# LEAN – GLOSSSARY & ACRONYMN LIST

| TERM | SOURCE REF | DESCRIPTION |
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| ***ABC*** | Rich et al. (2006) | A means of categorising products, failures or other group of observed issues such that the most important sources can be identified in terms of the impact and volume. 'A' classifications are therefore the most important, and 'C' the least and this allows problem solving to be directed to those issues/ problems with the most potential benefit to the company. |
| ***Agile manufacturing*** | Rich et al. (2006) | The ability to accommodate change responsively in terms of volume and mix flexibility. |
| ***Andon / Andon board*** | Miller & Schenk (1986) | A system of flashing lights used to indicate production status in one or more work centres; the number of lights and their possible colours can vary, even by work centre within a plant; however, the traditional colours and their meanings are:<br>▪ Green: No problem.<br>▪ Yellow: Situation requires attention.<br>▪ Red: Production stopped; attention urgently needed. |
| | Womack & Jones (1996) | 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. |
| ***Acceptable Quality Level (AQL)*** | Miller & Schenk (1986) | An outmoded concept which holds that there is some non-zero level of permissible defects. |
| ***Autonomation*** | Miller & Schenk (1986) | In Toyota parlance, automation with a human touch; English translation of ***jidoka***. |
| | Tapping & Fabrizio (2001) | Automation with a human touch (see ***jidoka***). The second of the two major pillars of the TPS (the first pillar is ***JIT***). |
| | Womack & Jones (1996) | 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, also known as ***jidoka***, was pioneered by Sakichi Toyoda at the turn of the twentieth century when he invented automatic looms that stopped instantly when any thread broke. This permitted one operator to oversee many machines with no risk of producing vast amounts of defective cloth. |

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| ***Autonomous maintenance*** | Rich et al. (2006) | Those activities of routine equipment maintenance conducted by individuals and small groups to a level of safety and quality assurance established by the business/ engineering specialists. This is the front line of maintenance activity and is used to detect and correct abnormalities quickly. [See ***TPM***]. |
| ***Batch-and-queue*** <br><br> ***(a.k.a Batch-and-push)*** | Rother & Shook (2002) | Producing more than one piece of an item and then moving those items forward to the next ***operation*** before they are actually needed there. Thus items need to wait in a queue. Contrast with ***continuous flow***. |
| | Womack & Jones (1996) | The mass production practice 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***. |
| ***Benchmarking*** | Tapping & Fabrizio (2001) | A structured approach to identifying a world-class process, then gathering relevant information and applying it within your own organization to improve a similar process. |
| ***Buffer inventory (a.k.a. buffer stock)*** | Tapping & Fabrizio (2001) | Finished goods available to meet variation in customer demand due to fluctuations in ordering patterns or ***takt time***. |
| ***CANDO*** | Bicheno (2000) | [An alternative nomenclature for 5S campaign. The C's stand for …] ***C leanup, A rranging, N eatness, D iscipline*** and ***O ngoing improvement***. [See also ***5Cs***]. |
| ***Catch-balling*** | Hines et al (2002) | The feedback and agreement process for plans within ***policy deployment***. |
| ***Cells*** | Rother & Shook (2002) | Operating a true ***continuous flow*** on machines and workstations placed close together in order of processing, sometimes in a "U" shape. Cell operators may handle multiple ***processes***, and the number of operators is changed when the customer demand rate changes. The "U" shaped equipment layout is used to allow more alternatives for distributing the work elements among operators, and to permit the leadoff and final operations to be performed by the same operator. |
| | Womack & Jones (1996) | The layout of machines of different types performing different ***operations*** in a tight sequence, typically in a U-shape, to permit single-piece flow and flexible deployment of human effort by means of ***multi-machine working***. Contrast with ***process villages***. |
| ***Cellular manufacturing*** | Miller & Schenk (1986) | An approach in which manufacturing work centres [cells] have the total capabilities needed to produce an item or group of similar items; contrasts to setting up work centres on the basis of similar equipment or capabilities, in which case items must move among multiple work centres before they are completed; the term ***group technology*** is sometimes used to distinguish cells that |

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| | | produce a relatively large family [group] of similar items. |
| | Rich et al. (2006) | A layout choice that involves the co-located configuration of machinery in a manner that the output of one machine directly feeds the next or feeds a small buffer before the next. The ideal cell adopts an approach of 'one ***[single] piece flow***'. |
| ***Chaku-chaku*** | Womack & Jones (1996) | 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 in 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*** | Rother & Shook (2002) | When a piece of equipment has to stop producing in order to be fitted for producing a different item. For example, the installation of a different processing tool in a metal working machine, a different colour paint in a painting system etc. |
| | Womack & Jones (1996) | 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 mould in an injection moulding machine, new software in a computer, and so on. The term applies whenever a production device is assigned to perform a different ***operation***. |
| ***Continuous flow [production] (a.k.a. single-piece flow or one-piece-flow)*** | Tapping & Fabrizio (2001) | The ideal state characterized by the ability to replenish a single part that has been "***pulled***" downstream. In practice, continuous flow is synonymous with ***JIT*** production, which ensures that both internal and external customers receive *only* what is needed, *just when* it is needed, and in the *exact amounts* needed. See also ***JIT production***. |
| | Rother & Shook (2002) | … items are produced and moved from one processing step to the next one-piece-at-a-time. Each ***process*** makes only the one piece that the next ***process*** needs, and the transfer batch size is one. Contrast with ***batch-and-queue***. |
| ***Constraint*** | Rich et al. (2006) | The bottleneck or limiting factor (either equipment, human or management policy) which limits the throughput and output of production. A concept developed by Eli Goldratt using the 'theory of constraints' approach to operations management. |
| ***Control chart*** | Imai (1997) | A chart with upper and lower control limits on which values of some statistical measures for a series of samples or subgroups are plotted. The chart frequently shows a central line to help detect a trend of plotted values towards either control limit. |
| ***Continuous*** | Rich et al. (2006) | See ***kaizen***. |

