



Glossary Module 25

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Glossary

5S- A set of concepts that help organizations ensure a clean and organized work place. 5S is a basic building block for Daily Management. The concepts, each starting with the letter “5,” are:

Sorting- Separates the necessary from the unnecessary. Unnecessary tools, equipment, and procedures are removed from the workplace.

Sweeping- Makes everything neat and clean by identifying potential problems. Unsafe conditions or damaged equipment are dealt with early in the process.

Standardizing- Defines how a task should be done and lets everyone involved in the process know the “best way” to perform tasks. Process changes are documented as they occur. Accelerated Improvement Rapid changes and improvements using a rigorous process made by employees who do the work in an organization.

Simplifying- Puts everything in its place and organizes material according to how frequently it is used. Visual aids are encouraged in order promote understanding.

Self-Discipline- Ensures that all housekeeping policies are adhered to, and usually paves the way for success in other Continuous Quality Improvement efforts.

Andon- Visual control tool that alerts supervisors to factory floor problems.

Paging Andon- Lit to request parts supplies.

Hire Andon- A group of Andon page the carts used for supplying carts.

Taxi Andon- Dispersed Andon pages the supply carts.

Andon Board- A visual control device in a production area, typically a lighted overhead display, giving the current status of the production system and alerting team members to emerging problems.

As-Is Process- Definition of a process the way it is currently performed.



Autonomation- Transferring human intelligence to automated machinery so machines are able to detect the production of a single defective part and immediately stop themselves while asking for help. This concept is also known as jidoka.

Batch-and-Queue- The mass production process of making large lots of a part and then sending the batch to wait in the queue before the next operation in the production process. Contrast with single-piece flow.

Brownfield- An established design or production facility operating with mass production methods and systems of social organization. Contrast with Greenfield.

Cell (also called Work Cell, Production Cell, Synchronized Production Cell)- A product-oriented layout which places the various machines in the exact sequence required to process a family of parts. Also applicable to non-manufacturing operations wherein functional tasks are co-located and sequenced to process paper transactions.

Chaku-chaku- A method of conducting single-piece flow in which the operator proceeds from machine to machine, taking a part from the previous operation and loading it into the next machine, then taking the part just removed from that machine and loading it in the following machine, etc. Literally means “load-load” in Japanese.

Changeover- The installation of a new type of tool in a metal working machine, a different paint in a painting system, a new plastic resin and a new mold in an injection molding machine, new software in a computer, etc. The term applies whenever a production device is assigned to perform a different operation.

Continuous Flow Production- An approach to production which stresses little or no in-process inventory. The eight conditions to establish this approach are: (1) one-piece flow, (2) lay out equipment according to the sequence of processes, (3) synchronization, (4) multi-process operations, (5) training of multi-process workers, (6) standing while working, (7) make equipment compact, and (8) create U-shaped manufacturing cells

Cycle Time- The amount of time to accomplish the standard work sequence for one product, excluding queue (wait) time. If the cycle time for every operation in a complete process can be reduced to equal Takt Time, products can be made in single-piece flow.

Five Whys- Taiichi Ohno’s practice of asking “why?” five times whenever a problem was encountered, in order to identify the root cause of the problem so that effective countermeasures could be developed and implemented..

Flow- The progressive achievement of tasks along the value stream so that a product proceeds from design to launch, order to delivery, and raw materials into the hands of the customer with no stoppages, scrap, or backflows.

Flow Time- The amount of time to accomplish the processing sequence, including queue (wait) and move times.

Gemba- The workplace, where the work of the department or organization is done.

Greenfield- A new design or production facility where best practices and Lean methods can be put in place from the outset. Contrast with Brownfield.

Group Technology Application- 1. Describing and arranging parts in groups based on similarities in their physical attributes (material, size and shape) and/or by their production sequences. 2. Establishing work cells that can produce parts by group.

