

# **LEAN GLOSSARY**

**STAUFEN.**

## 5A method > 5S method

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### 5S method

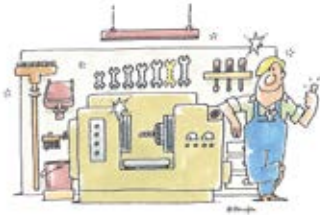
The 5S method is the foundation of continuous improvement. 5S stands for the five steps to maintain orderliness and cleanliness within an organization:

1. **Sort**, jap. seiri (Sort and separate what is not needed)
2. **Straighten**, jap. seiton (Arrange items so they are easy to find)
3. **Shine**, jap. seiso (Clean the workplace)
4. **Standardize**, jap. seiketsu (Personal orderliness)
5. **Adhere to and improve standards**,  
jap. shitsuke (Discipline)

Clean and orderly workstations reduce > **waste** resulting from time spent searching (motion) and make visual management possible. This makes it easier to detect and prevent deviations from standards.

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The 5S method is also referred to as the 5A method:



**A**ssessment  
**A**wareness  
**A**ssociation  
**A**dherence  
**A**scendency

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## 5 Whys


The 5 Whys are used to determine the causes of problems. The root cause for a problem is identified using the **5 Whys**. Other interrogative pronouns can be used as well.

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## 8D report

An 8D report is a document created as a part of quality management if there is an issue between a supplier and a customer.

"8D" stands for the eight mandatory process steps carried out when processing a claim, in order to get to the root cause. The report includes the type of claim, responsibilities and measures taken to prevent the problem from recurring:


- D1** Establish a problem-solving team
  - D2** Describe the problem
  - D3** Define intermediate measures
  - D4** Determine the root cause(s)
  - D5** Plan corrective action
  - D6** Introduce correction measures
  - D7** Prevent recurrence
  - D8** Recognize the team
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## A3 Report

The A3 report comes from the name of the paper size used to prepare the report. Its structure is influenced by the PDCA method (> **PDCA cycle**).

The best-known A3 report is the problem-solving report. In this case, the user follows a systematic process that makes it possible to describe the symptoms that emerged. Using text fields, it supports the user in describing the symptoms, determining the cause, and planning and implementing measures to solve the problem. The individual text fields are: Title, problem background, problem description, description of the target state, immediate action, cause and effect relationship, determination of the root cause, determination of countermeasures, information of adjacent areas, concluding activities.

A > **mentor** should encourage the processing and develop the > **mentee** through targeted questions. This ensures that the A3 report is not just used to "put out fires."



## Andon | jap. for "lantern"

Andon is a visual signal that indicates when there is a problem. The signal can be triggered by a "rip cord."

> Machine stop authorization



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## Audit

An audit is done to verify whether processes, requirements or guidelines meet the required standards. This verification process has its roots in quality management, but has recently been applied to many other fields of management (e.g. environmental management, value creation, etc.). Audits are carried out by an auditor who has been trained in this field.


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## Autonomation | jap. Jidoka

Autonomation is a combination of the words automation and autonomous and refers to automation with a human touch.

Every machine in the work process should be able to operate without being constantly watched by an operator, and, if there is an abnormality, i.e. if a component breaks, it should shut off automatically, so that no defective parts are introduced further down the line.

Autonomation is one of the two pillars of the Toyota production system and is also referred to as "intelligent", simple or half automation, because in contrast to the full automation, because in contrast to the full automation, employees are involved in the introduction of automation. The goal is broad qualification beyond the operation of the system, i.e. the operating, repairing, testing and improving employees. Autonomation supports the qualification process.



## Auto unloading | jap. Hanedashi

The term auto unloading indicates that each machine automatically unloads the part, so all the operator has to do is load the machine.

> Auto unloading

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## BIM Building Information Modeling

Building Information Modeling (BIM) is a method to optimally plan, develop and manage buildings using software. All relevant building data is captured digitally, combined, and then networked. The result is a geometrically represented, virtual building model (computer model). BIM is used in the building sector (planning and development) and also in facility management.

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## Blue Sky

In a so-called blue sky workshop, a team elaborates on the ideal picture as it applies to their value streams.

Figuratively speaking, the team “gazes into the blue, cloud-free sky” to come up with an ideal, waste-free value stream.

This is used to develop the next possible target state and the project road map.