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| ***improvement*** | | |
| ***Cycle time*** | Tapping & Fabrizio (2001) | The time that elapses from the beginning of a ***process*** or operation until its completion. |
| | Rother & Shook (2002) | How frequently an item or product actually is completed by a ***process***, as timed by direct observation. Also, the time it takes an operator to go through all of his or her work elements before repeating them. |
| | Womack & Jones (1996) | The time required to complete one cycle of an ***operation***. If cycle time for every ***operation*** in a complete ***process*** can be reduced to equal ***takt time***, products can be made in ***single-piece flow***. |
| ***Defects*** | Rich et al. (2006) | The manifestation of an error within the production system which results in 'un-saleable' products or stopped administrative process. An error represents a deviation, by humans or machines. [One of the ***seven wastes***]. |
| ***Demand/ customer demand*** | Tapping & Fabrizio (2001) | The quantity of parts required by a customer. See also ***takt time***. |
| ***EPEI (Every-Product-Every Interval)*** | Rother & Shook (2002) | A measure of production ***batch size***.<br><br>For example, if a machine is able to ***change over*** and produce the required quantity of all the high-running part types dedicated to it within three days, then the *production* ***batch size*** for each individual part type is about three days worth of parts. Thus this machine is making every part every (EPE) three days. |
| ***Error proofing*** | Rich et al. (2006) | The design of processes and devices which prevent the creation of errors and defects through physical means. Eg the prevention of accidental consumption of tablets through the introduction of caps to medical bottles that can only be opened by adults. [See ***poke-yoke***]. |
| ***Fabrication process*** | Rother & Shook (2002) | Segments of the ***value stream*** that respond to requirements from internal customers. Fabrication ***processes*** are often characterized by general-purpose equipment that ***changes over*** to make a variety of components for different downstream processes. Compare to ***pacemaker process***. |
| ***FIFO (First In, First Out)***<br><br>***(a.k.a. CONWIP –*** | Rother & Shook (2002) | Material produced by one ***process*** is used up in the same order by the next process. FIFO is one way to regulate a queue between two decoupled processes when a ***supermarket*** or ***continuous flow*** are impractical. A FIFO queue is filled by the supplying process and emptied by the customer process. When a FIFO queue gets full, the supplying process must stop producing until the |

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| ***Constant Work in Progress)*** | | customer process has used up some of the inventory. |
| ***Five Cs (5C)*** | Imai (1997) | [An alternative nomenclature for 5S campaign. The C's stand for …] ***clear out, configure, clean and check, conform*** and ***custom & practice***. [See also ***CANDO***]. |
| ***Five Ms (5M)*** | Imai (1997) | A method for managing resources in ***gemba*** – manpower, machine, material, method and measurement. [LINK: Ishikawa diagram 'spines']. |
| ***Five Ss (5S)*** | Imai (1997) | A checklist for good housekeeping to achieve greater order, efficiency and discipline in the workplace. It is derived from the Japanese words ***seiri, seiton, seiso, seiketsu*** and ***shitsuke*** and adapted to the English equivalents of ***sort, straighten, scrub, systemise*** and ***standardise***. In some companies it is adopted as the ***5Cs*** campaign [or alternatively ***CANDO***]. |
| | Womack & Jones (1996) | Five terms beginning with S utilised to create a workplace suited for visual control and ***lean production***. ***Seiri*** [sort] means to separate needed tools, parts, and instructions from unneeded materials and to remove the latter. ***Seiton*** [straighten] means to neatly arrange and identify parts and tools for ease of use. ***Seiso*** [scrub] means to conduct a cleanup campaign. ***Seiketsu*** [systemize] means to conduct ***seiri***, ***seiton*** and ***seiso*** [scrub] at frequent, indeed daily, intervals to maintain a workplace in perfect condition. ***Shitsuke*** [self discipline] means to form the habit of always following the first four Ss. See also ***shine, sort, standardize*** and ***sustain***. |
| ***Five whys*** | Womack & Jones (1996) | 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. |
| ***Flexible Manufacturing System (FMS)*** | Miller & Schenk (1986) | An integrated manufacturing capability to produce small numbers of a great variety of items at low unit cost; a FMS is also characterised by low changeover time and rapid response time. |
| ***Flow*** | Tapping & Fabrizio (2001) | The movement of material or information. Manufacturing businesses are successful to the extent that they are able to move material and information with as few disruptions as possible – preferably none. |
| | Rother & Shook (2002) | A main objective of the entire ***lean production*** effort, and one of the key concepts that passed directly from Henry Ford to Taiichi Ohno (Toyota's production manager after WWII). Ford recognised that, ideally, production should flow continuously all the way from raw materials to the |

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| | | customer and envisioned realising that ideal through a production system that acted as one long conveyor. |
| | Womack & Jones (1996) | 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. |
| ***FMEA (Failure Mode and Effect Analysis*** | Imai (1997) | An analytical tool used to predict and eliminate in advance any potential design defects in a new product by analysing the effects of failure modes of component parts on the final product performance. FMEA is also used for design review activities of a new production facility (called ***process FMEA***). |
| ***Gemba (workplace)*** | Imai (1997) | Literally "real place" … now "workplace" – or the place where ***value*** is added. In manufacturing, it usually refers to the shop floor. |
| ***Gemba kanri*** | | ?????? |
| ***Genbutsu*** | Imai (1997) | The tangible objects found at ***gemba***, such as work pieces, rejects, jogs and tools, and machines.<br><br>Means something physical or tangible. In the context of gemba, the word can refer to a broken-down machine, a reject, a tool that has been destroyed, returned goods or even a complaining customer. |
| ***Genchi genbutsu*** | Liker (2004) | Interpreted by Toyota to mean 'going to the place to see the actual situation for understanding'. |
| ***Heijunka***<br><br>***(a.k.a Level scheduling or load scheduling)*** | Tapping & Fabrizio (2001) | Balancing the amount of work to be done (the *load*) during a shift with the capacity to complete the work. A heijunka system distributes work in proportions based on demand, factoring in volume and variety. |
| | Rother & Shook (2002) | The act of levelling the variety and/ or volume of items produced at a process over a period of time. Used to avoid excessive ***batching*** of product types and/or volume fluctuations, especially at the ***pacemaker*** process. |
| | Womack & Jones (1996) | The creation of a "*level schedule*" by sequencing orders in a repetitive pattern and smoothing the day-to-day variation in total orders to correspond to longer-term demand.<br><br>For example, if customers during a week order 200 of Product A, 200 of product B, and 400 of |

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| | | 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 …<br><br>Similarly, if customer orders totalling 1,000 products per week arrive in batches of 200 products on day one, 400 on day two, zero on day three, 100 on day four and 100 on day five, the level schedule would produce 100 per day, and in the sequence A, C, A, B …<br><br>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 that the short-term discrepancy between the heijunka schedule and actual demand is steadily minimised, aided by ***level selling***. |
| ***Heijunka box*** | Tapping & Fabrizio (2001) | A physical device used to level production volume and variety over a specified time period (usually one day). The box is divided into slots that represent ***pitch*** increments. The slots are loaded with ***kanbans*** that represent customer orders. The order in which kanbans are loaded into the box is determined based upon volume and variety. |
| ***Heinrich's Law*** | Imai (1997) | A principle related to occurrence ratio of accidents with injuries. Heinrich expressed the ratio as follows:<br><br>*Serious injury : minor injury : no injury = 1 : 29 : 300*<br><br>This equation expresses that when you see 1 person who is seriously injured by an accident, the same accident might have hurt 29 persons slightly. At the same time, there might have been 300 people who were luckily not injured but experienced the same accident. |
| ***Hiyari KYT (kiken-yochi training)*** | Imai (1997) | Refers to the practice of anticipating danger in advance and taking steps to avoid it. |
| ***Hiyari report (scare report)*** | Imai (1997) | … is a written form from a worker to a supervisor that reports a condition that is unsafe and could lead to a quality problem and/ or accident. |

