Kaizen Tools

Kaizen is one of the most popular approaches for continuous improvement. During its implementation Kaizen practitioners use various tools, depending on the area of application. Kaizen can broadly be applied to:

• Increase productivity.

• Improve quality.

• Reduce Waste.

Some productivity tools applied in Kaizen implementation are:

• SMED

• Total Productive Maintenance.

• Demand Flow Technology.

• Kanban.

• 5 S's.

Some of the Quality tools applied in Kaizen:

• Poka yoke.

• Standardized Work.

• Jidoka .

• Value Stream Mapping.

Some Kaizen tools for waste reduction:

• 7 Wastes.

• Visual Management.

Quality Tools > Single Minute Exchange of Die (SMED)

A Japanese management consultant, Shigeo Shingo in 1969, originally developed SMED. The SMED technique is by far the best method for achieving really significant reductions in set-up times. Machine setter sand operators can easily understand and apply it themselves, after just a few hours of instruction. The SMED system is a simple but often misleading term as it can be applied to processes other than machine tools that use a die. The focus is on reducing non-value adding set-up time like changing tools or die, clamping and unclamping work and other such non-productive activities. This concept can be of great value in all industries. Set-up and changeover times are broken down into the simple elements and each element is analyzed to eliminate, externalize, and simplify. A set-up will normally consist of a number of separate tasks, some of which can only be carried out when the machine or process is stopped. Others could be carried out when the machine or process is in operation. Shingo called the former 'internal activities' and the later 'external activities'. Examples of 'internal' activities are:

• Removing work from machines, tools dies etc., cleaning down the work surfaces, fixing new tools in place, conducting trial runs and adjusting the machines etc. Examples of ‘external’ activities are:

• Getting instructions for the next job, procuring material and tools for the next job from the stores, returning tools from the last job to tool stores etc. There are three stages to the SMED technique application. The first stage that Shingo developed in 1950 enabled him to reduce the average time for changing set-up on large steel presses from four hours to less than ninety minutes.

The second and third stages, introduced in 1969, led to reducing the same to less than ten minutes. Since Shingo developed his ideas mainly on steel presses and plastic molding and extrusion machinery, he called the technique ‘Single Minute Exchange of Dies’ (‘single minute’ meaning less than double figures, i.e. less than ten minutes).The three stages of the SMED procedure are as follows:

Stage1:

Identify internal and external activities; arrange for external activities to be carried out while the machine is working on another batch, instead of during the set-up time.

Stage 2:

Convert as many internal activities as possible into external activities, so that they too can be done while the machine is working on another batch.

Stage 3:

Continuously strive to improve or eliminate each element of the remaining internal and external activities. It wasn’t until the 1980s that the Western world started applying SMED. Even today only a few manufacturers have realized the tremendous benefits of the process. Many companies assume that their processes are different and hence do not consider SMED principles. According to Dr. Shingo, ‘knowing the process we are associated with implies understanding why we do it. If we know that, changing how we do it is simple’. Reducing set up time till it is economic to manufacture in small batches is a key aim of the SMED technique.

Quality Tools > Total Productive Maintenance (TPM)

Today’s global marketplace is dominated by opportunities and competition. Companies are thus drawing business strategies to deliver reliable products or services to promptly satisfy customer requirements. To be competitive prices of products and services must be low and yet fetch profitable revenues. Manufacturing companies should aim at reduction and elimination of unnecessary costs associated with material and time wastages. Thus, a great deal of attention should be paid on the reliability of production lines and their effective functioning. Although most manufacturing operations are automated, maintenance activities depend profoundly on human inputs. Total Productive Maintenance (TPM) is a productive maintenance program, which focuses on:

• Maximizing equipment effectiveness.

• Establishing a thorough system of Preventive Maintenance (PM) for the equipment’s entire life span.

• Involving every single employee from top management to shop floor workers.

• Empowering employees to initiate corrective activities.

• Implementing TPM. The steps for implementing TPM are:

• Designing and implementing improvement activities to enhance equipment efficiency.

