

LEAN TERMINOLOGY

Activity Ratio (AR). An indicator of process efficiency, equal to the sum of the critical path **Process Times** for all the individual steps divided by the sum of the critical path **Lead Time**.

Andon. A visual control device used to show the current status of the process and/or system. The visual control usually takes the form of a lighted overhead display or series of lights that can signal normal and abnormal conditions in the process.

AR. See **Activity Ratio**.

Autonomation. A machine or process that immediately stops whenever a defect or abnormal condition occurs. This technique is an essential element in introducing one-piece flow to a process. Also referred to as **Jidoka**. Compare with **Mistake Proofing**.

Barriers to Flow. Any barrier, physical or not, that prevents the passing of one unit of work directly to the next process without the work stopping.

Batch and Queue. A processing method where multiple pieces of work (often referred to as a “batch” or “lot”) are processed and/or passed together from one operation to the next. Upon arrival at the next process, some or all of these pieces of work may wait in a “queue” to be worked on. Contrast with **One-Piece Flow**.

Cause-and-Effect Diagram. A visual root cause analysis tool used to brainstorm and document potential causes and subcauses for an undesired effect. The primary causes often used are referred to as the “6Ms,” standing for: man, machine, materials, methods, measurement, and Mother Nature (*Note:* More recently, “people” and “environment” are being used in lieu of man and Mother Nature.) Also referred to as an **Ishikawa Diagram** (after its developer) or **Fishbone Diagram** (due to its shape).

Cells. See **Layout for Flow**.

Changeover. The activity of converting a process from performing one type of work to another. Changeover time is the elapsed time from when the last good unit of the run is completed until the first good unit of the following run is completed. Changeovers can be physical (changing a fixture) or mental (orienting one’s self with the next “job”). Long changeovers often result in batch processing, inhibiting the ability to achieve one-piece-flow. This term is also commonly called **Setup**.

Checklist. A form used as a reference to ensure all of the key steps in a process have been completed. Checklists are often integrated into the standard work for an operation.

Check sheet. A simple form used to tabulate information regarding the type and frequency of an occurrence. Checksheets are often used to quantify data and provide direction for corrective

actions or continuous improvement activities. Results from checksheets often provide the input data for creating Pareto charts.

Co-location. See **Layout for Flow**.

Complete and Accurate (%C&A). See **Percent Complete and Accurate**.

Continuous Flow. A work process management system wherein workers only work on one unit at a time, and only one unit of work moves from process to process. Implementation of continuous flow can have significant impact on reducing throughput time, minimizing waste, and improving value-adding activity. This concept is also referred to as **Single-Piece Flow** or **One-Piece Flow**. Contrast with **Batch and Queue**.

Continuous Improvement. A philosophy of frequently reviewing processes, identifying opportunities for improvement, and implementing changes to get closer to perfection. See **Kaizen** and **Kaikaku**.

Countermeasure. A change to a process, designed to reduce or eliminate the root cause of an undesired symptom.

Critical Path. When parallel activities occur in a process, the critical path is the sequence of activities along the path with the longest lead time through the process from request to delivery.

Cross-Functional Team. A team composed of individuals representing different functions or departments within a given process. The team may be formed for a specific activity (e.g., a Kaizen Event), or the team may be more permanent in nature (a cross-functional team, co-located and cross-trained; put in place to support a specific product or customer).

Cross-Training. Training individuals to perform a variety of tasks and skills. In a lean environment, the focus of cross-training should be to increase competence along the value stream in order to optimize performance of that value stream.

CS. See **Current State**.

CT. See **Cycle Time**.

Current State (CS). All of the steps that are performed to complete the work as it is operating in today's environment (this is often quite different from how a written procedure states it should be done) as well as the issues and performance (metrics) of the process.

Cycle Time (CT). The frequency, or interval, of work being completed. Compare to **Process Time**; contrast with **Lead Time**.

Downstream. As viewed from a reference point, downstream processes are activities that take place after the reference point (e.g., transmitting a quote to the customer is a downstream process from writing the quote). Contrast with **Upstream**.

Effective. Measure of quality. How well is it done? All processes must be both efficient and effective. Contrast with **Efficient**.

Efficient. Measure of speed. How fast is it done? All processes must be both efficient and effective. Contrast with **Effective**.