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| ***Hoshin kanri*** <br><br> ***(a.k.a. Policy deployment)*** | Womack & Jones (1996) | A strategic decision-making tool for a firm's executive team that focuses resources on the critical initiatives necessary to accomplish the business objectives of the firm. 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 projects and deployed down to the implementation level in the firm. *Hoshin kanri* unifies and aligns resources and establishes clearly measurable targets against which progress towards the key objectives is measured on a regular basis. |
| ***ILU Chart*** | Hines et al (2002) | A skills and competency charting method that visually displays the existing position for each employee [usually in a ***cell***] against a given set of targets to identify necessary training and development needs. |
| ***Ishikawa diagram*** | Miller & Schenk (1986) | A name for the fishbone [cause-effect] chart that recognizes its developer, Kaoru Ishikawa. |
| ***Jidoka*** | Miller & Schenk (1986) | A Japanese word that translates as ***autonomation***; a form of automation in which machinery automatically inspects each item after producing it, ceasing production and notifying humans if a defect is detected; Toyota expands the meaning of jidoka to include the responsibility of all workers to function similarly, ie to check every item produced and to make no more if a defect is detected, until the cause of the defect has been identified and corrected. |
| | Tapping & Fabrizio (2001) | The second of two TPS pillars. A method based on the practical use of automation to mistake-proof the detection of defects and free up workers to perform multiple tasks within work ***cells***. In other words, jidoka uses automation in such a way to promote ***flow***. |
| | Womack & Jones (1996) | See ***autonomation***. |
| ***Jishuken*** | Imai (1997) | Autonomous ***JIT*** study team. |
| | Liker (2004) | Voluntary study group. |
| ***Jishuken gemba kaizen*** | Imai (1997) | In the early 1960s, ***jishuken*** was started to implement ***JIT*** activities in ***gemba*** among the Toyota group of companies. |
| ***Jishu Kanri (JK)*** | Imai (1997) | Means autonomous management … and refers to workers' participation in ***kaizen*** activities as part of their daily activities under the guidance of the line manager; it is different from ***quality circle*** activities which are voluntary and are carried out by the workers' own volition. |

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| ***Just-in-Time (JIT) [production]*** | Miller & Schenk (1986) | A production scheduling concept that calls for any item needed at a production ***operation*** – whether raw material, finished item, or anything in between – to be produced and available precisely when needed, neither a moment earlier nor a moment later. |
| | Rother & Shook (2002) | Producing or conveying only the items that are needed by the next ***process*** when they are needed and in the quantity needed. |
| | Tapping & Fabrizio (2001) | The first of two TPS pillars (the other being ***jidoka***); a production paradigm which ensures that customers receive *only* what is needed, *just when* it is needed, and in the *exact amounts* needed. See also ***continuous flow***. |
| | Womack & Jones (1996) | A system for producing and delivering the right items at the right time in the right amounts. JIT approaches *just-on-time* when upstream activities occur minutes or seconds before downstream activities, so ***single-piece flow*** is possible. The key elements of JIT are ***flow, pull, standard work*** (with standard in-***process*** inventories) and ***takt time***. |
| ***Kaikaku*** | Rich et al. (2006) | From the Japanese meaning radical break to the circle of improvement. This approach is a very condensed and intense activity conducted within the factory to make an instant improvement in performance and to demonstrate that change can be instantaneous. |
| ***(a.k.a. Breakthrough kaizen, Flow kaizen or System kaizen)*** | Womack & Jones (1996) | Radical improvement of an activity to eliminate ***muda***, for example by reorganizing process ***operations*** for a product so that instead of travelling to and from isolated "***process villages***", the product proceeds through the ***operations*** in ***single-piece flow*** in one short space. |
| ***Kaizen*** | Miller & Schenk (1986) | The philosophy of ***continual improvement***, that every ***process*** can and should be continually evaluated and improved in terms of time required, resources used, resultant quality, and other aspects relevant to the ***process***. |
| ***(a.k.a. point kaizen or process kaizen)*** | Rother & Shook (2002) | Continuously improving in incremental steps. [from the Japanese meaning 'virtuous circle']. |
| | Tapping & Fabrizio (2001) | Small daily improvements performed by everyone. *Kai* means "take apart" and '*zen'* means "make good". The point of kaizen implementation is the total elimination of ***waste***. |
| | Womack & Jones (1996) | Continuous, incremental improvement of an activity to create more ***value*** with less ***muda***. |
| ***Kanban*** | Miller & Schenk (1986) | A card or sheet used to authorise production or movement of an item; when fully implemented, kanban (the plural is the same as the singular) operate according to the following rules: |

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| | | 1. All production and movement of parts and material takes place only as required by a downstream ***operation***, ie all manufacturing and procurement are ultimately driven by the requirements of final assembly or the equivalent.<br>2. The specific tool which authorises production or movement is called a kanban. The word literally means card or sign, but it can legitimately refer to a container or author authorizing device. Kanban have various formats and content as appropriate for their usage; for example, a kanban for a vendor is different than a kanban for an internal machining ***operation***.<br>3. The quantity authorised per individual kanban is minimal, ideally one. The number of circulating or available kanban for an item is determined by the demand rate for the item and the time required to produce or acquire more. This number generally is established and remains unchanged unless demand or other circumstances are altered dramatically; in this way inventory is kept under control while production is forced to keep pace with shipment volume. A routine exception to this rule is that managers and workers are continually exhorted to improve their ***processes*** and thereby reduce the number of kanban required. |
| | Rother & Shook (2002) | 4. A signalling device that gives instruction for production or conveyance of items in a ***pull*** system. Can also be used to perform ***kaizen*** by reducing the number of kanban in circulation, which highlights line problems. [LINK: The Boatman analogy]. |
| | Tapping & Fabrizio (2001) | An inventory control card at the heart of a ***pull*** system. The card is the means of communicating upstream precisely what is required (in terms of product specifications and quantity) at the time it is required. See also ***production kanban***, ***signal kanban*** and ***withdrawal kanban***. |
| | Womack & Jones (1996) | A small card attached to boxes of parts that regulates ***pull*** in the Toyota Production System by signalling upstream production and delivery. |
| ***Keiretsu*** | Womack & Jones (1996) | A grouping of Japanese firms through historic associations and equity interlocks such that each firm maintains its operational independence but establishes permanent relations with other firms in its group. Some keiretsu such as Sumitomo and Mitsui, are horizontal, involving firms in different industries. Others, such as the Toyota Group, are vertical, involving firms up- and downstream from the "system integrator" firm that is usually a final assembler. |
| ***Kiken*** | Imai (1997) | See ***Three Ks (3K)***. |