Heijunka- The creation of a "level schedule" by sequencing orders in a repetitive pattern and smoothing the day-to-day variations in total orders to correspond to long-term demand. For example, if customers during a week order 200 of Product A, 200 of Product B, and 400 of Product C in batches of 200, 200 and 400 respectively, level scheduling would sequence these products to run in the progression A, C, B, C, A, C, B, C, A, C.....Similarly, if customer orders totaling 1,000 products per week arrive in batches of 200 products on day one, 400 on day two, zero on day three, 100 per day, and in the sequence A, C, A, B....Some type of level scheduling is unavoidable at every producer, mass or Lean, unless the firm and all of its suppliers have infinite capacity and zero changeover times. However, Lean producers tend to create excess capacity over time as they free up resources and to work steadily at reducing changeover times so the short-term discrepancy between the heijunka schedule and actual demand is steadily minimized, aided by level selling.

Hoshin Kanri- A strategic decision-making tool for an organization's executive team that focuses resources on the critical initiatives necessary to accomplish the business objectives of the organization. By using visual matrix diagrams similar to those employed for quality function deployment, three to five key objectives are selected while all others are clearly deselected. The selected objectives are translated into specific products and deployed down to the implementation level in the organization. Hoshin Kanri unifies and aligns resources and establishes clearly measurable targets against which progress toward the key objectives is measured on a regular basis. Also called policy deployment.

Inventory- In the broadest sense, inventory is all physical goods on hand that are to be consumed or transformed into a product by the business. Inventory includes all Work-in-Process (WIP) and goods used in manufacturing—specifically raw material, detail parts, assemblies, finished products, and supplies.

Inventory is also plentiful in service and support functions. This includes Information in Process (IIP) such as files, copies, in-baskets, routing lists, and periodic publications (biannual reports).

It also includes Decisions in Process (DIP) such as approval lists, long decision flows, delays, and multiple meetings.

When inventory is in place, it can be used to mask inefficiencies. By using inventory as a diagnostic tool, inefficiencies and flow time can be reduced.

JIT Production System- A market-oriented production system based entirely on serving customer needs. Goods are delivered to the production line just in time to be used, and in needed quantities. Virtually no inventory is required.

JIT Purchasing System- A materials management system where costs have been reduced through elimination of waste, inventory reductions and small lot purchases with frequent delivery just in time for use. Suppliers are chosen based on delivery, performance and price.

Just-In-Time (JIT also called Non-Stock Production) - JIT is the name Toyota gave to its own production system. The goal of JIT is to supply exactly the required products (parts, paper, service), in exactly the required time. JIT deliveries need to happen for all processes at all stages. This includes design information and external and internal suppliers at every step of the process until delivery of the final product to the external customer. It is the process where everyone and every process receive what they need, when they need it, in exactly the needed amount.

Just-In-Time production, though simple in principle, requires dedication and careful, hard work to implement properly. Once managers and employees have mastered the basic concept, they learn to devise various tools and techniques for putting that concept into practice. Notably, they learn to distribute the production of different kinds of items evenly through the day and week to allocate work evenly and thereby use resources optimally (leveled production). They learn to link each process organically to the preceding and following processes (pull system). They learn to make items literally one at a time wherever possible and emulate one-at-a-time processing in batch processing by reducing the size of batches (continuous-flow processing). Finally, they learn to establish a time frame for linking the pace of work in every process to the pace of sales in the marketplace (Takt Time).

Jidoka- When a machine has the capacity to detect when abnormality has occurred, when defects are being produced, and to stop itself from continuing to produce defective products (or when it has produced the required quantity).

Kaikaku- Radical improvement of an activity to eliminate Muda. For example, reorganizing processing operations for a product so that instead of traveling to and from isolated process villages, the product proceeds through the operations in single-piece-flow in one short space.