## Bottleneck

A bottleneck describes a work station in which the > **cycle time** is greater than the > **takt time**.

The time actually required exceeds the time available.



## Cardboard Engineering

Cardboard engineering is used to optimize and simulate working systems within a team.

Cardboard engineering is used to redesign working systems as a cardboard model by simulating work processes and verifying them as a whole.

Over the course of a 3 to 5-day intensive workshop, the creativity of all participants is used to significantly improve workspace design, ergonomics and best-point preparations with respect to material and tool readiness.

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## Chaku-Chaku line

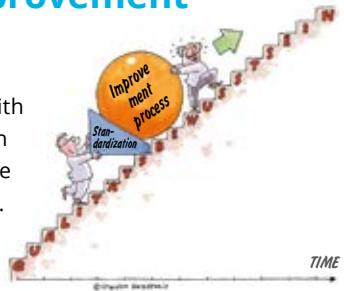
Chaku-Chaku is a standard term that applies to a lean production cell that has several features. The most significant of these features is multi-machine operation and highly standardized body and hand-movements, to achieve consistent and safe operation. Each machine in the cell has an > **LCIA**-type ejector, so that all the operator has to do is load the part.

## Change Agent

Change agents are those who initiate cultural change within an organization.

## CIP Continuous Improvement Process

Continuous improvement with an organization can occur on different levels and therefore requires different platforms. We differentiate between: **Employee CIP** for small, everyday problems and ideas



### 12-week project

for "medium-sized" improvements (which can be realized within 12 weeks at most) that are developed and implemented in one or more workshops, and

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### Large projects

for bigger changes within an organization that require more than 6 months and require corresponding cost, deadline and resource management.

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## Coaching

The learning and performance ability of the coachee is improved when the coachee is motivated by the coach to develop solutions to the problems encountered. This is called coaching. The coach is not an expert, but, under certain conditions, is often seen as a technical point of contact and is asked for advice or a personal opinion.

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## Cycle time

Cycle time is the actual time needed to carry out a work process. For an optimum production cycle time, the operator's cycle time matches the > **takt time**.

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## Deviation management

Deviation management is the ability to identify a deviation from a standard work process (= disruption) in a timely manner and to eliminate it.




## Doctor nurse principle

The operator creating the value (doctor) receives the materials and tools from the logistics provider (nurse), so that his/her primary activity is not interrupted by secondary activities.




## Drain

The drain is where materials are used. The place of origin / manufacturing site is called the > **source**.



## ECRS method


The ECRS method systematically considers the set-up process, but also work processes in general, with the aim of **e**liminating, **c**ombining, **r**earranging and / or **s**implifying work steps.



## EMIPS method

**EMIPS = Eliminate, Minimize, Integrate, Parallelize, Synchronize**

The EMIPS method is used to improve processes. It is implemented in order to carry out a structured assessment of processes or individual process steps with the goal of optimizing the approach used.



## **EPEI**

### **Every Part Every Interval**

The EPEI represents the frequency at which a so-called production goes through its full cycle and the same component is produced again. All components are produced once with one resource.

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## **Ergonomic work place**

An ergonomic work place that takes into consideration ergonomic aspects such as the operator's size, reach and range of motion (without turning or bending, if possible).

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## **External setup**

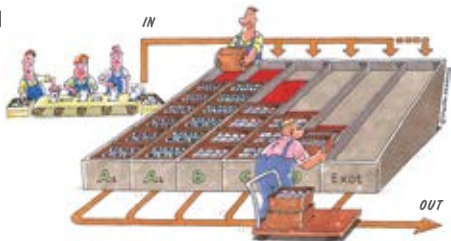
External setup denotes the steps and procedures during setup while the machine is still operating (preparation and follow-up).

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## FIFO

### First In First Out

FIFO is a storage and removal principle. The parts that were first stored are removed first.



## Fishbone principle

The fishbone principle means that several process chains are connected to the main stream and supply it synchronously.





## FMEA

# Failure Mode & Effects Analysis

FMEA is an analytical method using reliability techniques to find potential weak points. Used as a part of quality or safety management, FMEA is used preventively to avoid errors and increase technical dependability.

It is primarily applied in the development phase of new products or processes and is requested by suppliers of serial parts for the industry.



## Gemba | jap. for "Where it happens"

Gemba refers to the actual place in the workstation / production facility.