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| ***(dangerous)*** | | |
| ***Kitani (dirty)*** | Imai (1997) | See ***Three Ks (3K)***. |
| ***Kitsui (stressful)*** | Imai (1997) | See ***Three Ks (3K)***. |
| ***Kosu*** | Imai (1997) | Manufacturing operations can be divided between *machining hours* and *man hours*.<br><br>*Kosu* refers to the specific *man hours* it takes to process one unit of a product in a given ***process***, and is calculated by multiplying the number of workers involved in a process by the actual time it takes to complete the process, and dividing that by the number of units produced.<br><br>Kosu reduction is one of the key measures of productivity improvement in ***gemba***. |
| ***Lead time*** | Rother & Shook (2002) | The time required for one piece to move all the way through a ***process*** or ***value stream***, from start to finish. Envision timing a marked item as it moves from beginning to end. |
| | Womack & Jones (1996) | 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 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 [production / manufacturing]*** | Miller & Schenk (1986) | An English phrase coined to summarize Japanese manufacturing techniques, especially as exemplified by Toyota. |
| | Tapping & Fabrizio (2001) | Shorthand for Lean manufacturing – a manufacturing paradigm based on the fundamental goal of the TPS: minimizing ***waste*** and maximizing ***flow***. |
| ***Lean enterprise*** | Tapping & Fabrizio (2001) | An organization that fully understands, communicates, implements and sustains ***Lean*** concepts seamlessly throughout all operational and functional areas. |
| ***Levelling*** | Tapping & Fabrizio (2001) | Evenly distributing over a shift or a day the work required to fulfil customer demand. Levelling is achieved either through implementing ***paced withdrawal*** or ***heijunka*** (load levelling). |
| ***Level selling*** | Womack & Jones (1996) | A system of customer relations that attempts to eliminate surges in demand aused by the selling system itself (for example, due to quarterly or monthly sales targets) and that strives to create long-term relations with customers so that future purchases can be anticipated by the production system. |

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| ***Line balancing*** | Miller & Schenk (1986) | Equalizing ***cycle times*** [productive capacity, assuming 100% capacity utilization] for relatively small units of the manufacturing ***process***, through proper assignment of workers and machines; ensures smooth production flow. |
| | Tapping & Fabrizio (2001) | A process in which work elements are evenly distributed within a ***value stream*** to meet ***takt time***. |
| ***Location indicator*** | Tapping & Fabrizio (2001) | A visual workplace element that shows where an item belogs. Lines, arrows, labels, and signboards are all examples of location indicators. |
| ***Manufacturing Resource Planning (MRP II)*** | Rother & Shook (2002) | [MRPII] … expands MRP to include capacity planning, a finance interface to translate operations planning into financial terms, and a simulation tool to assess alternative production plans. |
| | Womack & Jones (1996) | Expands ***MRP*** to include capacity planning tools, a financial interface to translate operations planning into financial terms, and a simulation tool to assess alternative production plans. |
| ***Material handlers*** | Rother & Shook (2002) | Production-support persons who travel repeatedly along scheduled routes within a facility to transfer materials, supplies, and parts in response to ***pull*** signals, and to make ***paced withdrawal*** of finished goods at ***pacemaker processes***. [LINK: The Water Spider analogy]. |
| ***Material Requirements Planning (MRP)*** | Rother & Shook (2002) | A computerised system typically used to determine the quantity and timing requirements for delivery and production of items. Using MRP specifically to schedule production at ***processes*** in a ***value stream*** results in ***push production***, because any predetermined schedule in only an estimate of what the next ***process*** will actually need. |
| | Womack & Jones (1996) | A computerized system used to determine the quantity and timing requirements for materials used in a production system. MRP systems use a master production schedule (MPS), a bill of materials (BOM) listing every item needed for each product to be made, and information on current inventories of these items in order to schedule the production and delivery of the necessary items. |
| ***Meister*** | Womack & Jones (1996) | A production group leader in a German manufacturing firm. |
| ***Milk run*** | Rother & Shook (2002) | Routing a delivery vehicle in a way that allows it to make pickups or drop0offs at multiple locations on a single travel loop, as opposed to making separate trips to each location. |
| | Womack & Jones (1996) | A routing of a supply or delivery vehicle to make multiple pickups or drop-offs at different locations. |
| ***Minus-cost*** | Miller & Schenk | A principle for establishing reasonable and necessary cost targets through the subtraction of |

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| ***principle*** | (1986) | required profit margins from the prices necessary to generate desired sales volume and market share;<br>Contrasts with the opposite approach [***cost-plus***] of adding margins to costs in order to establish selling prices; the term reflects the reality that profits, which are prices minus costs, can only be improved permanently through cost reductions. |
| ***Mittelstand*** | Womack & Jones (1996) | Mid-sized and usually family-controlled German manufacturing firms that have been the backbone of the postwar export economy. |
| ***Mixed-model production*** | Duggan (2002) | Mixed model production means producing a variety or mix of products or product variations through the same value stream *at the pull of the customer*. This means to build and deliver the right quantity of a specific product (out of a high number of products available) when the customer wants it. In mixed model production, a group of products are determined to be a ***product family*** and are treated as one. This means that we review the total volume for a product family rather than the individual demand for each product in the family to see if we can ship the orders needed each day. |
| | Miller & Schenk (1986) | Capability to produce a variety of models, that in fact differ in labour and material content, on the same production line; allows for efficient utilisation of resources while providing rapid response to marketplace demands. |
| ***Monument*** | Womack & Jones (1996) | Any design, scheduling, or production technology with scale requirements necessitating that designs, order, and products be brought to the machine to wait in a queue for processing. Contrast with ***right-sized tools***. |
| ***Morning market*** | Imai (1997) | A daily routine at ***gemba*** that involves examining rejects (***gembutsu***) made the previous day before the work begins so that countermeasures can be adopted as soon as possible, based on ***gemba-gembutsu*** principles. This meeting involving the ***gemba*** people (and not staff) is held first thing in the morning. |
| ***Muda (waste)*** | Imai (1997) | Means "***waste***" … when applied to management of the workplace, refers to a wide range of non-value-adding [NVA] activities. In ***gemba***, there are only two types of activities: value-adding [VA] and NVA. In gemba kaizen, efforts are directed first to eliminating all types of NVA activities. Elimination of muda in the following areas can contribute to significant improvements in QCD: overproduction, inventory, rejects, motion, processing, waiting, transport and time. Muda |