• Training equipment operators to be “equipment conscious”, “equipment skilled” and establishing a system of autonomous maintenance for them to perform·

• Establishing a planned maintenance system.

• Conducting training courses to improve operators’ skills.

• Creating Maintenance Prevention (MP) design and early equipment management. MP design generates equipment requiring minimal maintenance and early equipment management makes new equipment operational in a short time. Bringing maintenance into the forefront, TPM focuses on scheduling it as an integral part of the manufacturing process. The goal is to minimize and eventually eliminate emergency and unscheduled maintenance.

Quality Tools > Demand Flow Technology

The world demands a wide range of products especially in the auto, electronics, consumer durables, and computer industry that are custom built and delivered quickly. An organization that is able to meet as well as stimulate such demand will get a head start that competitors will struggle to catch up with. John Costanza’s Demand Flow Technology (DFT) concept does just that.

DFT eliminates schedules, forecasts, and finished goods inventory. It uses Raw-In-Progress inventory (RIP) that can be used flexibly to customize the final product. The products are made to order and delivered with no stopgap in between. With the need for future business to become highly responsive to the varying demands of customers, Costanza felt the existing systems of production would not suffice. He decided to develop a production system that would enable manufacturing systems to quickly respond to changing customer demand. The system he developed system can be illustrated thus: A car manufacturing plant needs to build eight cars in a day. The work time available in a day is 8 hours, implying the plant will have to produce one car every hour. The normal line production system takes 32 hours to build a car. Breaking the 32hours of work into one-hour slots and assigning each piece to a worker and machine can achieve this target. What if some pieces of work need more than an hour while others less than that? The solution is to reallocate workers who complete their tasks earlier, to other tasks in the plant. This will also ensure that work in process inventory for the less time consuming tasks is kept under control. The production cells in DFT are designed to handle a wide range of products, instead of a single or narrow line. The work to be done for making a particular product is first broken into Sequence Of Events (SOE) i.e. a defined number and sequence of operations at a given level of quality. While designing SOE, the non-value adding work is kept at the minimum. The best mix of products that can be produced is determined depending on the production cell. To provide flexibility, DFT incorporates tools to reallocate work, change levels of inventory, and add resources depending on demand variation. The daily product mix and volume are closely tied up to the variations in demand. Due to this in built flexibility, DFT is better able to handle seasonal and unforeseen fluctuations in demand. Similarly, unpopular products can be discontinued and new products introduced easily into the production process without much disruption. In DFT, set up and changeover come under non-value adding operations and hence should be kept at a minimum through continuous improvements. This apart from the fact that DFT cells are designed to accommodate the most likely but broad product families makes the tooling and fixture aspects flexible enough to provide optimal set up and changeover times.DFT requires, and hence trains personnel in at least three operations of the flow line. Each of the cell personnel should know the operations of the one before and one after their own. This means that even if every alternate employee is taken out from the flow line creating holes, the production will continue though at a slower rate. This provides the plant excellent flexibility in labor management. In times of low demand, some employees can be taken out from the flow line. Their services can be utilized in other areas, like developing and modifying SOEs, preparing related operation sheets, training, and maintenance and so on. The flow line gets flexed at different locations to adjust the daily variation in demand. The focus of DFT is less on individual efficiency and more on team productivity based on proper staff management and utilization of resources. In DFT, operation sheets are prepared, based on the sequence of events for easy reference. Written instructions are kept to a minimum. The operation sheets give graphical and color coded instructions regarding work to be done and quality levels to be maintained. These are then placed at every workstation for ready reference.

The instructions also include checking quality of the work done at the previous operation before starting an operation. A similar check of the quality is done on the work completed before forwarding the work piece for the next operation. Thus DFT is a technique that combines the best features of lean and flexibility in manufacturing.