Kaizen- Gradual, unending improvement, doing little things better, setting - and achieving - ever higher standards. Kaizen is the lifeblood of standardized work. Kaizen furnishes the dynamism of continuing improvement and the very human motivation of encouraging individuals to take part in designing and managing their own jobs. Kaizen improvements in standardized work help maximize productivity at every worksite. Because standardized work involves following procedures consistently, any inherent problems in the working sequence surface repeatedly and conspicuously. Team leaders and their team members therefore can identify the problems easily. They can rectify the problems promptly. Similarly, monthly changes in production volumes require changes in the standardized work. Team leaders and team members devise new standardized work procedures to accommodate monthly changes in production volumes. Kaizen activities include measures for improving equipment, as well as measures for improving work procedures. But work kaizen tends to be easier, faster and less expensive than equipment kaizen. So, we usually start with work kaizen when we are trying to resolve a problem. If modifying the working sequence is insufficient to resolve a problem, we consider possible solutions through equipment kaizen.

Kanban- A directional device which gives information concerning: in what quantity, by what means, and how to transport it. Literal translation is a “visible record” for controlling production and inventory on the shop floor. Kanban is usually seen in the form of a card; however, it can be a special container or a token of other means. A kanban is a signal element used in the JIT system.

Kit- A kit is a group of parts or assemblies required for a single assembly or installation job, provided by a single supplier, and delivered to the point of use at the time needed. The kit configuration aligns with the associated design module; a kit may include required standards.

Lead Time- The total time a customer must wait to receive a product after placing an order. When a scheduling and production system are running at or below capacity, lead time and throughput time are the same. When the demand exceeds the capacity of a system, there is additional waiting time before the start of scheduling and production, and lead-time exceeds throughput time.

Lean Manufacturing- A production strategy in which all parts of the production system are focused to eliminate waste while continuously increasing the percentage of value-added work. Methodologies include designing assembly and fabrication for short flows, killing of details and subassemblies, in-process defect prevention, and Hardware Variability Control (HVC)/ Advanced Quality System (AQS).

Line Balancing- Balancing the assignment of tasks to work stations so that the number of people working on the line and the total amount of idle time are minimized.

Lot Production- Producing items for large-quantity production runs, as opposed to a one-piece flow approach.



Mistake-proofing- A defect-prevention system that builds into a design or production process devices that make mistakes impossible—for example, designing mating parts so they will fit together in only one way, tooling in such a way that assembly can only be accomplished in the correct way, or using menus on computers.

Mixed Production- An approach in which quick changeover allows production of different products in lot sizes approaching one. Production is responsive to the customers' orders.

Monument- A machine imposing a constraint. It is unable to be readily moved due to cost or size. A machine that has a set batch size due to equipment design limiting the economical reduction of lot sizes.

Motion- Any action within an operation which does not add value.

Muda- Any activity that consumes resources but creates no value - Muda is waste (see definition of waste). Womack and Jones in Lean Thinking defined two distinct types of Muda: Type 1: Non-value added activities that are currently required by the production system. Type 2: Non-value added activities that can be stopped immediately with no detrimental effect. Besides Muda there is also Muri: The waste of unreasonable expectations; and, Mura: The waste of unevenness or inconsistency.

Multi-machine working- Training of employees to operate and maintain different types of production equipment. Multi-machine working is essential to creating production cells where each worker utilizes many machines.

Multiskilled- Connotes a flexible work force, trained to operate effectively in a variety of skill classes and factory line positions.

One Less Process- Continuously learning how to satisfy your customer with “one less” unit of waste in the pipeline, while improving quality, delivery, and cost. The “one less” process exposes problems and constraints.

One-Piece Flow Production- One component of the Just-in-Time manufacturing system, whereby processing equipment is physically grouped together for ease of processing flow, allowing one person to perform all the steps necessary to process the part. This system eliminates wasted time between operations, paperwork, and unnecessary scheduling, while delivering a streamlined flow of products to exactly meet customer needs.

Open-book Management- A situation in which all financial information relevant to design, scheduling, and production tasks is shared with all employees of the firm, and with suppliers and distributors up and down the value-stream.

Operation- An activity or activities performed on a product by a single machine. Contrast with process.