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| | | elimination epitomises the low-cost, commonsense approach to improvements. |
| | Rother & Shook (2002) | See ***waste***. |
| | Womack & Jones (1996) | Any activity that consumes resources but creates no ***value***. See ***waste***. |
| | Tapping & Fabrizio (2001) | See ***waste***. |
| ***Mura (irregularity or variability)*** | Imai (1997) | Japanese word meaning irregularity or variability. |
| ***Muri (strain and difficulty)*** | Imai (1997) | Japanese word meaning strain and difficulty. |
| ***Multi-machine working*** | Womack & Jones (1996) | Training of employees to operate and maintain different types of production equipment. Ulti-machine working is essential to creating production ***cells*** where each worker utilizes many machines. |
| ***Negara*** | Miller & Schenk (1986) | Smooth production flow, ideally one piece at a time, characterized by synchronization [balancing] of production ***processes*** and maximum utilization of available time, including overlapping of ***operations*** where possible. |
| ***Nemawashi (consensus decision making)*** | | ????? |
| ***NVA*** | Rich et al. (2006) | Non-value adding or actions conducted by the organisation that adds no value to the product [but consumes resource] and serves to increase costs. Activities for which the customer would prefer not to pay. |
| ***Obeya*** | Liker (2004) | Big room, war room or project room. |
| ***O.E.E. (Overall Equipment*** | Hines et al (2002) | A composite measure of the ability of a machine or ***process*** to carry out ***value adding*** activity. |

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| ***Effectiveness)*** | | *OEE = %time machine available x  % of maximum output achieved x %perfect output*<br><br>[See also ***TPM***]. |
| | Rich et al. (2006) | The baseline measure of all ***TPM*** activities and means of charting progress (through trend analysis) of improvement activities. |
| ***Open-book management*** | Womack & Jones (1996) | 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*** | Womack & Jones (1996) | An activity or activities performed on a product by a single machine.  Contrast with ***process***. |
| ***Operator balance chart*** | Tapping & Fabrizio (2001) | A visual display of the work elements, times, and operators at each location in a ***value stream***.  The operator balance chart is used to show improvement opportunities by visually displaying each work operation's times in relation to ***total cycle time*** and ***takt time***. |
| ***Overproduction*** | Rother & Shook (2002) | Producing more, sooner or faster than is required by the next ***process***. |
| ***Paced withdrawal*** | Rother & Shook (2002) | A timed sequence of withdrawal of finished product from the ***pacemaker process***.  Paced withdrawal is a tool for pacing an *assembly* ***process*** and becoming aware of production problems within a ***pitch*** increment. |
| | Tapping & Fabrizio (2001) | A method of ***levelling*** that involves moving small batches of material through the ***value stream*** over time intervals equal to the ***pitch***. |
| ***Pacemaker process*** | Rother & Shook (2002) | … is a series of production steps, frequently at the downstream (customer) end of the ***value stream*** in a facility, that are dedicated to a particular ***product family*** and respond to orders from external customers.  The pacemaker is the most important process in the facility because how you operate here determines how well you can serve the customer, and what the demand pattern is like for upstream ***fabrication processes***.  [LINK:  Takt time and TOC "Drum"] |
| ***Pack-out quantity*** | Tapping & Fabrizio (2001) | A small batch equal to the number of units or parts that can be moved throughout the ***value stream*** to ensure an efficient ***flow***.  Pack-out quantity may or may not be customer driven. |
| ***PDCA (Plan-Do-Check-*** | Imai (1997) | The basic steps to be followed in ***kaizen***. |

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| ***Act)*** | | |
| ***Perfection*** | Womack & Jones (1996) | The complete elimination of ***muda*** so that all activities along a ***value stream*** create ***value***. |
| ***Pitch*** | Rother & Shook (2002) | When ***takt time*** is too short for a reasonable ***paced withdrawal*** it can be adjusted upwards to a consistent increment of work called *pitch*, which becomes the basic unit of your production schedule for a ***product family***. Pitch represents the frequency at which you withdraw finished goods from a ***pacemaker process*** as well as the corresponding amount of schedule you release to that ***process***. Pitch is often calculated based on the customer's *ship container quantity*. |
| | Tapping & Fabrizio (2001) | The amount of time – based on ***takt*** – required for an upstream operation to release a predetermined ***pack-out quantity*** of WIP to a downstream operation. Pitch is therefore the product of ***takt time*** and the p***ack-out quantity***. |
| ***Poke-yoke*** | Miller & Schenk (1986) | A manufacturing technique of preventing mistakes by designing the manufacturing process, equipment and tools so that an ***operation*** literally cannot be performed incorrectly; an attempt to perform incorrectly, as well as being prevented, is usually met with a warning signal of some sort; the term poke-yoke is sometimes used to signify a system where only a warning is provided. |
| ***(a.k.a Baka-yoke)*** | Womack & Jones (1996) | A mistake-proofing device or procedure to prevent a defect during order-taking or manufacture.<br><br>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 the discovery of inputting errors or buying based on misinformation.<br><br>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 poke-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. |
| ***Policy deployment*** | Womack & Jones (1996) | See ***hoshin kanri***. |
| | Rich et al. (2006) | The process of setting 3-5 year business goal and annual improvement challenges to all business |

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| | | functions. The total population of middle managers agree the key projects which will enhance the competitiveness of the firm and collaborate to ensure their execution. The hidden lesson of ***lean manufacturing***. |
| ***Process*** | Womack & Jones (1996) | A series of individual operations required to create a design, completed order, or product. |
| ***Process kaizen*** <br><br> ***(a.k.a. Point kaizen)*** | Rother & Shook (2002) | Improvements made at an individual process or in a specific area. |
| ***Processing time*** | Rother & Shook (2002) | The time a product is actually being worked on in a machine or work area. |
| | Womack & Jones (1996) | 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 villages*** | Womack & Jones (1996) | The practice of grouping machines or activities by type of operation performed; for example, grinding machines or order-entry. Contrast with ***cells***. |
| ***Profit potential*** | Hines et al (2002) | The profit potential is the effect on the 'bottom line' of any activity that occurs during a ***lean*** transformation programme. |
| ***Product family*** | Rother & Shook (2002) | A group of products that go through the same or similar downstream or "assembly" steps and equipment. |
| | Tapping & Fabrizio (2001) | A group of parts that share common equipment and processing attributes. |
| | Womack & Jones (1996) | A range of related products that can be produced interchangeably in a production ***cell***. The term is often analogous to "platforms". |
| ***Production kanban*** | Tapping & Fabrizio (2001) | A printed card indicating the number of parts that must be produced to replenish what has been ***pulled*** from a ***supermarket***. [See also ***kanban***]. |
| ***Production smoothing*** | Rother & Shook (2002) | See ***heijunka***. |
| | Womack & Jones (1996) | See ***heijunka***. |

