

Technical Guide

“Single-Minute Exchange of Dies”



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Ministry of Industries & Production

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1 Disclaimer

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2 Introduction to SMEDA

The Small and Medium Enterprises Development Authority (SMEDA) was established in October 1998 with an objective to provide fresh impetus to the economy through development of Small and Medium Enterprises (SMEs). With a mission "to assist in Employment Generation and Value Addition to the national income, through development of SME sectors, by helping increase the number, scale and competitiveness of SMEs", SMEDA has carried out 'sectoral research' to identify Policy, Access to Finance, Business Development Services, strategic initiatives and institutional collaboration & networking initiatives. Preparation and dissemination of prefeasibility studies in key areas of investment has been a successful hallmark of SME facilitation by SMEDA. Concurrent to the prefeasibility studies, a broad spectrum of Business Development Services is also offered to the SMEs by SMEDA. These services include identification of experts and consultants and delivery of need-based capacity building programs of different types in addition to business guidance through help desk services.

2.1 Industry Support Program

In order to enhance competitiveness of SMEs and achieve operational excellence, SMEDA established an Industry Support Cell (ISC) for provision of foreign technical support and knowledge transfer in collaboration with International Development Organizations. SMEDA's Industry Support Program (ISP) initially launched with Japan International Cooperation Agency (JICA) and actively engaged in reducing energy inefficiencies and improving production and quality of products with the support of Japanese Experts. Later on, similar activities with other international partner organizations like German Corporation for International Cooperation (GIZ), Training and Development Centers of the Bavarian Employers' Association (bfz), Germany, and United Nations Industrial Development Organization (UNIDO) were also successfully implemented.

3 WHAT IS SMED?

SMED means Single-Minute Exchange of Dies, it is a system for intensely decreasing the time it takes to complete equipment changeovers. The essence of the SMED scheme is to convert as many changeover steps as possible to “external” (performed while the equipment is running), and to shorten and streamline the remaining steps. The name Single-Minute Exchange of Dies comes from the goal of reducing changeover times to the “single” digits (i.e. less than **10 minutes**).

3.1 A successful SMED program will have the following benefits:

- It lowers the manufacturing cost (faster changeovers mean less equipment downtime)
- Smaller lot sizes (faster changeovers enable more frequent product changes)
- Improved responsiveness to customer demand (smaller lot sizes enable more flexible scheduling)
- Lower inventory levels (smaller lot sizes result in lower inventory levels)
- Smoother startups (standardized changeover processes improve consistency and quality)

4 BASICS OF SMED:

SMED was developed by Shigeo Shingo, a Japanese industrial engineer who was extraordinarily successful in helping companies dramatically reduce their changeover times. His pioneering work led to documented reductions in changeover times averaging 94% (e.g. from 90 minutes to less than 5 minutes) across a wide range of companies.

Changeover times that improve by a factor of 20 may be hard to imagine, but consider the simple example of changing a tire:

For many people, changing a single tire can easily take 15 minutes. For a NASCAR pit crew, changing four tires takes less than 15 seconds.

Many techniques used by NASCAR pit crews (performing as many steps as possible before the pit stop begins; using a synchronized team to perform multiple steps in parallel; creating a standardized and highly optimized method) are also used in SMED. In fact, the journey from a 15-minute tire changeover to a 15 second tire changeover can be considered a SMED journey. In SMED, changeovers are made up of steps that are termed “elements”. There are two types of elements:

- Internal Elements (elements that must be completed while the equipment is stopped)
- External Elements (elements that can be completed while the equipment is running)

The SMED process focuses on making as many elements as possible external, simplifying and streamlining all elements.