Eighty (80%) Percent Rule. See **Pareto Principle**.

FC. See **Freed Capacity**.

FIFO. See **First In First Out** and **FIFO Lanes**.

FIFO Lanes. A type of **Pull Production** that is often used in administrative and nonstandard product environments. A FIFO lane is a coupling mechanism, which defines the maximum work-in-process (WIP) level between two processes. FIFO lanes are typically physical in nature, which provides supplying process workers with a clear visual indicator when they have authorization to produce and when they should stop (e.g., five color-coded folders between the design and estimating steps indicate design activities should stop if all five folders are full with work for the estimating process). Compare to **Kanban**.

First In First Out (FIFO). An order sequencing and control approach, which ensures that the first order entering the system is the first order to be worked on.

First Pass Yield (FPY). A quality metric that indicates process performance. First pass yield is expressed as a percentage and is calculated by dividing the number of “right the first time” units of work by the quantity of work entering the process. Similar to **%C&A**.

Fishbone Diagram. See **Cause-and-Effect Diagram**.

Five Ss (5Ss). An approach utilizing workplace organization and visual controls to improve performance. It is derived from the Japanese words *seiri*, *seiton*, *seiso*, *seiketsu*, and *shitsuke*. The English equivalents are sort, set-in-order, shine, standardize, and sustain. Safety is often referred to as the sixth “S,” but in traditional 5S programs, safety is assumed to be predominant throughout.

Five Whys. A root cause analysis tool used to identify the true root cause of a problem. The question “why” is asked a sufficient number of times to find the fundamental reason for the problem. Once that cause is identified, an appropriate countermeasure can be designed and implemented to eliminate recurrence.

Flow. The smooth, uninterrupted movement of a product or service through a series of process steps. In true flow, the work product (information, paperwork, material, etc.) passing through the series of steps never stops.

Flowchart. A schematic representation of a process, from start to finish, including inputs, outputs, paths, steps, and decision points. Traditional process maps are often depicted in flowchart form. Also referred to as a **Process Flowchart**. Contrast with **Metrics-Based Process Map**.

Flow Stopper. See **Barriers to Flow**.

FPY. See **First Pass Yield**.

Freed Capacity (FC). The amount of capacity created as a result of process improvements, typically expressed in number of full time equivalents (FTEs). It is calculated by subtracting the post-improvement sum of process times (in hours) from the pre-improvement sum of process times (in hours), and multiplying that value by the number of occurrences per year. To determine the freed capacity (the new number of FTEs required), divide the resulting product by 2,080 (number of scheduled work hours per year).

FS. See **Future State**.

FTE. See **Full-Time Equivalent**.

Full-Time Equivalent (FTE). Number of resources (usually people) required to run a process or series of processes if they were employed full time on that activity. For people, the number is usually based on 2,080 hours per year (i.e., 2,080 hours of work = one FTE) or 40 hours per week. Example: Four people working 20 hours per week each on the same activity, equals two FTEs.

Functional Arrangement. The grouping and management of resources based on similar activities or operations, as opposed to physically arranging and managing a work team based on the sequence of process steps. An example would be where all the design engineers sit together, separate from the drafting staff. Contrast with **Layout for Flow**.

Future State (FS). A plan for how a process is planned to be running at a defined point in time in the future. Serves as the primary input for the development of an implementation plan. Future state value stream maps are usually developed looking three to twelve months into the future.

Gemba. A Japanese word for the “real place” or the place where the work actual occurs. To understand the real issues that affect a process, it is critical to go to gemba and see what is actually happening.

Genchi Genbutsu. A Japanese term that refers to seeing for yourself. Genchi genbutsu is the act of going to gemba.

Heijunka. See **Level Loading**.

Ishikawa Diagram. See **Cause-and-Effect Diagram**.

Jidoka. See **Autonomation**.

JIT. See **Just-in-Time**.

Just-in-Time (JIT). A process management system utilizing the concept of flow to produce goods and provide services only when needed and only in the quantity needed.

Kaikaku. Radical process improvement over a short period of time—innovation. Changes of this type are often implemented during the course of a **Kaizen Event**.

