The Power of SMED
by Malcolm Jones, Productivity Europe

There is an ongoing debate on the Superfactory web forum concerning SMED (Single Minute Exchange of Die) as developed by Shigeo Shingo, and in particular about Shingo's influence on Toyota. As someone who had the privilege of meeting Shingo a few times before his death in 1991 and who has taught SMED for 15 years, I would like to give my view on the importance of the SMED process.

The present debate in brief is that Taiichi Ohno bought quick exchange tooling from the USA for Toyota in the 1950's, whereas Shingo claims to have introduced them to SMED in 1969, when most Toyota presses were already being changed in less than ten minutes, so SMED is not responsible for Toyota's changeover performance. It is also a fact that Shingo taught industrial engineering at Toyota from 1955 onwards – this was an extension of the original Training Within Industry IE programme, given to Toyota, amongst other Japanese companies, by the USA.

So what was Shingo's contribution, and why is the SMED Process important?
Shingo was a great theoretician as well as a great engineer, Taiichi Ohno was a great practitioner and a hard task master. Taiichi Ohno was only interested in practice and he was a great experimenter – if you read his writings you will see that some of his experiments in the 1950's were failures, but he regarded failures as 'mountains of treasure' – learning to be had. The important thing was to try, not to discuss theory or say it can't be done.

Shingo was a hard task master like Ohno, but also a great theoretician – he needed to develop an overall theory of why something worked. Shingo had two major theories which defined how he approached problems. The first was his ideas about process and operation. Basically he said that improving the flow through a whole process was much more important and value creating than improving individual operations. Where less skilled engineers would get involved in issues of how to improve a particular operation, Shingo thought this was meaningless unless the operation was a constraint on flow through the process. Unless the process as a whole could not meet its QCD targets, and a particular operation was the immediate constraint, improving an operation would not give returns to the bottom line. This theory was so important to Shingo that it appears as the first chapter in many of his books, including his book on SMED.
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learnt his second major theory, which receives less attention, from one of Shingo's students, JMA consultant Shigehiro Nakamura. This is the leveling up process, an approach to improvement. Under this theory, if you want to improve a process you first need good information on current performance and performance requirements, you then need the right people and then a good standard method. Only when you have reached the limits of these three, do you then look to improve through more traditional engineering methods – looking at measurements - the IE and QC data, machines – equipment modifications and materials, including product design.

Toyota's approach to quick changeover was the traditional engineering methodology of ECRS – Eliminate, Combine, Re-Arrange, Simplify. So Toyota were breaking down changeovers into their elements and then applying ECRS to each element. The quick release dies which Mr Ohno bought form the USA were a means of simplifying the attaching and removal of dies. Mr Ohno was also wedded to idea of standard methods, and everything in Toyota changeovers was standardised, so that

changeover times were consistent.
Shingo takes this further, and his theory allows the process to be applied to any changeover, not just dies. The theory developed over nearly twenty years by Shingo's own account, and the 1969 invention of SMED was the culmination of this. Like all theories, SMED works by first defining categories.

In SMED the first important distinction is between Internal and External changeover. Internal Changeovers are those elements which have to be performed while production is stopped, the rest is external. This crucial distinction focuses improvement effort on performing only internal elements while production is stopped, and then simplifying those.

The second distinction is between types of activities in changeover. Shingo defined these as Preparation, Exchanging Parts, Adjustment and Trial Processing. In general, exchanging parts only takes 5% of the time of the changeover, so buying quick release dies can only improve that 5%, the rest is procedural.

The first step in SMED's three step process is to identify and separate internal and external activities. In practice this means eliminating all preparation activities from the time when production is stopped. The second step is to shift activities from internal to external, thus eliminating them from the machine downtime. In practice this means focusing on externalizing adjustments and the cleaning of parts. The third step is to streamline the remaining internal elements. In practice this can mean improving fasteners and reducing any remaining internal adjustment.

SMED is a step by step process which follows the DMAIC, Define, Measure, Analyse, Improve, Control cycle. It provides categories for the analysis phase and a procedure for the improvement phase. Control is provided by the development of a standard procedure. SMED projects rarely result in less than a 50% reduction in changeover time, and often as much as 80-90%.

When I first met Shingo (I was 33, he was 80) he asked me if I had been using his SMED process. I replied that working in a machine shop we had reduced changeovers from 90 minutes to 15 minutes. He gave me a steely look and said through his interpreter that when he was at school 15 was a two digit number; SMED meant single digit numbers – 9 minutes or less. He ended his diatribe in English with the words "You must do better".

Description
Malcolm Jones founded Productivity Europe in 1989 to develop support and facilitation services in World Class Manufacturing techniques. He learnt from Japanese masters such as Shigeo Shingo and the Total Productivity group at the Japan Management Association, and has edited three books on World Class Manufacturing techniques and practices.

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