## Goods (unfinished) Work in progress (WIP)

Work in progress is the key figure that represents the value of the material in the process chain.

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## Hancho | jap. for "Group leader"

The Hancho is the first management level of the Lean organization. A hancho is the technical leader (Japanese chô) in one part of the process chain (Japanese han) and typically consists of 5 to 7 employees. The hancho masters all processes in his/her area, receives a slightly higher wage (5-10 %) than normal production employees and is selected and appointed by the company. The hancho's responsibilities include reacting to abnormalities and promoting standardized work and continuous process improvement.

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## Hanedashi | jap. for "Auto unloading"


> Auto unloading



## Heijunka | jap. for "Production leveling"

Leveled and smoothed loading of production demand guarantees regular processes and therefore less > **waste**. Leveling transforms ununiform order inputs into uniform production quantities.


Based on leveled production quantities, a production pattern in an unvarying sequence and with the smallest possible batch sizes is the determinant (smoothing). The Heijunka board depicts the specified production pattern for the production process. Heijunka enables a steady and synchronous production with little control effort.



## Hoshin Kanri | jap. for "Compass management"

Hoshin Kanri aligns the management and development of employees with the vision. Hoshin Kanri creates a connection between the vision, objectives, projects and success factors using tools and forms. The X matrix is a tool used to link breakthrough targets, annual targets, improvement projects and enablers. Involving all levels of management across all organizational functions helps align the organization and is a key component of Hoshin Kanri.

Management agrees on the goal and the common path (horizontal alignment) and communicates to the organization with "one voice." Hoshin Kanri can only be fully effective in the organization (vertical alignment) if there are no conflicting messages in the strategy.



## Ideal state

The ideal state in the lean world is represented by processes that are fully waste-free. Once there is no more obvious or hidden > **waste**, the process consists of 100 % value creation.

When defining the ideal state for a value stream or a process, the team has to see beyond current limits. Often, the team will come up with ideas to further reduce waste in order to reach the next target state. The target state is the achievable state that comes closest to the ideal state.



## Idle time

The idle time is the time that a material is in storage and waiting to be used in the process.



## Internal setup

Internal setup is the term used to encompass setup activities done when the machine is at a standstill.



## Inventory

Inventory is a type of > waste. Inventory includes all components, from raw materials to procured parts that are not immediately needed to meet customer orders.



## Jidoka | jap. for "Autonomation"

> Autonomation

## JIS

# Just-in-sequence

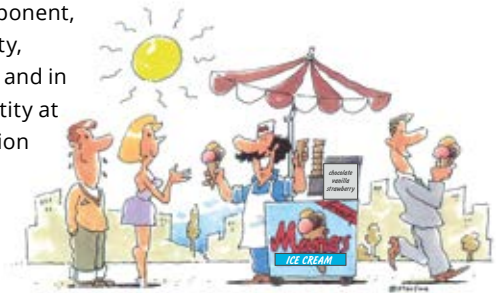
With the > **fishbone principle**, a side branch (pre-assembly) produces in the same sequence (= order) as the main branch.

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## JIT

# Just-in-time

The **right** component, the **right** quality, the **right** time, and in the **right** quantity at the **right** location (5R).



## **Kaikaku** | jap. for "Reform"

Kaikaku describes the radical improvement of a work process or business process - usually in one big step. The area of examination is larger than with > **Kaizen**.

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## **Kaizen** | jap. for "change" (Kai) and "good" (Zen)

Kaizen generally denotes continuous, incremental improvement (> **CIP**).

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## **Kanban** | jap. for "Sign, figurehead, order board, order card"

Cards (Kanbans) can be used to visually indicate when a material needs to be replenished, in accordance with the > **pull principle**. A Kanban serves as a carrier of information on the part, the quantity and the > **source** / > **drain** and signals according to the motto "If something's gone, it has to be replaced!" once the critical material inventory has been reached and new material has to be delivered.



Kanban cards replace traditional production or transportation orders. The Kanban system guarantees a smooth work process with minimal overproduction / minimal inventory.

The Kanban method can be used in all areas of the company, from administration to production.



## Kata | jap. for "routine" or "way of thinking and acting"

The term Kata comes from Japanese martial arts and stands for a type of dry run. It denotes a choreographed series of pre-defined movements that determines the sequence of a fight. In an actual fight, the opponents engage in an instinctive series of movements.