Quality Tools > Kanban

Global manufacturing enterprises strive hard to develop their manufacturing operations to stay ahead of their competitors. Admittedly, prosperous manufacturing organizations boast of unparalleled success as they meet changing customer demands efficiently. Complying with changing customer order pattern requires an accurate and precise manufacturing system. An efficient manufacturing system is one that absorbs lesser lead times (from order to delivery).Manufacturing Systems can be essentially classified as a 'Pull' System and a 'Push' System. Most manufacturing organizations use the traditional "Push" manufacturing system, even though it not equipped to handle changing customer demands. Push systems often have excess inventory and extended lead-times from order to delivery. This is because production is scheduled from one stage to the next irrespective of customer demand. Pull system, on the other hand provides companies flexibility in manufacturing, thereby avoiding excess inventories and large order lead-times.

Working on the principle of operating backwards, it uses signals to generate production events. These signals are triggered by the requirement of finished products at the finished goods warehouse, which are then sent to the preceding manufacturing stage. This stage signals to the component fabrication work centre for necessary components, which in turn, signal the vendor for raw material replenishment. Kanban, meaning card or marker in Japanese is a more widely known and recognized type of pull system. The "Kanban Pull" System enables the production line to be altered on the basis of signals received at the end of the supply chain. Thereby, it assists replenishment of finished products, components, and raw materials. This concept was first initiated at the Toyota Automobile Corporation. Hence, it is also referred to as the Toyota Production System. The Kanban System uses a specifically sized container that cycle back and forth between workstations. Each Kanban card set between departments authorizes material to be pulled into the previous department for processing and delivery to the next department.

These cards are used to control work-in-progress (WIP) and inventory flows. A Kanban system allows a company to use Just-In-Time (JIT) production and ordering systems, which in turn minimize their inventories while still satisfying customer demands. Two Kanban cards are utilized in the pull system. These are:

Production Kanban:

The primary function of the production Kanban is to release an order to the preceding stage to build the lot size indicated on the card. Production Kanbans are transferred at regular intervals to a collection box. This box acts as an authorization for the personnel to produce the required parts within a specified time frame. It is then attached to the production Kanban and placed in a warehouse where it awaits transfer to the using department. Production occurs at a department provided the raw material is available and it has a card authorizing production. Material is pulled through the system only when it receives the authorization to move.

Conveyance (withdrawal) Kanban:

The main function of a conveyance Kanban is to pass the authorization for the movement of parts from one stage to another. After getting the parts from the preceding process it moves them to the next process and so on until the process has consumed the last part. The withdrawal Kanban then travels back to the preceding process to get parts thus creating the cycle. A Kanban Pull System is governed by three simple rules:

• Producing departments do not produce parts unless a production Kanban in the dispatch box is authorized for production

• Every container has only one conveyance Kanban and one production Kanban.

• The numbers of containers are controlled by production management and kept to the minimum possible quantity. Companies use different card formats as per their requirements. Some variations of the conventional card system are:

• Single card Kanban systems.

• Metal plates.

• Ping-pong balls.

Quality Tools > 5S Practice

5S is an acknowledged housekeeping technique. The '5-S practice' is now a highly appreciated technique in business. It not only helps to impress customers but also to establish effective quality processes for good services and products.

The term '5-S' represents five words in Japanese namely Seiri, Seiton, Seiso, Seiketsu and Shitsuke. In English these terms mean Sort, Set in order, Shine, Standardize and Sustain.

a) Seiri (Sort):

This term suggests that all unnecessary items at the workplace need to be sorted out. This provides sufficient free space. Some things that can be sorted out are damaged tools, surplus raw material and other items not needed in the normal day-to-day work.

b) Seiton (Set in order):

Once the workplace has been freed of unnecessary items, the next step is to set in order. This involves creating appropriate storage space for items needed around the workplace. They should be placed such that they can be quickly identified and accessed.

c) Seiso (Shine):

Shine means cleaning the workplace till it is spic and span. A neat workspace has two advantages. One, it helps generate a sense of pride in the workmen. Second, it helps easy identification of malfunctions in equipment such as leaks and loose screws among others.

d) Seiketsu (Standardize):