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| ***Pull / Pull system / Pull production*** | Imai (1997) | One of the basic requirements of a ***JIT*** production system. The previous ***process*** produces only as many products as are consumed by the following ***process***. [Contrast with ***push production***]. |
| | Miller & Schenk (1986) | A manufacturing planning system based on communication of actual real-time needs from downstream ***operations*** – ultimately final assembly or equivalent – as opposed to a ***push system*** which schedules upstream ***operations*** according to theoretical downstream results based on a plan which may not be current. |
| | Rother & Shook (2002) | An alternative to scheduling individual ***processes***, where the customer process withdraws the items it needs from a ***supermarket***, and the supplying process produces to replenish what was withdrawn. Used to avoid ***push***. See also ***kanban***. |
| | Womack & Jones (1996) | A system of cascading production and delivery instructions from downstream to upstream activities in which nothing is produced by the upstream supplier until the downstream customer signals a need. The opposite of ***push***. See also ***kanban***. |
| ***Push production*** | Imai (1997) | The opposite of ***pull production***. The previous ***process*** produces as much as it can without regard to the actual requirements of the next ***process*** [in a ***batch***] and sends them to the next ***process*** whether there is a need or not. |
| ***QCD (Quality, Cost, Delivery)*** | Imai (1997) | Quality, cost and delivery is regarded as the ultimate goal of management. When management is successful in achieving QCD, both customer satisfaction and corporate success follow. |
| ***QCDMS (… Morale and Saefty)*** | Imai (1997) | In ***gemba***, often M(morale) and S(safety) are added to ***QCD*** as a target to be achieved. |
| ***QCDDM*** | | Nissan version of ***QCD*** / ***QCDMS***. Stands for ***Quality, Cost, Design, Delivery*** and ***Management***. |
| ***Quality circle*** | Imai (1997) | Quality improvement or self-improvement study groups composed of a small number of employees (ten or fewer). They were originated in Japan and are called quality control (QC) circles. The QC circle voluntarily performs improvement activities within the workplace, carrying out its work continuously as part of a company-wide program of mutual education, quality control, self-developmen, and productivity improvement. |
| ***Quality Function*** | Womack & Jones | A visual decision-making procedure for multi-skilled project teams which develops a common |

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| ***Deployment (QFD)*** | (1996) | understanding of the voice of the customer and a consensus on the final engineering specifications of the product that has the commitment of the entire team. QFD integrates the perspectives of team members from different disciplines, ensures that their efforts are focused on resolving key trade-offs in a consistent manner against measurable performance targets for the product, and deploys these decisions through successive levels of detail. The use of QFD eliminates expensive backflows and rework as projects near launch. |
| ***Queue time*** | Rother & Shook (2002) | The time a product spends waiting in line for the next processing step. |
| | Womack & Jones (1996) | The time a product spends in a line awaiting the next design, order-processing, or fabrication step. |
| ***Red tag*** | Tapping & Fabrizio (2001) | A label used in a ***five S*** (***5S***) implementation to identify items that are not needed or that are in the wrong place. |
| ***Repeaters*** | Hines et al (2002) | Products or services that have an ongoing demand but are difficult to predict. They exhibit medium risk to the business and may have medium levels of inventory. They generally have intermediate volumes but not dedicated facilities. [See also ***runners*** and ***strangers***]. |
| ***Right first time (RFT)*** | Rich et al. (2006) | A surrogate measure for zero defects which applies to perfecting production and administrative processes such that the activity never involves error. |
| ***Right-sized tool*** | Womack & Jones (1996) | A design, scheduling, or production device that can be fitted directly into the flow of products within a product family so that production no longer requires unnecessary transport and waiting. Contrast with ***monument***. |
| ***Runner*** | Tapping & Fabrizio (2001) | A worker who ensures that ***pitch*** is maintained. The runner covers a designated route within the ***pitch*** period, picking up ***kanban*** cards, tooling, and components, and delivering them to their appropriate places. [LINK: 'The water spider' – materials handler]. |
| ***Runners*** | Hines et al (2002) | Products or services that have a regular, ongoing, predictable demand which respresents low risk in the business and may have low inventories. Such products generally are high volume and have dedicated facilities. [See also ***repeaters*** and ***strangers***]. |
| ***Safety inventory*** <br><br> ***(a.k..a. safety stock)*** | Tapping & Fabrizio (2001) | Finished goods available to meet customer demand when internal constraints or inefficiencies disrupt process ***flow***. |

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| ***SDCA (Standardise-Do-Check-Act)*** | Imai (1997) | The basic steps to be followed to maintain current status. [See also ***PDCA***]. |
| ***Seiketsu (systemise)*** | Imai (1997) | One of the ***5S***. |
| ***Seiri (sort)*** | Imai (1997) | One of the ***5S***. |
| ***Seiso (scrub)*** | Imai (1997) | One of the ***5S***. |
| ***Seiton (straighten)*** | Imai (1997) | One of the ***5S***. |
| ***Sensei*** | Womack & Jones (1996) | A personal teacher with a mastery of a body of knowledge, in this book lean thinking and techniques. |
| ***Set in order*** | Tapping & Fabrizio (2001) | The second activity in the [Anglicised] ***5S*** system. It involves identifying the best location for each item that remains in the area, relocates items that do not belong in that area, setting height and size limits, and installing temporary ***location indicators***. |
| ***Setup time*** | Miller & Schenk (1986) | Work required to change over a machine or ***process*** from one item or ***operation*** to the next item or ***operation***; can be divided into two types:<br>1. *Internal*: Setup work than can be done only when the machine or ***process*** is not actively engaged in production; OR<br>2. *External*: Setup work that can be done concurrently with the machine or ***process*** performing production duties. |
| ***Seven muda / wastes*** | Womack & Jones (1996) | Ohno's original enumeration of the ***wastes*** commonly found in physical production. These are *overproduction* ahead of demand, *waiting* for the next ***processing*** step, unnecessary *transport* of materials (for example, between ***process villages*** or facilities), *overprocessing* of parts due to poor tool and product design, *inventories* more than the absolute minimum, unnecessary *movement* by employees during the course of their work (looking for parts, tools, prints, help, etc.), and the production of *defective parts*. [See also ***muda*** and ***wastes***]. |
| ***Shine*** | Tapping & Fabrizio (2001) | The third activity in the [Anglicised] ***5S*** system. It involves cleaning everything thoroughly, using cleaning as a form of inspection, and coming up with ways to prevent dirt, grime and other contaminants from accumulating. |
| ***Shitsuke (self-discipline)*** | Imai (1997) | One of the ***5S***. |