Perfection- The complete elimination of Muda so that all activities along a value stream create value.

Pitch- The amount of time needed in a production area to make one container of products. The ideal state in any pull system is to eliminate all waste and create one-piece flow through the entire production system; however, we know that customers will not usually order one piece at a time, but in a standard pack-out quantity shipped in a container of some sort. When this occurs, we must convert our Takt Time into a unit called pitch. Pitch is the amount of time – based on Takt – required for an upstream operation to release a predetermined pack-out quantity of work in process (WIP) to a downstream operation. Pitch is therefore the product of Takt Time and the pack-out quantity.

Pitch Formula- Pitch = Takt Time x pack-out quantity. For example, if your Takt Time is 60 seconds and you want to move 20 pieces at a time, you would set a pitch of 20 minutes: Pitch = 60 seconds (Takt Time) x 20 pieces (pack-out) = 1,200 seconds = 20 minutes.

Plan-Do-Check-Action (PDCA) Cycle- The continuous sequence of actions or events necessary for improvement and control. Sometimes referred to as the Shewhart Cycle or Deming Wheel.

- P: Establishing a plan and methods for achieving your goal and predicting results.
- D: Enacting the plan—educating, doing.
- C: Measuring and analyzing the results—checking the results and methods.
- A: Implementing the necessary changes when the results are not as originally planned—acting to correct, maintain or improve.

Planning and Control- A set of enterprise-level and work-area-level processes for forecasting orders, planning capacity, scheduling production and jobs, ordering material, receiving and releasing parts and kits, controlling and tracking inventory, generating detailed schedules, and collecting shop-level information to track performance and manage daily work. Each process is used in varying degrees, depending on the business stream.

Poka-yoke- A mistake-proofing device or procedure to prevent a defect during order taking or manufacture. An order taking example is a screen for order input developed from traditional ordering patterns that questions orders falling outside the pattern. The suspect orders are then examined, often leading to discovery of inputting errors or buying based on misinformation. A manufacturing example is a set of photocells in parts containers along an assembly line to prevent components from progressing to the next stage with missing parts. The poka-yoke in this case is designed to stop the movement of the component to the next station if the light beam has not been broken by the operator's hand in each bin containing a part for the product under assembly at that moment. A poka-yoke is sometimes also called a baka-yoke.

PQ Analysis (PQA)- An approach to understanding flow production which analyzes the relationship between parts (“P”) and quantity/production output (“Q”). PQ analysis helps line up processes for flow production.

Process- A series of individual operations required to create a design, completed order, or product.

Processing Time- The time a product is actually being worked on in design or production and the time an order is actually being processed. Typically, processing time is a small fraction of throughput time and lead-time.

Process-Oriented Layout- A production layout where machines of the same type or tasks stand alone in departments, and the work does not easily flow to the next station.

Process Villages- The practice of grouping machines or activities by type of operation performed; for example, grinding machines or order-entry. Contrast with cells.

Production Lead Time- The time from placement of an order to the time the product is ready for the customer.

Product-Oriented Layout- A production layout where machines are arranged sequentially to facilitate quick processing of each item.

Pull Production System- A system where parts, supplies, and information are pulled by internal and external customers exactly when they are needed.

- In production, this refers to the production of items only as demanded for use, or to replace those taken for use.
- In material control, this refers to the withdrawal of inventory as demanded by the using operations. Material is not issued until a signal comes from the user.
- In distribution, this refers to a system for replenishing field warehouse inventories in which replenishment decisions are made at the field warehouse itself, not at the central warehouse or plant.

Push System- A traditional inventory system where parts are processed by their schedules, and pushed on to the next process regardless of whether they are needed at that time or not.

Queue Time- The time a product spends in a line waiting for the next design, order processing, or fabrication step.

Rapid Process Improvement Workshop (RPIW)- A team of people who do the work, fully engaged in a rigorous and disciplined five day process, using the tools of Lean to achieve immediate results in the elimination of waste.