Kaizen. An improvement philosophy in which continuous incremental improvement occurs over a sustained period of time, creating more value and less waste, resulting in increased speed, lower costs, and improved quality. When applied to a business enterprise, it refers to ongoing improvement involving the entire workforce including senior leadership, middle management,

and frontline workers. Kaizen is also a philosophy that assumes that our way of life (working, social, or personal) deserves to be constantly improved.

Kaizen Event. A structured, team-based, problem-solving activity of short duration used to improve processes throughout an organization. Activities typically include: 1) team training, 2) current state analysis, 3) future state design, 4) prioritization of improvements, 5) train on new process, and 6) implementing the selected improvements. Duration is typically one to five days. The event team is focused on the process 100 percent of time during the event and is cross-functional in composition. Also referred to as Kaizen Blitz and Rapid Improvement Event (RIE).

Kanban. A type of **Pull Production** system whereby the downstream process signals the upstream process to replenish what has been consumed. Kanbans typically pull by part number. Kanban means signboard in Japanese. Compare to **FIFO Lanes**.

Layout for Flow. The co-location of processes and/or equipment in sequence to permit one-piece flow and the flexible deployment of workers to operate multiple processes (resources). The resources found in cells are often cross-functional in nature. Also referred to as **Cells**, or **Cellular Arrangement**. Contrast with **Functional Arrangement**.

Lead Time (LT). The amount of time it takes for a product (or service) to go through the system, from the first operation to the final operation, including processing, delays, movement, queues, etc. At a process level, the process lead time begins when the work is received and ends when the work is delivered to the next downstream customer. $Lead\ Time = Process\ Time + Wait\ Time$ (or delays). Also referred to as **Throughput Time** or **Turnaround Time**.

Lean. The philosophy of aggressive, continuous improvement executed through defining value from the customer's perspective; mapping the value streams; creating flow; working at the pull of the customer; and pursuit of perfection.

Level Loading. The leveling of quantities and types (mix) of products/services produced for the customer. Also referred to as **Heijunka** or **Production Smoothing**.

Line Balancing. See **Work Balancing**.

LT. See **Lead Time**.

MBPM. See **Metrics-Based Process Mapping**.

Metrics-Based Process Mapping (MBPM). A visual, micro-level process mapping technique that separates tasks into separate rows based on who the person or functional area is that is performing the tasks. These rows are sometimes referred to as swim lanes. The tasks are depicted in a sequential format such that a timeline can be created, which depicts total lead time. MBPM process blocks contain at a minimum the: process time, lead time, and %C&A for that step. Contrast with traditional **Flowcharts**.

Mistake Proofing. A device or procedure designed to prevent the generation of defects. The English translations for this Japanese phrase are: poka, which means “error” and yoke, which means “to avoid.” Also referred to as **Poka-Yoke**.

Muda. A Japanese word for waste. See **Non-Value-Adding** and **Waste**.

Multifunctional Workers. Individuals trained and qualified to perform a variety of tasks. In a lean operation, workers are typically cross-trained on operations upstream and downstream of their primary work, so they can support the value stream should problems occur.

Necessary Non-Value-Adding. Activities that add no value from the customer’s perspective but are required in order to operate the business. This could include legal and regulatory requirements, as well as certain internal business processes, which would put the business at risk if eliminated in today’s environment. Necessary non-value-adding is often referred to as Type I Muda. Contrast with **Unnecessary Non-Value-Adding**.

Non-Value-Adding (NVA). A task that the customer does not care about and would be unwilling to pay for if he/she knew the incremental cost of that task. The attribute of a task or activities that can be eliminated from a process without deterioration of the function, performance, or quality of a product or service as viewed by the customer. Two types of non-value-adding activity exist: **Necessary NVA** and **Unnecessary NVA**.

NVA. See **Non-value-adding**.

OEE. See **Overall Equipment Effectiveness**.

One-Piece Flow. See **Continuous Flow**.

Operation. An activity performed on a product or service. An operation is a component of **Process**. Also referred to as **Task**.

Overall Equipment Effectiveness (OEE). A measure of how effectively equipment is utilized during scheduled operating time. $OEE = (\% \text{ time available}) \times (\% \text{ of designed output rate}) \times (\% \text{ First Pass Yield})$. OEE is particularly useful when assessing how well critical equipment is utilized. Examples include medical equipment in healthcare, duplication equipment in the publishing industry, computers in many industries, vehicles and equipment in law enforcement, etc. Factors such as cost and available capacity are key determinants in evaluating OEE.