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Through the guided, routine processing of improvements in their own work area, the employee should be invited to intrinsically advance the > **CIP**. The > **mentor** accompanies the > **mentee** – improvement routine and mentoring routine work together. The improvement routine (Kata) consists of four steps:

1. Determine a vision or direction
2. Grasp the current condition
3. Define the next target condition
4. Conduct PDCA experiments (> **PDCA cycles**)



## KPI Key Performance Indicator

The “key performance indicator” refers to a key indicator that can be used to measure progress or degree of fulfillment with regard to important objectives within an organization, e.g. increase in EBIT by 15%. It should not be confused with the success factors that make

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> **Hoshin Kanri's** second cycle of indicators transparent as the interrelation between one's own actions and the indicator in the next higher employee level.



## LCIA

# Low Cost Intelligent Automation

LCIA is the automation of manual activities using the easiest methods available in the facility. In a multi-step process, existing manual activities are first made easier and then standardized. LCIA is set up so that it will stop when there is an error, to prevent the defective component from continuing down the line. When implementing LCIA, automated and manual work is to be kept separate.

Low Cost Intelligent Automation is primarily used in assembly, mechanical processing and internal transport.



## Lead time (also throughput time)

The lead time is the most important key figure in Lean philosophy and the lead time is proportional to the level of > **overproduction** and > **inventory** in the value stream.

It describes the time it takes for a part to either go through the entire process chain (from the starting machine to final assembly) or individual, clearly delimitable process chain sections.

“Lead time” refers to the throughput time of order processing including all procurement and distribution processes.

To calculate lead time in ...

... **Batch production:**

Processing time + transport time + idle time

... **Single-piece production:**

Time from order receipt to operation



## Leveling

Leveling is a component of > **Heijunka**.

Customer requirements are divided into equal quantities for each time unit (e.g. a shift or a day), so that the same quantity is produced and put into production according to the average requirement. If actual customer requirements and leveled quantities differ, these differences are balanced out by a finished goods supermarket.

A balanced dispatching of demand (leveling) is required to smooth production quantities. Ideally, the supplier and customer are synchronized.

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## Lighthouse project

The so-called lighthouse is the sub-area of a company in which the processes and structures come as close as possible to reaching the ideal state. As a prominent forerunner, this sector serves as an example for a company-wide implementation.

It provides direction, shows what is possible and therefore establishes the foundation of a successful roll-out.

## Machine cycle time

Machine cycle time is the time that a machine needs to produce a unit, including loading and unloading.



## Mentee

The mentee is the so-called student of the > **mentor**.



## Mentor

The term mentor goes back to Homer's saga, The Odyssey. Mentor was a friend of Odysseus and was responsible for accompanying and advising Odysseus' son Telemachus during his absence. He was like an uncle to Telemachus, an older person with life experience and wisdom. He encouraged and supported him and taught him to take responsibility.

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In the world of lean, the mentor strives to improve the competencies of his/her protégé, > **the mentee**, and thereby improve the level of problem-solving and improvement within the organization.

In contrast to the coach, the mentor has specialist knowledge, which is passed on to the mentee after carrying out the (learning) experiment.



## Milk run

The term milk run comes from the U.S., where a bottle of milk was only delivered to a home if an empty bottle was awaiting pickup on the doorstep. This ensured that the home never had too much milk and that it would not go bad.

The term milk run is used to describe a certain logistics concept. The key is to increase delivery frequency without increasing freight costs. Deliveries are no longer made one-by-one by each supplier in a star shape, but rather are done as a closed loop where several suppliers are connected to the recipient.



## Minimarket principle

A minimarket is a small storage area from which users can take parts, often located directly in the workstation. The minimarket is supplied by the > **supermarket**.

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## Mizusumashi | jap. for "water strider" or "bug"

Mizusumashi is the employee who is responsible for the material supply of the lines

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## Model mix

Defined sequence that ensures an even off-cycle of the (assembly) line.

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## MTM

# Methods Time Measurement

MTM is a process for analyzing work processes and determining planned and target times.