This emphasizes developing and maintaining standard work practices. It includes aspects such as visual communication, work procedures, personal and environmental cleanliness and safety among others. Standardization also includes the company's 5S best practices. Standards are the best way to ensure uniform performance.

e) Shitsuke (Sustain):

The important but difficult thing in 5S implementation is sustaining the progress made.5S cannot be a one- time affair. Often companies start off very well in their implementation of 5S. A walk through the workplace during the early days of 5S implementation will reveal a clean and orderly work environment. However, with passage of time, there is a tendency to neglect the simple practices and before long the work place becomes as dirty and disorderly as it was earlier. Sustaining 5S requires discipline. This is what will ensure success.

Quality Tools > Poka-Yoke/Mistake Proofing

Mistakes happen in organizations for many reasons, but almost all of them can be prevented. This though requires effort to identify when problems happen, define root causes, and then take the proper corrective actions. The objective is to prevent, or at least, detect and weed out defects, as early as possible in the process. The use of simple Poka-Yoke mechanisms and other safeguards can prevent mistakes from becoming catastrophic events. Shigeo Shingo introduced the concept of Poka-Yoke in 1961, when he was an industrial engineer at Toyota Motor Corporation. Poka-Yokes are mechanisms used to mistake-proof an entire process. Ideally, Poka-Yokes ensure that proper conditions exist before actually executing a process step. This prevents defects from occurring in the first place. Where this is not possible, Poka-Yokes perform a detective function, promptly eliminating defects in the process. Poka-Yoke mechanisms can be in electrical, mechanical, procedural, visual, human, or any other form that prevents incorrect execution of a process step. Poka-Yokes can also be implemented in areas other than production such as sales, order entry, purchasing, or product development where the cost of mistakes is much higher than on the shop floor. The Centre for Excellence in Operations (CEO) has developed a Poka-Yoke framework to help its clients understand, the various classifications and applications of mistake-proofing mechanisms. Given below is a brief overview of the framework:

Prevention-Based Poka-Yokes:

Prevention-based mechanisms sense an abnormality that is about to happen, and then signal the occurrence or halt processing, depending on the severity, frequency or downstream consequences. There are two approaches for prevention-based Poka-Yokes:

• Control Method:

This method senses a problem and stops a line or process, so that corrective action can take place immediately, thus avoiding serial defect generation. An example of this is an assembly operation wherein, if one of the components is found to be missing before the actual assembly step takes place, the process shuts down automatically. Another example is an incomplete sales order, which cannot be released for production until a true manufacturability configuration is defined.

• Warning Method:

This method signals the occurrence of a deviation or trend of deviations through an escalating series of buzzers, lights or other warning devices. However, unlike the control method, the warning method does not shut down the process on every occurrence. It is used when a bandwidth of acceptance exists, for a process. An example could be pressurizing a vessel or a filling operation, in which the results need not be exactly the same. Although the process continues to run, the Poka-Yoke signals the operator to remove a defect from the line, or make necessary adjustments to keep the process under control.

Detection-Based Poka-Yokes:

In many situations, it is not possible or economically feasible to prevent defects. This is particularly so where the capital cost of the Poka-Yoke mechanism, significantly exceeds the cost of prevention. For these situations, defects are detected early in the process, preventing them from flowing to downstream processes and multiplying the cost of non-conformance. The three categories of detection-based Poka-Yokes are as follows:

• Contact Method:

This method detects any deviation in shape, dimensional characteristics, or other specific defects, through mechanisms that are kept in direct contact with the part. A subset of this category is the non-contact method, which performs the same function through devices such as photoelectric cells. An example of this might include a chute that detects and removes upside-down or reversed parts, or an in-line gauge that removes dimensional defects and reroutes them to a defect lockbox.