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| ***Shojinka*** | Miller & Schenk (1986) | Continually optimising the number of workers in a work centre to meet the type and volume of demand imposed on the work centre; shojinka requires:<br>▪ Workers trained in multiple disciplines.<br>▪ Work centre layout, such as U-shaped or circular, that supports a variable number of workers performing the tasks in the layout.<br>▪ The capability to vary the manufacturing ***process*** as appropriate to fit the demand profile. |
| ***Shusa*** | Womack & Jones (1996) | A strong team leader in the Toyota development system. (Literally, however, a level of supervisor, like *katcho* or *honcho*). |
| ***Signal kanban*** | Tapping & Fabrizio (2001) | A printed card indicating the number of parts that need to be produced at a batch operation to replenish what has been ***pulled*** from the ***supermarket*** downstream. See also ***kanban***. |
| ***Single Minute Exchange of Dies (SMED)*** | Miller & Schenk (1986) | Changing a die on a forming or stamping machine in a minute or less; broadly, the ability to perform any setup activity in a minute or less of machine or ***process*** downtime; the key to doing this is frequently the capability to convert *internal setup time* to *external setup time*; variations on SMED include:<br>1. ***Single-digit setup***: Performing a setup activity in a single digit number of minutes, ie fewer than ten.<br>2. ***OTED***: One Touch Exchange of Die; literally, changing a die with one physical motion such as pushing a button; broadly, an extremely simple procedure for performing a setup activity. |
| | Womack & Jones (1996) | A series of techniques pioneered by Shigeo Shingo for ***changeovers*** of production machinery in less than ten minutes. ***One-touch setup*** is the term applied when ***changeover*** requires 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*** | Womack & Jones (1996) | A situation in which products proceed, one completed product at a time, through various operations in design, order-taking, and production, without interruptions, backflows, or scrap. Contrast with ***batch-and-queue***. |
| ***Sort*** | Tapping & Fabrizio (2001) | The first activity in the [Anglicised] ***5S*** system. It involves sorting through and sorting out items, placing ***red tags*** on these items, and moving them to a temporary holding area. The items are disposed of, sold, moved, or given away by a predetermined time. |

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| ***Spaghetti chart*** | Womack & Jones (1996) | A map of the path taken by a specific product as it travels down the ***value stream*** in a mass-production organization, so called because the product's route typically looks like a plate of spaghetti. |
| ***Standardize (for 5S)*** | Tapping & Fabrizio (2001) | The fourth activity in the [Anglicised] ***5S*** system. It involves creating the rules for maintaining and controlling the conditions established after implementing the first three S's. Visual controls are used to make these conditions obvious. |
| ***Standardisation*** | Imai (1997) | One of the three foundations of ***gemba kaizen*** activities, and means the documentation of the best way to do a job. |
| ***Standard work*** | Imai (1997) | An optimum combination of man, machine and material. The three elements of standard work are ***takt time, work sequence*** and ***standard work-in-progress***. |
| | Tapping & Fabrizio (2001) | An agreed-upon set of work procedures that establishes the best method and sequence for each manufacturing or assembly process. Standardized work is implemented to maximise human and machine efficiency while simultaneously ensuring safe conditions. |
| | Womack & Jones (1996) | 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. |
| ***Standards*** | Imai (1997) | The best way to do a job, namely the set of policies, rules, directives, and procedures established by management for all major operations, which serve as guidelines that enable all employees to perform their jobs to assure good results. |
| ***Statistical Process Control (SPC)***<br><br>***(a.k.a. Statistical Quality Control)*** | Imai (1997) | The application of statistical techniques to control a process. [See also ***SQC*** and ***control charts***]. |
| ***Statistical Quality Control (SQC)*** | Imai (1997) | Term often used interchangeably with ***SPC***, but includes acceptance sampling as well as ***SPC***. |
| | Miller & Schenk (1986) | Using statistical methods to identify, prioritise and correct elements of the manufacturing process that detract from high quality; proper SQC is NOT the use of statistical methods, such as sampling, to ensure that defects are kept below an acceptable level (refer to ***AQL***). |
| ***Storyboard*** | Tapping & Fabrizio (2001) | A poster-sized framework for holding all the key information for a ***Lean*** implementation. It contains the outcomes for each of the eight steps of ***value stream management***. |

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| ***Strangers*** | Hines et al (2002) | Products or services that are hard to predict and will exhibit highly irregular but generally low demand profiles. [See also ***runners*** and ***repeaters***]. |
| ***Supermarket*** | Rother & Shook (2002) | A controlled inventory of items that is used to schedule production at an upstream ***process***. |
| | Tapping & Fabrizio (2001) | A system used to store a set level of finished-goods inventory or WIP and replenish what is "***pulled***" to fulfil customer orders (internal and external). A supermarket is used when circumstances make it difficult to sustain ***continuous flow***. |
| ***Sustain*** | Tapping & Fabrizio (2001) | The fifth activity of the [Anglicised] ***5S*** system. It involves ensuring adherence to ***5S standards*** through communication, training and self-discipline. |
| ***System kaizen*** | Rother & Shook (2002) | Improvement aimed at an entire ***value stream***. |
| ***Takt image*** | Tapping & Fabrizio (2001) | The vision of an ideal state in which you have eliminated ***waste*** and improved the performance of the ***value stream*** to the point that it is possible to achieve ***single-piece flow*** based on ***takt time***. |
| ***Takt time*** | Tapping & Fabrizio (2001) | The "beat" of customer demand – the time required between completion of successive units of end product. Takt time determines how fast a ***process*** needs to run to meet customer demand. [It] is calculated by dividing the total time available for production by the total customer requirement. |
| | Rother & Shook (2002) | The rate of customer demand. How often the customer requires one finished item. [It] is used to design *assembly* and ***pacemaker processes***, to assess production conditions, to calculate ***pitch***, to develop material handling containerisation and routes, to determine problem-response requirements and so on. Takt is the heartbeat of a ***lean*** system.<br><br>Takt time is calculated by dividing production time by the quantity the customer requires in that time. |
| | Womack & Jones (1996) | The available production time divided by the rate of customer demand. Takt time sets the pace of production to match the rate of customer demand and becomes the heartbeat of any lean system.<br><br>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. |