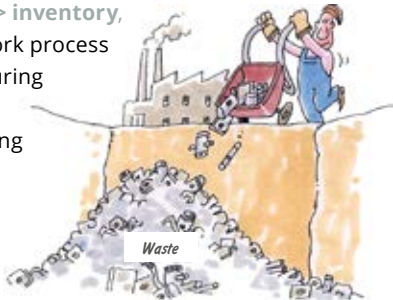
When using MTM, all movements performed by people are traced back to certain basic movements for which the required time is determined. The individual times are then used to determine the time required for an entire work process.

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## Muda | jap. for "Waste"

All processes that relate to the product and do not increase the value of it. **There are 7 types of waste by definition:**

> **overproduction**, > **inventory**, scrap, during the work process (overprocessing), during transport, during movement and during waiting time.



## Mura | jap. for "Scattering of standard values"

Lack of consistency in process quality, costs and delivery dates  
> waste (> Muda).

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## Muri | jap. for "Exaggeration" and "Overload"

Muri is the overburdening of all types of resources (equipment, operators), and results in wear and production downtime.

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## O & C Orderliness and cleanliness

Clean and tidy workplaces reduce > waste from searching (motion) and enable > visual management.

This makes it easier to detect and prevent deviations from standards.



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A lack of order and particularly a lack of cleanliness are also the cause for defective processes. The > **5S method** can be used to achieve orderliness and cleanliness.

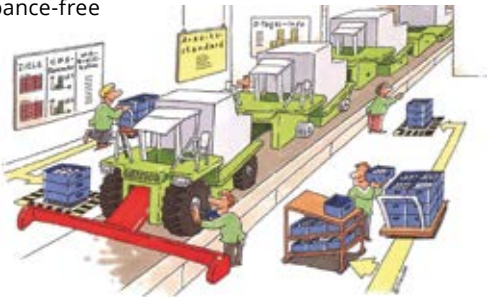


## One-piece-flow

Reduction of the > **lead time** through flow-optimized manufacturing.

In a one-piece-flow process chain (flow-optimized production), the parts are passed on from machine to machine without intermediate storage. The lead time is minimal if only part of it is passed on. This is only possible in closely connected work systems. Switching the work systems to one-piece-flow requires disturbance-free

processes and can therefore only take place if existing capacities are highly available.



## One-point lesson

A one-point lesson is a form of communication on a single topic, written and illustrated on one piece of paper.

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## Operator cycle time

Operator cycle time is the time it takes for an operator to complete a given process, including the time needed to load and unload parts, but excluding wait times.

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## OTED

### One-Touch Exchange of Die

The setup process is improved to such an extent that it can be carried out in a single step (one touch).

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## Overproduction

Overproduction is the worst of the seven types of waste: it is revealed through unnecessary in-house production parts and involves all other types of waste.

Lean uses the term > **inventory** to refer to purchased parts and raw materials.



## Pacemaker

The process within a value stream, the > **cycle time** of which is the closest to the > **takt time**, specifies the rhythm ("step") in a process chain.

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## Pareto cart

A pareto cart is used to help determine the waste characteristics of a product. They are sorted onto a cart so that the most frequent defects can be visualized. > **Pareto principle**

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## Pareto principle

According to the Pareto principle, named after Vilfredo Pareto (1848–1923), the effects of a problem (80 %) are most often due to a small number of causes (20 %).

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## PDCA cycle

The PDCA cycle was first proposed by Walter Stewhart and later developed by William Deming.

It consists of four phases:

**Plan - Planning phase**

**Do - Implementation phase**

**Check - Effectiveness test**

**Act - Standardization**

The PDCA cycle is usually repeated in the sense of continuous improvement.



## Point Kaizen

Point Kaizen is an improvement that is limited to a given work station (= punctual).




## **Poka Yoke** | jap. for "Prevention of unintentional mistakes"

Poka Yoke is any mechanism that helps prevent unplanned mistakes. It is about the introduction of simple, error-preventing mechanisms to consistently prevent incorrect installation, confusion or the transfer of defective parts.

Because stable and high quality processes begin long before the production phase, simple Poka Yoke measures can be implemented preventively in the construction and planning phase to ensure quality.

Poka Yoke is used effectively to prevent:

Leaving out or forgetting process steps, process or operational-related mistakes, incorrect or missing parts, setup or installation.





## PPM

### Parts per million

The error rate indicates that out of a million parts produced, a maximum of a predefined number may be defective. In the automotive industry in particular, failure rates are expressed in PPM. Car manufacturers demand low PPM rates from suppliers, e.g., in the electronics of built-in control units.

