' techniques. Lean manufacturing creates a system designed to increase the value of the outcome using production techniques that are simple to implement but which result in maximum efficiencies. The whole manufacturing process is planned around the need for full customisation of each individual truck to suit the specific requirements of the driver. The production system is structured to be flexible enough to allow a number of different truck models to be produced at the same time on the same line, with each individual set of specifications being successfully met. To do this reliably requires a very efficient part-handling system.

[2]...The foundation of the quality management system used by Toyota at the Altona plant in Melbourne is the empowerment of its workers to strive to continually improve the quality of the work they are doing. Quality control during production requires that the correct materials are available at each stage of the process. All materials need to be fitted with the required precision and accuracy so that the end result is a product that can fully meet the expectations of all their customers.

[3]...The post-World War 2 Toyota Production System (TPS) successfully merged the novel just-in-time concept with the well-established Toyota principles of intelligent automation and human respect. Its goal was to create a manufacturing system with a smooth, continuous and optimised flow of work – cutting out any wasteful storage of yet-to-be-used or waiting-to-be-sold materials. Customer demand was to be satisfied by linking all production activity to marketplace demand – with inventory costs minimised by having the required parts arriving at their point of use just as they are needed. Processes would be re-designed to be more flexible to allow for easy switching of products allowing the exact quantity of what is needed to be produced when it is needed. In the system all waste is minimised – including not only inefficient use of raw materials, but also things like over-production, the need for re-work and unnecessary transport and long-term storage.

In the Toyota plant this system hinged on the use of Kanban cards. Fully loaded supply trucks bring in combinations of parts required for the assembly process. These parts are transported to racks alongside the appropriate assembly lines in the factory. When parts are picked up for use the worker removes the attached Kanban card. This is then returned to the delivery point for sorting and pick-up by the transport driver for delivery back to the supply company and speedy replenishment of the parts. This means that the production processes in the supplier plants only uses those parts that have been withdrawn for use. That prevents a wasteful build-up of inventories and ensures that the suppliers are effectively linked into the requirements of the Toyota plant. All processes carried out internally in the car factory itself are linked in the same way.....

[4]...From the moment workers join the company they are encouraged to take an active role in quality control by treating the next person on the production line as their customer and making sure that they never pass on a defective part or piece of work to the next stage in the process. Where opportunities are seen for improvement they are actively encouraged to discuss their ideas with other team members and to submit their idea to senior management. The best ideas can end up being adopted company wide. Workers do receive a small reward for this type of contribution to process improvement, but the main driver is being able to contribute in some way to the process of continuous improvement.

This team effort is combined with thousands of rigorous inspections of the work being done as the cars move down the production line. Individuals working on the production line have to take responsibility for the suitability of the parts they use. They must act as inspectors of their own work and that of their fellow workers. If they spot a problem the expectation is that they will do something about it.

[5] In Toyota plants worldwide a rope called the 'Andon cord' stretches the whole length of the assembly line. When a problem is spotted by a worker, this can be pulled to alert supervisors that assistance is required.

The first Andons introduced in the Toyota factories were not very complex – just simple lights that enabled operators to signal the status of the production line at that point. The



lights were coloured – green for normal operation, yellow when help was required, and red when the production line was down. Today the systems used are much more sophisticated and can include using text, graphics, or audio elements. Audio alerts may be carried out using coded tones, music with different tunes corresponding to the various alerts, or pre-recorded verbal messages.

Reasons for workers to look to activate the Andon system include shortage of parts, defects found or unexpectedly created in the process, tools not working properly, or sudden safety problems. Getting some additional assistance will usually solve the problem, but if sufficiently serious, work can be stopped until a solution is found. In their modern factories new data collection tech-

nology allows each incident to be automatically logged to a database and machine-analysed as part of the plant's continuous-improvement programme.

Although technical sophistication may have improved over the years the original intent of the introduction of the Andon remains the same - to increase the accountability of production workers by providing a simple and effective method for them to communicate the current status of the production process to their supervisors. In this way the Andon cord increases the supervisors' ability to identify and resolve any potentially serious quality, down time and safety problems that occur in the manufacturing process.