PACE Chart. A graphic used to help quickly prioritize a list of improvement ideas based on ease of implementation and anticipated benefit.

Pareto Chart. A graph or chart, based on the Pareto Principle, that ranks occurrences from the most frequent to the least frequent. Pareto charts are often used to prioritize improvement activities. **Checksheets** are a common input to creating a **Pareto Chart**.

Pareto Principle. The concept that most of the effects in a situation can be traced back to a small number of contributors. In the early 1900s Wilfred Pareto observed that 80 percent of the property in Italy was held by only 20 percent of the population. Joseph Juran later observed that

this 80/20 relationship is, in fact, quite common and coined this phenomenon as “The Pareto Principal.”

PDCA. See **Plan–Do–Check–Act**.

Percent Complete and Accurate (%C&A). A quality metric used to measure the degree to which work from an upstream supplier is determined by the downstream customer to be complete and accurate (or error free). In other words, to what degree does the downstream customer need to: 1) correct information that is incorrect; 2) add missing information that should have been supplied by an upstream supplier; and/or 3) clarify information provided. Out of 100 “things” passing to the downstream customer, what percentage is complete and accurate and do not require one of the three above actions before completing the task? The number is obtained by asking the immediate, or successive, downstream customer(s) what percentage of the time they receive work that is 100 percent complete and accurate.

Percent Value-Adding. See **Activity Ratio**.

Plan–Do–Check–Act (PDCA). The basic steps to be followed in making continuous incremental improvements (kaizen), adapted by W. Edwards Deming from Walter Shewart’s PDSA Cycle (S = Study).

Poka-Yoke. See **Mistake Proofing**.

Process. An operation or group of operations that receives inputs, performs an activity, and then provides outputs to an internal or external customer.

Process Flowchart. See **Flowchart**.

Process Time (PT). The amount of time it takes to perform a task (or series of tasks) if the worker could work uninterrupted. For example, if one enters data for 2 minutes, places a call to obtain additional information, waits for 10 minutes for the call to be returned, talks with the information supplier for 3 minutes, and finishes data entering in 1 minute, the process time is six minutes (2 + 3 + 1). Process time plus wait time (or delays) = lead time. This time is related to **Takt Time** such that if every operation in a complete process has a process Time equal to or less than the takt time, then the product or service can be made in **One-piece Flow**. Also referred to as **Touch Time** or **Cycle Time**.

Product Family. A group of products or services that pass through similar process steps. In the service sector, product families are often referred to as **Service Families**.

Production Smoothing. See **Level Loading**.

PT. See **Process Time**.

Pull Production. A **work-in-process (WIP)** management approach whereby the downstream process authorizes upstream production through the consumption of work. Common pull systems include **One-Piece Flow**, **Kanban** and **FIFO Lanes**.

Push Production. A system where an upstream process produces as much as it can without regard to the actual requirements of the next process and sends them to the next process whether they have capacity to begin work or not. Push Production typically results in queues of work building up, which result in delays.

Queue Time. The amount of time that product, people, information, or material waits to be worked on. Also referred to as “wait time.”

RCA. See **Root-Cause Analysis.**

Reliability. The ability of a process to produce the same results (product or service) over repeated cycles.

RFPY. See **Rolled First Pass Yield.**

Rolled First Pass Yield (RFPY). A quality metric for determining the percentage of work going through a series of process steps that is error free. RFPY is the product of the percent yield (or %C&A) of all of the process steps. For example, in a three-step process, if the %C&A is 80 percent at the first step, 75 percent at the second step, and 90 percent at the third step, the rolled first pass yield = $80\% \times 75\% \times 90\% = 54\%$. In this example the 54 percent RFPY means that only 54 percent of the things going through the process pass through the process “completely and accurately.”

Root Cause Analysis (RCA). A problem-solving approach whereby the underlying cause of a problem is first identified and only then is the corrective action or solution designed. The intent of RCA is to reduce or eliminate recurrence of the same problem. RCA tools include **Five Whys, Cause-and-Effect Diagrams, Check Lists** and **Pareto Charts.**

Sensei. A Japanese word for teacher or master. In lean circles, sensei typically refers to an individual who has been led numerous lean transformations.