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## Production diary


The production diary is a fixed weekly schedule for the management team including supporting functions and is posted on the board for > **Shop Floor Management**.

It sets the daily shop floor discussions regarding daily activities and defines the daily activities to be carried out by the executives. This includes support for problem solving and process confirmation. It also defines who takes part in which meeting and when. Additional meetings must be scheduled around the times set out in the production diary.

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## Process chain

Process chains are directly aligned with a flow or "chain".  
The materials are only able to flow to the next process step.



## Product / machine matrix

The product / machine matrix represents which component families are produced on which machines. This matrix forms the basis for developing assembly lines and process chains.



## Production smoothing

Production smoothing is part of > **Heijunka**.  
A prerequisite for smoothing is uniform dispatching of the customer demand to production (leveling).  
When smoothing, the clocked / leveled quantities are broken down further into the smallest possible, equal production batches.

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By sequencing the batches for all components produced by one resource, a production pattern is created.

This is the guideline for a recurring production order that remains the same.

Smoothing is a prerequisite for synchronous production.

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## Project management

Project management is a structured method used to work through complex tasks or projects based on: Clearly defined organizational structure with defined tasks, competencies and responsibilities, clearly defined process structure, with defined methods, tools and resources.

The objective of project management is to provide a clear overview of “big” changes within an organization.


Projects are plans with a defined goal as well as constraints with respect to time, finances and personnel.

These projects are clearly differentiated from other projects and have a project-specific organizational structure.




## Pull principle

The pull principle is one of the four building blocks of lean production. The downstream process or concrete customer demand determine which component is delivered or produced when and in what quantity. Minimum / maximum inventory levels are defined between customers and suppliers. This thereby limits > **overproduction** quantities.



## Push principle

"Push production:" The downstream process or a prognosis are what determines the quantity delivered or processed, and when. This creates > **overproduction** between the work steps, the > **lead time** is longer and usually cannot be planned.



## Raw material

Raw materials are materials that are included in finished products as components.



## Regular communication

Regular communication is the regular, efficient and effective way of transmitting information.

So that all processes in an organization are implemented efficiently, all relevant information must be in the right place at the right time and in the required quality. One tool to ensure this is standardized, regular communication. Communication can, for example, be between management and employees, project teams, or employees working together across the value stream. Those involved can regularly exchange target-oriented, situational information on short-cycle projects.

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This standardized information flow creates clear channels of communication, ensures that information flows, and frees up time by, e.g., reducing the number of e-mails.



## Sequencing stability

This key figure sets the planned order (of the products to be manufactured / assembled) in relation to the actual order. The better the sequence stability, the more uniform the production and the more transparent and manageable the production control (> **just-in-sequence**).

## Sequential manufacturing

In sequential manufacturing, the sequencing of production materials is value stream-driven and production materials are connected using simple transportation devices.

Another characteristic of lean sequential manufacturing is that the machines specialize in only a few work steps (usually only one). With as little investment as possible, every single work step should be possible with the right sized equipment.

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## Sensei | jap. for "master" or "teacher"

A Sensei is an expert on "lean" production. The sensei passes on knowledge as a > **mentor**.

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## Set-up time reduction

To reduce the set-up time, the set-up process is observed and analyzed (e.g. using the **ECRS method**), the **> waste** is reduced, the concept developed is tested and standardized.

The defined process standard is the basis for training employees who carry out the setup process.

The goal of set-up reduction is to reduce **> overproduction**.

This is achieved through the production of small batches. To produce these batches without too much time loss, the set-up times must be kept as short as possible.





## SFM

# Shop Floor Management

The term SFM stands for improved management on the path towards becoming a learning organization and applies to all areas of the company. It achieves more because it offers methods that target the optimization of the interaction between

- a) Leaders and
- b) Leaders and employees.

The manager is supported in improving their leadership skills, the employee is supported in the problem-solving and improvement process. Switching between open questions from the supervisor and answers from the employee, each of which reveals their leadership / problem-solving competence, characterizes the joint discussion on site, i.e. where the problem occurred.

Shop Floor Management clearly defines management tasks and requires special modes of behavior. Management is supported by the application of specific tools.