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| ***Target cost*** | Womack & Jones (1996) | The development and production cost which a product cannot exceed if the customer is to be satisfied with the ***value*** of the product while the manufacturer obtains an acceptable return on investment. |
| | Rich et al. (2006) | An approach to determining product features and costs using a backward process of deducting marginal, distribution costs to derive the maximum cost of production. This cost is used as a challenge to product and process designers. The objective is to meet the cost or design products with lower costs to enhance margins and profitability. |
| ***Three Ks (3K)*** | Imai (1997) | The Japanese words referring to conventional perception of ***gemba*** – ***kiken*** (dangerous), ***kitanai*** (dirty) and ***kitsui*** (stressful) – in direct contrast to the idea of ***gemba*** being the place where real value is added and the source of ideas for achieving ***QCD***. |
| ***Three Ms (3M)*** | Imai (1997) | ***Muda*** (waste), ***mura*** (irregularity) and ***muri*** (strain). These three words are used as ***kaizen*** checkpoints to help workers and management to identify the areas for improvement. |
| ***Throughput time*** | Womack & Jones (1996) | 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 cycle time*** | Tapping & Fabrizio (2001) | The total of the cycle times for each individual operation or ***cell*** in a ***value stream***. [It] ideally equals total value-added time. |
| ***Total Productive Maintenance (TPM)*** | Imai (1997) | TPM aims to maximise 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 autonomous activities, and involves such basic elements as developing a maintenance system, education in basic housekeeping, problem-solving skills, and activities to achieve zero breakdowns and accident-free gemba. Autonomous maintenance by workers is one of the important elements of TPM. ***5S*** is an entry step to TPM. [See also OEE]. |
| | Womack & Jones (1996) | A series of methods, originally pioneered by Nippondenso (a member of the Toyota ***keiretsu*** group), to ensure that every machine in a production ***process*** is always able to perform its required tasks so that production is never interrupted. |
| ***TPS*** | | Acronym of 'Toyota Production System'. |
| ***TQC / TQM*** | Miller & Schenk | Total Quality Control (TQC) / Total Quality Management (TQM): Refers to: |

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| | (1986) | 1. A company-wide emphasis on quality, including all individuals and functions.<br>2. An examination of all aspects of the company's processes that design, sell, produce, deliver, and service items for customers. |
| ***Transparency*** | Womack & Jones (1996) | See ***visual control***. |
| ***Turn-back analysis*** | Womack & Jones (1996) | Examination of the ***flow*** of a product through a set of production operations to see how often it is sent backwards for rework or scrap. |
| ***Uptime*** | Hines et al (2002) | The % of time that a machine is available for productive work. |
| ***U-shaped cells*** | Tapping & Fabrizio (2001) | A U-shaped, product-oriented cell layout that allows one or more operators to produce and transfer parts one piece –or one small lot- at a time. [See also ***cells*** and ***single piece flow***]. |
| ***Value*** | Womack & Jones (1996) | A capability provided to a customer at the right time at an appropriate price, as defined in each case by the customer. |
| ***Value added time*** | Rother & Shook (2002) | Time for those work elements that transform the product in a way the customer is willing to pay for. |
| ***Value Analysis (VA)*** | Imai (1997) | A method for cost reduction introduced by LD Miles at GE in 1947. it aims at reducing material and component costs at the upstream stages of designing and design reviews and involves cross-functional collaborations of product design, production engineering, quality assurance and manufacturing etc. VA is also employed for competitive ***benchmarking***. |
| ***Value Engineering (VE)*** | Imai (1997) | A method and practice for cost reduction developed by the US Department of Defence in 1954. in Japan, both ***VA*** and VE are used almost for the same purposes. |
| ***Value stream*** | Hines et al (2002) | The specific activities within a supply chain required to design, order and provide a specific product or service. |
| | Rother & Shook (2002) | All activities, both value added and non value added, required to bring a product from raw material into the hands of the customer, a customer requirement from order to delivery, and a design from concept to launch. Value stream improvement usually begins at the door-to-door level within a facility, and then expands outward to eventually encompass the full value stream. |
| | Tapping & Fabrizio (2001) | A collection of all the steps (both value-added and non-value added) involved in bringing a product or group of products from raw material to finished products accepted by a customer. |
| | Womack & Jones | The specific set of activities required to design, order, and provide a specific product, from concept |

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| | (1996) | to launch, order to delivery, and raw materials into the hands of the customer. |
| ***Value stream loops*** | Rother & Shook (2002) | Segments of a ***value stream*** whose boundaries are typically marked by ***supermarkets***. Breaking a ***value stream*** into loops is a way to divide future state implementation into manageable pieces. |
| ***Value stream management*** | Tapping & Fabrizio (2001) | A [proprietary] sequential, 8-step process used to implement ***Lean*** concepts and tools derived from the TPS. The purpose of value stream management is to minimize the ***waste*** that prevents a smooth, ***continuous flow*** of product throughout the ***value stream***. |
| ***Value stream [process] mapping*** | Hines et al (2002) | The process of charting out or visually displaying a ***value stream*** so that improvement activity can be effectively planned. |
| | Rother & Shook (2002) | A pencil-and-paper tool used in two stages:<br><br>a) Follow a product's production path from beginning to end and draw a visual representation of every ***process*** in the material and information flows.<br>b) Then draw a future state map of how ***value*** should ***flow***. The most important map is the future state map. |
| | Tapping & Fabrizio (2001) | The visual representation of the material and information flow of a specific product family; Steps 4 and 6 of the ***value stream management*** process. |
| | Womack & Jones (1996) | Identification of all the specific activities occurring along a ***value stream*** for a product or product family. |
| ***Visual control*** | Womack & Jones (1996) | The placement in plain view of all tools, parts, production activities, and indicators or production system performance, so the status of the system can be understood at a glance by everyone involved. Used synonymously with ***transparency***. |
| | Rich et al. (2006) | An approach to visualising the status of a process and to make deviation in performance readily identifiable without need for specialist training. |
| ***Visual management*** | Imai (1997) | An effective management method to provide information and ***gembutsu*** in a clearly visible manner to both workers and managers so that the current state of operations and the target for ***kaizen*** are understood by everybody. It also helps people to identify abnormality promptly. |
| ***Withdrawal kanban*** | Tapping & Fabrizio (2001) | A printed card indicating the number of parts to be removed from a supermarket. |
| ***Waste*** | Miller & Schenk | Activities and results to be eliminated; within manufacturing, categories of waste (according to |

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| | (1986) | Shigeo Shingo) include:<br>1. Excess production and early production.<br>2. Delays.<br>3. Movement and transport.<br>4. Poor ***process*** design.<br>5. Inventory.<br>6. Inefficient performance of a ***process***.<br>7. Making defective items.<br>[See also ***muda*** and ***seven muda***]. |
| | Rother & Shook (2002) | Any activity that consumes resources but creates no ***value*** for the customer. |
| | Tapping & Fabrizio (2001) | Anything within the ***value stream*** that adds cost or time without adding ***value***. The seven most common wastes are wastes of 1) overproducing 2) waiting 3) transport 4) processing 5) inventory 6) motion 7) defects and spoilage. [See also ***muda***]. |
| ***WIP (Work in Progress)*** | Rother & Shook (2002) | Any inventory between raw materials and finished goods. |
| ***Yamazumi Chart***<br><br>***(a.k.a. Crew Load Charts)*** | Robert Bourke (BAB meeting, 21/08/06) | Charts up in each team area. Indicates the sequence of work operations (post work study and agreement with the team), along with progress versus standard time. |
| ***Zaibatsu*** | | The post war precursors of ***kieretsu*** – outlawed by the American post war administration [for being anti-competitive]. |