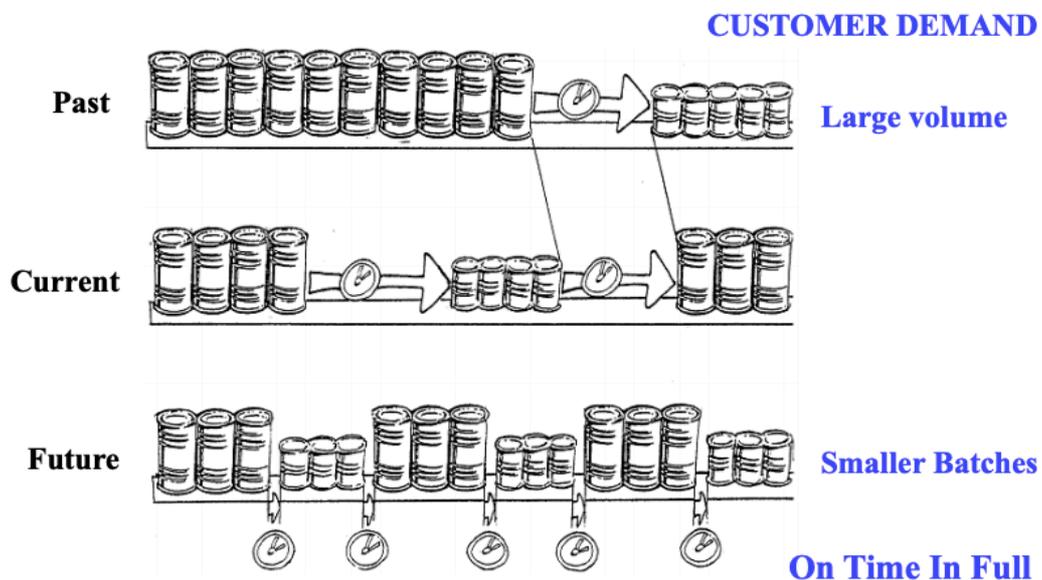
5 Changeover vs. Maintenance:

⇒ **Changeover:** The removal/replacement/adjustment of alternative part(s).

⇒ **Maintenance:** The removal/replacement/adjustment of the same part(s).

Good changeover practice
equates to good maintenance
practice

Why Reduce Changeover Time?



6 Benefits:

- **Increases Productivity (or reduce production time):**
 - a) Shorter changeovers reduce downtime and Increase machine capacity.
 - b) Which means a higher equipment productivity rate and an increase in profit.

- **Increases Flexibility:**
 - a) Meet the demands of the growing market and the changing customer needs.
 - b) Diversified product options.

- **Quicker Delivery:**
 - a) Small lot production means less lead time and less customer wait time.

- **Improves Quality:**
 - a) Quick changeovers lower defects by reducing set-up errors and trial runs of the new product.
 - b) This will improve customer satisfaction and retention.

- **Increases Safety:**
 - a) Planned and simpler changeovers decrease confusion.

- **Improves Process Flow (stockless production):**
 - a) Reduce inventory levels which leads to reduction in working capital.
 - b) Reduce batch sizes.
 - c) Reduce WIPs.

- **Other Benefits:**
 - a) Reduces waste in materials and parts.
 - b) Increases worker utilization.
 - c) Set-Up becomes easier which leads to
 - d) Operator's satisfactory.
 - e) Lowers skills requirements since changes are now designed into the process.
 - f) New attitudes amongst staff that will prevent deviation from standards.
 - g) Improves workplace organization.

7 Typical Causes for Delays in Changeovers:

- Waiting.
- Searching.
- Missing tools / tooling.
- Lack of calibration.
- Poor schedule information.
- No checklist.
- Moving slowly.

8 SMED Five steps:

1. Study the process:

Study the process, analyze the whole setup from the last good piece of the earlier reference until the first good piece of the next reference. Create spaghetti diagrams, record the time of each task, comprehend which tools are being used, notice every waste of the process. Classify every task into internal or external. In order to create a wide base of support for the SMED project, include the full spectrum of associated employees in the selection process, and work hard to create a consensus within the team as to the target equipment choice.

2. Internal vs External work:

Separate internal from external work. Every external task that was being performed with the machine not running will now be performed either before we stop the machine, or after. The most effective way of doing this is to videotape the entire changeover and then work from the videotape to create an ordered list of elements. Be sure to capture both “human” elements (elements where the operator is doing something) and “equipment” elements (elements where the equipment is doing something). As discussed later, the human elements are usually easiest to optimize.