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**Five Shop Floor Management-related tasks are carried out on-site and are as follows:**

- 1. Conduct regular communication**
- 2. Confirm processes**
- 3. Empower employees**
- 4. Promote continuous improvement of processes**
- 5. Solve problems in a structured manner**

For example, management keeps its comments to a minimum, only makes binding commitments, gives but also accepts feedback, gains its own perspective of a situation, allows mistakes in learning situations, does not lay blame and establishes questioning techniques.

SFM tools support the effectiveness of management, e.g., production diary, KPI charts, problem-solving sheet, T-card board.



## Signal Kanban

Every container is marked with a Kanban card or signal. When material is removed, the > **Kanban** is sent to the > **source** and added to the Kanban board.

The Kanban board reflects the exact inventory levels and depicts the level of > **overproduction** by > **source** and > **drain**. From the distribution of the cards in the color areas, the need for the next necessary setup process can be determined directly.



## SIPOC Supplier – Inputs – Process – Output – Customer

SIPOC is a tool from > **Six Sigma** for recording an overall process at the start of an improvement measure or project. SIPOC can be used to clearly delimit processes within a process chain. A SIPOC diagram illustrates a moment in time of a process



## Six Sigma

Six Sigma ( $6\sigma$ ) is a management system for process improvement, a statistical quality goal and at the same time a method of quality management. Its key element is to describe, measure, analyze, improve and monitor business processes using statistical methods.

As a rule, every quality characteristic leads to an undesired variation in process results. As a part of a so-called process capability inspection, deviations from the target state in relation to the tolerance level of the characteristics in question are identified. The standard deviation of the characteristic (the Greek letter  $\sigma$ , which is read as sigma) plays an important role. It measures the variance of the characteristic and how much the characteristics' values deviate from one another. The further the standards deviate from the range of tolerance, the more likely it is that the tolerance levels will be exceeded. Also, the further the mean is from the middle of the tolerance range (the closer it is to one of the tolerance levels), the greater the regression. That is why it is important to measure the distance between the mean and the closest tolerance range using standard deviations. This should never be exceeded.

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This distance, divided by  $3\sigma$  is the process capability index  $Cpk$ ;  $Cpk = 1$  if the mean is  $3\sigma$  from the closest tolerance level.

These techniques were named Six Sigma because Six Sigma requires that the closest tolerance level be at least six standard deviations ( $6\sigma$ , Six Sigma) from the mean. When this requirement is met, we can assume that a zero-error production has been met and that the tolerance levels are rarely exceeded.

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## SMED

### Single-minute exchange of die


Shigeo Shingo came up with this series of techniques to set up production equipment in less than 10 minutes.

(> set-up reduction)

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## Source


The place of origin / manufacturing site of materials is called the source. The place of consumption is called a > **drain**.



## Standardization


Standardization is the method that leads to standardized work, standard work and standards. Standardization ensures that optimum performance is continuously achieved, that resources are used efficiently and that quality remains consistent, regardless of the operator.

Standards describe the predefined procedure of processes and workflows. Standards are visually recognizable, making it easier to immediately identify errors and problems that deviate from the standard. Based on this, error stoppage measures, for example, can be determined, or a problem-solving process is initiated. Standards make it possible to more quickly and easily familiarize employees with the process.




## Standard layout

A standard layout diagram illustrates a workstation or cell and indicates how and in what order standardized work is performed.




## Standard work

Standard work describes the pre-defined process steps carried out by an employee during the > **cycle time**.



## Standard work combination sheet

A standard work combination sheet is a document that displays the process steps for one or several employees. It is used to display the optimum combination of human and machine work.



## Stop-the-line authority

The ability of workers to stop the process when there are problems and to pull the > **Andon** cord. This prevents defective parts from entering downstream processes.



## Supermarket


The term supermarket is used to identify an instrument that independently controls production. In a supermarket, all components can be found in a pre-defined area; they are organized for optimum reach, their inventory level is limited, and components are replaced as soon as they are used.





## Swim lane diagram


A swim lane flowchart is used to analyze and model business processes by illustrating the business processes as a flowchart. Various job responsibilities are placed horizontally in a (swim) lane, so that the transfer of responsibility or interfaces is more apparent.



## Takt time

Takt time is the basis for an even production rhythm. The cycle times of all production steps in production are aligned with the takt time.


To calculate the takt time, the available net working time is divided by the customer demand in the respective time. The customer requirement represents the number of end products required by the customer per unit of time.



## Target agreement

The term target agreement is used to describe a management technique in which management and employees reach an agreement regarding achieving company goals.