• Fixed Value Method:

This method is used in operations, where a set of steps is sequentially performed. The fixed value method employs automatic counters or optical devices and controls the number of moves, rate, and length of movement besides other critical operating parameters. In this case, mechanisms are usually built into progressive stamping, welding, Systems Manufacturing Technology (SMT), and automatic insertion equipment. Sometimes this is referred to as odd part out method. Here parts left over after assembly signal a defect. Fixed value also includes critical condition detection (pressure, temperature, current, etc.) through electronic monitoring devices.

• Motion Step Method:

This method ensures that a process or operator does not mistakenly perform a step that is not part of the normal process. An example of this is color coding of electronic components on drawings and totes to prevent using mixed or incorrect parts. Another example is a visual to assist customer service representatives, in providing the right literature sets for various products. The Poka-Yoke philosophy requires a strong foundation in TQM. However, first, organizations must learn to be customer focused. Second, organizations must promote quality at the source, and ensure proper investment in their people. As a consequence they are truly empowered. Third, a clear distinction needs to be made between good versus bad quality. Fourth, organizations must embrace the PSP philosophy: Pre-, Self-, and Post-Inspection at the source. Finally,, Poka-Yokes require real-time feedback and corrective action. These are the building blocks of an effective Poka-Yoke effort.

Additional Reading:

1. Everyday examples of Mistake Proofing:

This article gives the everyday examples of mistake proofing.
http://www.campbell.berry.edu/faculty/jgrout/everyday

Quality Tools > Standardized Work

In any organization a work/job is defined as a combination of many inter related activities or work elements. Standardized work is defined as a work in which the successive activities have been properly structured so that it can be done efficiently. Standardized work forms the basis for the continuous improvement of a process. The aim of standardized work is to bring the process under control by reducing variation. This in turn eradicates wastage sand increases the productivity. A standardized work sequence signifies the best practices for the worker to follow in completing his job. Details of best practices are documented and displayed at various departments using standardized work charts. This helps all the employees working in a particular process to stick to the optimal work sequence. The worker can easily handle problems discovered in the process, at any point of time by referring to the standardized work charts. Standardized work is built on the three principles of:

• Takt time.

• Work sequence.

• Standardized in-process stock.

Takt time:

Takt time is defined as the time required for producing a unit of output. Takt time is found out by utilizing the equation: Takt time = time available per shift / no of items to be produced based on demand. For e.g. the time available per shift is 8hrs, and the required number of items to be produced based on demand is 400 per shift. The Takt time is therefore 28800seconds / 400 = 72 seconds. Takt time depends on customer demand and changes with variations in demand.

Work Sequence:

It is the sequence in which the operations have to be performed by the workers in order to complete a work. The work sequence is displayed at the work place so as to determine the workers conformance to standardized work.

Standard In-Process Stock:

In-process stock is defined as the optimum amount of stock necessary to complete a job. The standard in-process stock is documented and displayed at the workplace on the standardized worksheets. This helps in reduce inventory wastage.

Two work sheets are used to put across the standardized work to the team members in the production department:

• Standardized work analysis sheet.

• Standardized work combination sheet.

Standardized work analysis sheet:

The standardized work analysis sheet provides a graphical representation of the work place. Sometimes the machinery and equipment that the worker operates are also illustrated. Information about the three principles of standardized work i.e. takt time, work sequence, standardized in-process stock is provided in the work analysis sheet. The graphics are produced by hand rather than by a computer emphasizing the fact that the worksheets can be modified easily or updated as and when required.

Standardized work combination sheet:

In any organization a work is a combination of many activities, which are inter related. These activities can also be called as work elements. Standardized work combination sheet provides information regarding the work sequence of an operation. It also graphically conveys the time required for each work element in the form of a bar chart. The time required for each work element comprises the handwork; machine time and walking that are graphically displayed on the chart. With the help of this chart the conformance of a worker to standardized work sequence can be easily determined.