Setup Reduction- Decreasing the amount of time necessary for changeover or setup to run a different lot or product.

Sensei- A personal teacher with the mastery of a body of knowledge, in this case Lean production.

Single-Minute Exchange of Die (SMED) - An element of Just-in-Time production systems, SMED is a practice that reduces machine set-up times to less than 10 minutes. One-touch setup is the term applied when changeovers require less than a minute. Obviously, the long-term objective is always zero setup, in which changeovers are instantaneous and do not interfere in any way with continuous flow.

Single-piece Flow- A situation in which products proceed, one complete product at a time, through various operations in design, order-taking, and production, without interruptions, backflows, or scrap. Contrast with batch-and-queue.

Small Lot Production- An approach that emphasizes the total elimination of overproduction generated by inventory and costs related to employees, land, and facilities needed for managing inventory. Two principle methods for small lot production are Single Minute Exchange of Die (SMED) and the use of kanban to control lot size. Small lot production is based on the principle that the elimination of overproduction is both more cost-effective and more customer-focused than mass production.

Spirit of Improvement- A mindset which includes ideas such as “Improvement is everyone’s job and is endless”, “Empower people to fix problems, not just study them”, and “Ask ‘why?’ and don’t say ‘can’t.’”

Standard Operations Combination Chart- A chart which displays the interaction of people and equipment so more efficient operations methods can be developed.

Standard Operation- The normal steps and time required to perform a specific operation.

Standardize-Do-Check-Act (SDCA) - The sequence of events necessary to stabilize and standardize a process, so that people perform it in a consistent, predictable, measurable way. Once a baseline about how the process is actually working is established, areas for improvement can be accurately identified.

Standardized Process- A process is standardized when it is set up to have uniform measures and designated as a model to be followed.

Standard Work Sequence- A precise description of each work activity specifying cycle time, Takt Time, the work sequence of specific tasks, and the minimum inventory of parts on hand needed to conduct the activity.

Standard Work- The basis for Kaizen. Standard work is a tool for maintaining productivity, quality, and safety at high levels. It provides a consistent framework for performing work at the designated Takt Time and for illuminating opportunities for making improvements in work procedures. We use three elements in structuring standard work: Takt Time, working sequence, and standard in-process stock. Takt Time is the pace of sales in the marketplace. The working sequence is the series of steps that we determine is the best way to perform a task. Standard-in-process stock is the minimum number of work pieces that we need to have on hand in a process to maintain a smooth flow of work. Standard work provides detailed, step-by-step guidelines for every job in the Lean production system. Team leaders determine the most efficient working sequence. With their team members, they make continuing improvements – kaizen – in that sequence. Kaizen thus begets new patterns of standardized work. Standard in-process stock is the amount of material that is flowing through a process when work is proceeding smoothly. It is the minimum amount of material needed to maintain a smooth flow of production without accumulating inventories.

SWIP (Standard Work in Process)

The number of patients required to keep the process flowing.

$$\text{SWIP} = \frac{\text{Lead Time}}{\text{Takt Time}}$$

Takt Time- The available production time divided by the rate of customer demand. For example, if customers demand 240 widgets per day and the factory operates 480 minutes per day, Takt Time is two minutes; if customers want two new products designed per month, Takt Time is two weeks per design. Takt Time sets the pace of production to match the rate of customer demand and becomes the heartbeat of any Lean system.

Throughput Time- The time required for a product to proceed from concept to launch, order to delivery, or raw materials into the hands of the customer. This includes both processing and queue time. Contrast with processing time and lead time.

Total Productive Maintenance (TPM) - (1) Total Productive Maintenance aims at increasing equipment effectiveness throughout the entire life of the equipment. TPM involves everyone in all departments and at all levels; it motivates people for plant maintenance through small-group and voluntary activities, and involves such basic elements as developing a maintenance system, education in basic housekeeping, problem-solving skills, and activities to achieve zero breakdowns.