A target agreement consists of two elements: the goal and the measures used to achieve that goal, i.e. a combination of quantitative goals and action plans.



## Toyota Production System (TPS)

The TPS is the so-called source code of Lean Management. In the middle of the last century, Taiichi Ohno recognized how one can build up an efficient production only by using the scarcest means.


The goal of the TPS is to prevent > **waste**, reduce lead times and develop the problem-solving and improvement skills of employees.



# TPM


## Total Productive Maintenance

TPM is a standardized method used to obtain interruption-free production. **The goals of TPM are as follows:**

- » to increase machine availability by reducing plant interruptions
  - » reducing disturbance-related repair and effort for “putting out fires” to a minimum
  - » to recognize and eliminate equipment and material weak points
  - » to increase the identification of the employees with the plants and resources and to involve the employees in maintenance and repair work
  - » to increase plant production and
  - » to reduce total costs for maintenance through regular and standardized maintenance and inspection.
- 

## Transition period

The time which material requires to get from one work process to another. It is a combination of idle and transport time. Idle period is the time the material is in one place, e.g. a storage room.



## True north

In the world of lean, true north represents the target state: waste-free processes.

The term refers to the North Star, or true north. The North Star is approximately  $0.7^\circ$  from the North Celestial Pole and is visible from the Northern Hemisphere all year-round.

Because it is so close to the North Pole, it has long been used as a navigational aid. It can be used to verify compass readings for determine a ship's direction. It is visible to the naked eye and is always seen in the same location. Its height in the sky roughly corresponds to the northern line of latitude in which the observer is located.

The world of lean uses this term to denote an ideal state that can never change; a state that never moves.



## U-shape layout

The U-shape layout describes the layout of machines and workstations in a > **one-piece-flow**, where they are laid out in the shape of the letter “U”. The operator works within the U shape, thereby reducing necessary movement to a minimum. Material allocation is done outside of the U layout, making the process interruption-free.




## Value creation

In contrast to > **waste**, creation of value describes all tasks which add value to the product from the customer’s perspective.


## Value stream analysis / design

Value stream analysis / design is a method used to record and design value streams. Standardized symbols are used to represent material and information flow on a sheet of paper. The most important key figures that are determined from the value stream analysis are the > **lead time** and the lean index. In value stream design, the target state is modelled as the target value stream, and the implementation projects are based on this.



## Visual management

The visual management concept includes all principles, tools and standards that make it possible to visualize the information, so that management and employees can easily see and understand all related information. This makes it possible to quickly identify all deviations. Good visual management leads to immediate corrective measures (e.g. > **PDCA**, > **5W**) on the shop floor.



## Waste

As opposed to value creation, waste denotes all activities that, from a customer standpoint, add no value to a product.

Taiichi Ohno categorized waste into obvious waste and hidden waste. Obvious waste should be eliminated; hidden waste can only be minimized.

Taiichi Ohno also divided waste into seven types:

1. **Overproduction** (more parts are produced than currently needed)
2. **Inventory** (includes raw materials and purchased components)
3. **Scrap**
4. **Overprocessing** (processes not adapted, e.g. processes too large, ergonomics lacking)
5. **Transportation of material**
6. **Motion of employees within the workflow**
7. **Waiting times for employees**

It is important to be aware of the order these types are listed in: > **Overproduction** is the worst type of waste and triggers the other types of waste.



## Work in progress (WIP)

The key figure indicates the number of products that are in the process chain, > **overproduction** in the process chain.

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## Yokoten

The term “Yokoten” refers to methods for documenting and sharing knowledge on what does and does not work. So, “Yokoten” is a form of knowledge management.

Measures resulting from this in terms of BestPractice are only needed for other applications, however, if the transfer makes sense (i.e. is beneficial); so, if the same risk hazard is dominant in another case/area and it is expedient to adopt the measures preventively. NOT: “Blind transfer” of solutions/measures à

> **Muda: Overprocessing**

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## Zero defects principle

The zero defects principle is a basic lean management principle. Three basic rules are the basis of the zero defects principle:

- 1. Do not accept defective parts.**
- 2. Do not make any mistakes.**
- 3. Do not allow defective parts to move downstream.**

The zero-error principle promotes robust processes and is therefore the basis for three other lean features: flow, rhythm and pull.



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