Additional Reading:

1. Standardized Work instruction processes.

This article explains Standardized work and some critical sub processes in the form of flowcharts.

http://www.steelconsulting.com/AdobeDocuments/Work_instruction.pdf

Quality Tools > Autonomation/Jidoka

Autonomation:

An organization must ensure that the products manufactured in a batch are zero percent defective. Care should also be taken to ensure that the product flow is consistent and within the specified time frame. Therefore, the reliability of the automated processes assumes critical importance in a manufacturing system. Jidoka (Intelligent Automation as it is popularly known) can be defined as a technique that makes a machine controlled process more dependable in terms of quality. Autonomation should not be mistaken for automation. Autonomation is making the automated operation autonomous i.e. making the automated (machine controlled) manufacturing equipment “Intelligent”. It involves the “empowering” of the automated machines with human discretion so as to differentiate products that conform to quality from those that do not. This ensures the reliability of the process. ‘Do’ in Jidoka is a Japanese word that signifies a human character. Autonomation can also be viewed as the technique of stopping a manufacturing process when an abnormality crops up. This is done either manually or automatically. An abnormality is any form of variation from the specifications. Autonomation derives its origin from the Toyota Production System. Autonomation or Jidoka along with the Just in Time concept is the cornerstone of Toyota Production System.

The Toyota Power loom:

The Toyota Power loom is one instance, where the Jidoka concept was successfully incorporated. Before introducing the Jidoka concept in the power loom, the shuttlecocks that were a part of the production process would cause defects in the yarn being manufactured. Some of the shuttlecocks would stick to the yarn thereby rendering the cloth defective. Prior to automation, the weaver could spot this problem in the loom and immediately stop the process for rectification. However, the automated machines in the power looms would operate continuously irrespective of the defects caused during the manufacturing process. This caused a steep increase in the wastage, cost of production, and customer dissatisfaction. As a part of its Jidoka approach, the Toyota loom put in place a stopper that sends alarm signals each time the shuttlecocks stuck to the cloth. This in turn helped stop the process flow and set right any variations in the process. The result was manufacture of high quality yarn. Jidoka thus implies making the process autonomous enough

• To operate on its own.

• To identify abnormalities cropping up, and

• To deal with those abnormalities.

Quality Tools > Value Stream Mapping

Most management approaches focus on a specific area for achieving functional excellence. The result is excellence in a specific few areas only. Value Management is viewed as an approach to overcoming this problem. Value Management is a style of management particularly dedicated to motivating people, developing skills and promoting synergies and innovation. It aims at maximizing an organization’s overall performance. Value Management is different from traditional management approaches, in that it simultaneously integrates characteristics normally not found within a single management system. One of the important methodologies in Value Management is Value stream mapping. A value stream is a collection of all the activities required to bring a product through the main flow i.e. from raw materials to delivery to the customer. A value stream refers to the specific areas and activities of the firm that actually add value to a particular product or service. The objective is to identify and get rid of the waste in the process (waste being any activity that does not add value to the final product) Identification of the value stream reveals the wastes in a company. These wastes may be in the form of unnecessary steps, backtracking, or waiting time as products move from one department to another or from one company to another. Therefore, it is crucial to first identify the entire value stream for every product and product family. All departments and supply chain partners should together create a channel to eliminate all wastes. Value stream mapping is crucial here. The internal manufacturing operations in a company can be broadly categorized as.

• Non-Value adding operations:

These activities are unnecessary wastes and ought to be eliminated completely. These include waiting time, unnecessary handling of products and piling up intermediate inventory.

• Necessary but non-value adding:

Though these activities are a waste they are required to be performed. Such activities include walking long distances to pick up parts, unpacking of products delivered in the warehouse, and transferring of tools from one machine to another.

• Value adding:

Activities that involve the conversion of raw materials or intermediate products to finished products fall in this category of operations. Activities such as sub-assembly of parts, turning raw material, painting a product body are typical examples. Operations classified thus facilitate easy identification of waste. A map is essential before any important journey. But before reaching the final destination one should know where he is presently. In short, one needs a "current state map." To know what should be achieved in the future one needs a "future state map." Current and final state maps are the starting points to mapping the value stream. Value Stream Mapping has been recognized as an important tool for effectively designing and introducing lean production systems. It also facilitates shorter lead times through the value chain. Serving as blueprints for lean manufacturing implementation, seven key tools for the implementation of value stream mapping have been identified. They are:

• Process activity mapping.