Service Family. See **Product Family.**

Setup. See **Changeover.**

Single-Piece Flow. See **Continuous Flow.**

Spaghetti Diagram. A diagram representing the physical path taken by a product (or service) as it travels through all the steps required to transform a requirement into a deliverable. This can also be used to draw the path walked by those involved in completing the required activities to deliver the product (or service). The diagram derives its name from the way it commonly looks after mapping a process because the diagram looks much like a plate of spaghetti.

Stakeholder. Anyone who has an interest in a process, typically the suppliers, customers, and people who actually perform the work.

Standard Work. Documentation of the best known method for completing a task or activity. This becomes the way for everyone working on that process to perform the work. This also

becomes the baseline for future work. In the words of Taichii Ohno, “Where there is no standard, there can be no kaizen (improvement).”

Takt Time (TT). The pace at which work must be completed in order to meet customer demand. To calculate, divide the available work time by the customer demand for that period. For example, if a call center receives 900 calls per shift, and there are 27,000 seconds of available work time, the takt time is 30 seconds per call. Therefore, one call must be completed every 30 seconds to meet customer demand. Takt, a German word, meaning pace, is the heartbeat of any lean system. **Process Time** divided by **Takt Time** yields the number of workers required to support a specific product.

Task. See **Operation**.

Throughput Time. See **Lead Time**.

Total Quality Management (TQM). A management approach which evolved out of the work of quality pioneers including Deming, Juran, Ishikawa and Shewart. TQM focuses on the delivery of quality product and quality services to achieve customer satisfaction, concepts that provided the foundation for the Toyota Production System.

Touch Time. See **Process Time**.

TQM. See **Total Quality Management**.

TT. See **Takt Time**.

Turnaround Time. See **Lead Time**.

Upstream. As viewed from a reference point, upstream processes are activities that take place prior to the reference point (e.g., receiving a request for a quote from the customer is upstream to writing the quote). Contrast with **Downstream**.

Unnecessary Non-Value-Adding. Activities that add no value from the customer’s perspective nor are they necessary to properly run the business. These activities are often legacy in nature (“we’ve always done it that way”). Unnecessary non-value-adding activities are often referred to as Type II Muda.

VA. See **Value Adding**.

Value. A customer-defined desired feature or attribute provided at the right time and at an appropriate price.

Value Adding (VA). Any activity which, from the ultimate customer’s perspective is of value, such that the customer is willing to pay for that activity, or that that activity is a condition of doing business with that customer.

Value Stream. The specific activities required to design, order, and provide a specific product or service from the point of product (or service) concept, through launch, ordering raw materials, production, and placing the product (or service) in the hands of the customer. From a share-

holder's perspective the value stream could also include the steps and time required until the receipt of revenue.

Value Steam Map (VSM). A high-level, visual representation of all of the process steps (both VA and NVA) required to transform a customer requirement into a delivered good or service. A VSM shows the connection between information flow and product flow, as well as the major process blocks and barriers to flow. Value stream maps are used to document current-state conditions as well as design a future state. One of the key objectives of value stream mapping is to identify non-value-adding activities for elimination. Value stream maps, along with the Value Stream Implementation Plan are strategic tools used to help identify, prioritize, and communicate continuous improvement activities.

Visual Management. An approach to managing products, people, and processes using low-cost, easy-to-understand visual devices. These devices, when properly utilized, will quickly and effectively communicate objectives, performance, operating conditions, and problems.

VSM. See **Value Stream Map.**

Waste. Any activity that consumes resources, but does not provide value as defined by the customer. Also referred to as **muda** or **non-value-adding activities**. The eight common types of waste are:

- Overproduction
- Overprocessing
- Waiting
- Inventory
- Defects
- Motion (by people)
- Transportation (of product/material)
- Underutilization of people

WIP. See **Work-in-Process.**

Work Balancing. Designing processes so that the Process Time for each person is equal or slightly less than the Takt Time that is required to meet customer demand. Also referred to as **Line Balancing.**

Work-in-Process (WIP). Work that has been made available to be worked on, has been initiated, or has been completed but has not yet been released to the downstream customer.