3. Convert Internal work:

Convert internal work into external work. If you are assembling your tool while the machine is not running, pre-assemble while it is still running. The current changeover process is carefully examined, with the goal of converting as many internal elements to external as possible. For each internal element, the team should ask the following questions: If there was a way to make this element external, what would it be? How could we do it?

This will result in a list of elements that are candidates for further action. This list should be prioritized so the most promising candidates are acted on first. Fundamentally, this comes down to performing a cost/benefit analysis for each candidate element:

Cost as measured by the materials and labor needed to make the necessary changes.
Benefit as measured by the time that will be eliminated from the changeover. Once the list has been prioritized work can begin on making the necessary changes.

4. Reduce Internal Work:

Reduce internal work. Use quick tightening tools and eliminate adjustments. For each internal element, the team should ask the following questions: If there was a way to reduce external work, what would it be? How could we do it?

This will result in a list of elements that are candidates for further action. This list should be prioritized so the most promising candidates are acted on first. Fundamentally, this comes down to performing a cost/benefit analysis for each candidate work:

⇒ Cost as measured by the materials and labor needed to make the necessary changes.

⇒ Benefit as measured by the time that will be eliminated from the changeover.

Once the list has been prioritized work can begin on making the necessary changes. Prepare parts in advance (e.g. preheat dies in advance of the changeover). Then use duplicate jigs (e.g. perform alignment and other adjustments in advance of the changeover). We can also modify equipment (e.g. add guarding to enable safe cleaning while the process is running)

5. Reduce External Work:

Reduce external work. Create setup kits, so every time you start a setup everything is ready for you and you don't need to waste time preparing. Retrieval of parts, tools, materials, and/or instructions. Inspection of parts, tools, and/or materials. We should

focus on cleaning tasks that can be performed while the process is running. Quality checks for the last production run is very mandatory.

SINGLE MINUTE EXCHANGE OF DIES (SMED) PROCESS STEPS

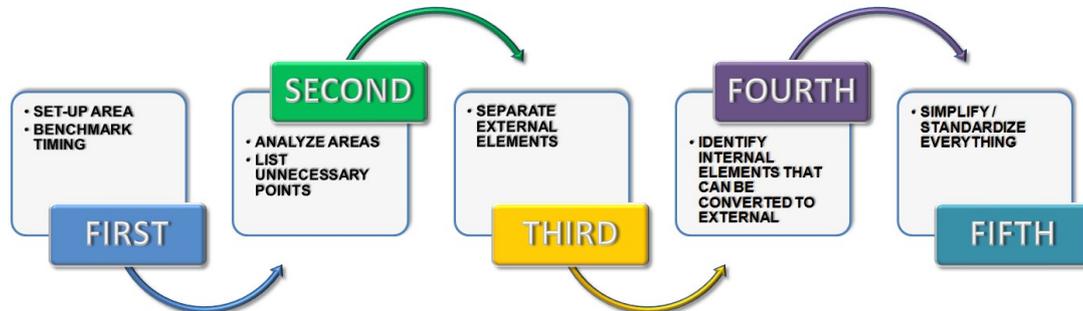


Figure: Five Steps of SMED

9 What's Next:

- ⇒ A new Standard Operating Procedure (SOP) should have been developed and agreed by the shop floor persons.
- ⇒ The team should develop a continuous improvement action plan (Self-improving Kaizens).
- ⇒ The team should put what was taken from the idea into practice.
- ⇒ The team may conduct some practice runs to be comfier with the new practices.
- ⇒ Continuous assessment and exploration of further improvements is absolutely necessary.

10 Summary:

- ⇒ SMED helps achieve higher productivity, greater flexibility, and higher throughput.
- ⇒ SMED needs to be considers as a constant improvement program.
- ⇒ SMED is a tool which will allow us to focus on reducing wastes.
- ⇒ The causes of wastes will be thoroughly identified, investigated and removed.
- ⇒ Continuous assessment and investigation of further improvements is absolutely essential.
- ⇒ Practice makes perfect.