• Supply chain response mapping.

• Quality filter mapping.

• Production variety funnel.

• Demand amplification mapping.

• Decision point analysis.

• Physical structure mapping.

Process Activity Mapping [PAM]:

With its origins in industrial engineering PAM aims to establish a map of the processes under study. First, a primary analysis of a process is done. This is followed by a detailed analysis. All resources required in each process are recorded. The processes can first be categorized into activity types such as processing, transportation, inspection, and storage. Then the machine or area used for each of the activity types is noted. A flow chart of the activity type being undertaken can then be made. This includes details like distance moved, time taken, and the number of people involved. Using this flowchart and applying techniques such as 5 Whys (progressively asking why 5 times) helps eliminate non-value adding activities. A simplification, sequence change or a combination of activities can take place during this waste elimination. Various alternatives for improvement can be mapped before choosing the best one for implementation.

Supply Chain Response Mapping:

This tool originated from the time compression and logistics movement. It was originally used in a textile supply chain setting. The tool aims at a 'time based process mapping'. The critical lead-time constraints are represented in a simple diagram or simple graph. The cumulative lead-time can be shown on the x-axis and the number of days of material held in the system on the y-axis. The total response time can then be calculated. Once this is done individual lead times and inventory amounts can be improved.

Production Variety Funnel:

Production variety funnel is similar to IVAT analysis and helps one understand how products are produced. IVAT analysis is used to view the internal operations in companies consisting of activities that confirm to I, V, A or T shapes. 'I' plants are unidirectional, regular production of multiple items as in a chemical plant. In a 'V' plant a limited number of raw materials are processed into a large number of finished products in a generally diverging pattern.

Divergence means that the relatively few raw materials diverge into a greater number of intermediate items and those intermediate items diverge into still more items and so on until the final process or assembly. Textile and metal fabrication are examples of V plants. Few end items and many raw material and parts items are the main characteristics of an 'A' plant. Unlike the V plant, the flow of materials and parts "converge" as they approach final assembly. Convergence means that fabricated parts converge into a subassembly, which, in turn, converges into another subassembly and so on until final assembly. Aerospace and major assembly industries are typical examples of 'A' plants. 'T' plants are characterized by a large number of end items made from a relatively few common parts. These plants are similar to "A" plants except that the process is dominated by divergences almost all occurring at or near the final assembly point. Typical examples are the electronics and household appliance industries. Such a description using the production variety funnel allows the person responsible for mapping to recognize how the firm or the supply chain functions. It also helps in targeting the point to reduce inventory and make changes to the processing of products.

Quality Filter Mapping:

Quality filter mapping helps in identifying quality problems. The quality filter map identifies three different types of quality defects that occur in the supply chain. Typically they are:

• Product defects: These defects are produced in products and passed onto customers. They are not identified in the in-line or end of line inspections.

• Service defects: Defects associated with difficulty to a customer and not related to the product itself or production errors are service defects. The associated level of service provided causes such defects. Examples include unsuitable delivery (late or early) or incorrect documentation.

• Internal scrap: These defects are identified in the inline or end of line inspections. Once identified these defects are mapped along the supply chain. This helps in identifying where they occur and thereby identify problems, inefficiencies and wasted effort to improve upon them.

Demand Amplification Mapping:

Demand amplification mapping helps examine the increase in demand variability as one travels up the supply chain. This mapping tool is used to illustrate how demand shifts along the supply chain in varying lengths of time. The information can be used for decision-making and analysis while redesigning the value stream. It also serves as basis for managing regular demand in one manner and exceptional demand in another. Thereby it minimizes variations.

Decision Point Analysis:

Decision point is the point along the supply chain where the real demand-pull gives way to forecast driven push. At this point products are made according to forecast demand in place of the actual demand. With knowledge of this point, all processes that function in both directions (upstream and downstream) can be aligned as per the relevant approach adopted, either pull or push. Various alternative scenarios can be evaluated by shifting this point along the value stream.