(2) A series of methods, originally pioneered by Nippondenso (a member of the Toyota group), to ensure that every machine in a production process is always able to perform its required tasks so that production is never interrupted.



Toyota Production System (TPS)- A system of production, first developed at Toyota, that is based on the philosophy of total elimination of waste and the utmost in rationality in the way things are made. The key aspects of the system are Just-in-Time production (getting materials needed exactly when needed and in the quantity needed) “automation with a human touch” (including TPM, line-stop, visual control, etc.) balanced load-smoothing production, and “respect for humanity” through employee involvement in continuous improvement activities.

Value- A capability provided to a customer at the right time, at an appropriate price, as defined in each case by the customer.

Value Stream- The specific activities required to design, order, and provide a specific product, from concept to launch, order to delivery, and raw materials into the hands of the customer.

Velocity- The speed at which the production process turns an order into a finished product.

Visual Control System- Used on the shop floor to help management and workers know the production status. There are two types of systems: one is a production scheduling scoreboard; the other is like a traffic signal with green, yellow, and red lights that signify the state of quality, or problems, at each processing station.

- Progress toward the daily production goal (these are usually overhead scoreboards that are constantly updated during the shift).
- Identification of problems (red, yellow, and green lights that visually show the status of a processing station of machine. It may also be a simple light connected to an inspection device showing a “go/no-go” condition).

Waste- Any activity that occurs as a direct result of nonconformance to the valid requirements of customer—can usually be found in seven critical areas as defined by Taiichi Ohno, father of the Toyota Production System: Overproduction, Time on Hand (waiting), Transportation, Processing, Stock on Hand (inventory), Movement, Defective Products.

WIP (Work In Process)

The actual number of patients or elements in process at any given time, including those waiting.

Work- Any action within an operation which adds value. Further defined as Muri, Mura, Muda. Muri focuses on the preparation and planning of the process, or what can be avoided proactively. Mura then focuses on implementation and the elimination of fluctuations at the operations level, such as quality and volume. Muda is discovered after the process is in place and is dealt with reactively. It is seen by variation in output. It is the role of management to examine the Muda, or waste, in the process and eliminate the deeper causes by considering the connections to Muri and Mura of the system. The Muda, waste, and Mura inconsistencies, must be fed back into the Muri, or planning stage for the next project. The continuous cycle of self-examination allows for the outcomes to continuously improve. This brings in management's responsibility to provide and improve a flexible system and, to connect the workforce and the customer.

Sources:

JIT Implementation Manual, Hiroyuki Hirano, Productivity Press.

Lean Thinking, Womack and Jones, Productivity Press.

A World Class Production System, John Black, Thomson Learning (out of print).

Toyota Production System, Taiichi Ohno, Productivity Press.

Study of Toyota Production System, Shigeo Shingo, Japan Management Association and Productivity Press.

Just-In-Time For Today and Tomorrow, Taiichi Ohno with Setsuo Mito, Productivity Press.

Non-Stock Production: The Shingo System for Continuous Improvement, Shigeo Shingo, Productivity Press and Japan Management Association.

A Revolution in Manufacturing: The SMED System, Shigeo Shingo, Productivity Press.

Zero Quality Control: Source Inspection and the Poka-yoke System, Shigeo Shingo, Productivity Press.

Notes on the War – The War on Waste, edited by John Black, unpublished.

Lean Lexicon, The Lean Enterprise Institute.

Value Stream Management, Don Tapping, Tom Luyster and Tom Shuker.

The Toyota Way to Health Care Excellence: Increase Efficiency and Improve Quality with Lean (ACHE Management), John Black, Health Administration Press.

Lean Production, John Black, Industrial Press Inc.

Hoshin Kanri - Policy Deployment for Successful TQM; Yoji Akao, Editor; Productivity Press, 1991.

Hoshin Kanri for the Lean Enterprise; Thomas L. Jackson; Productivity Press, 2006.

Beyond Strategic Vision; Michael Cowley and Ellen Domb; Routledge; First Edition, 2011.