Physical Structure Mapping:

This mapping tool gives a broad overview of the value stream at an industry level. What the industry looks like and areas where development should take place are some of the questions this tool helps answer. Two sets of diagrams can be used in the process:

Volume structure:

This diagram illustrates how the industry is structured. It can depict the various tiers that exist in the supply and the distribution chain. Thus it helps in capturing all the firms in a particular area of the value stream.

Cost structure:

It is similar to the volume structure diagram but for the linkage to the value/cost adding process, in place of the number of firms involved. The information derived from this tool serves as the basis for improving the value stream map. The process selected is the input and the improved value stream map the output.

Allocations of appropriate weightings that determine the usefulness of each tool to identify waste help select The Value Stream Mapping tools. These weightings depend on the industry being considered, with some wastes being more relevant in certain industries. However, used together these seven tools can provide an effective framework for identifying and eliminating wastes.

Quality Tools > 7 Wastes

The objective is to identify and get rid of the waste in the process (waste being any activity that does not add value to the final product).

Conducting a value stream map can do this. A value stream map is a collection of all the activities required to bring a product through the main flow i.e. from raw material to delivery to the customer. It refers to the specific parts of the firm that actually add value to a particular product or service. The essence of mapping the value stream is to eliminate the seven commonly accepted wastes out of the manufacturing operations. They are:

• Waste from over-production, e.g. making a batch of 100 when they had only orders for 50, so that the balance had to go into stock; or making a batch of 52, instead of 50, in case there were rejects. Both tie up production facilities longer than necessary and excess production may eventually have to be scrapped if it can't be sold.

• Waste of waiting time, e.g. allowing queues to build up between operations, resulting in longer lead times and higher work-in-progress.

• Transportation waste, e.g. the time and effort spent in moving products around the factory as a result of poor layout.

• Processing waste: e.g. off cuts of raw materials.

• Inventory waste: Inventory does not add value. Not only does it cost money to run a store, but also its costs in terms of the interest that has to be paid on the money tied up in stock. In many cases production of customer's orders would have been delayed as a result of production resources being tied up in production items for stock.

• Waste of motion: e.g. as a result of inefficient layout of tools and materials around the workplace.

• Waste from production defects: This is a result of not getting it right the first time.

Quality Tools > Visual Management

• How important is communication in the industrial scenario?

Perhaps most important! Operations within any organization involve vital transfer of information. In short, communication dictates organizational performance.

Communication is all about a sender intending to reveal specific information to a receiver. Researchers believe that effective communication can influence human behavior and performance. An efficient communication mode must therefore be conclusive, comprehensive, and clear. According to industrial gurus, organizations that strive to attain world-class status must have communications systems containing these three characteristics. However, in this era of cutthroat competition, communications systems must also be economical. Visual communication is one such system that is both efficient and cost effective. It includes signs, symbols, charts, or even physical models that convey a message.

Visual communication helps organizations convey messages/information with minimum fuss and maximum results. Sadly though, for most companies visual communication is about a logo atop a letterhead or a building. According to industrial gurus entering an organization without a visual image is like being asked to find the door in a dark room. Similarly, an organization that fails to provide visual signs of what each unit does is synonymous to one operating blindfolded.

Visual communication has always been a proven asset in many fields. Researchers believe that visual communication catches human imagination more strongly than any other form of communication. Statistics support this fact:

1. Sight - Vision - 75% of human imagination2. Hearing - Audible sounds - 13 %3. Feeling – Physical - 6%4. Smell – Olfactory - 3% and5. Taste – Gustatory – 3%

The role of visual communication stretches far beyond insignias within facilities. In world-class organizations, visual communication is a part of top management strategy. It enhances plant and frontline personnel performance. Visual communications is extremely efficient because it is characteristically universal and rich in meaning. Visual signs convey the same meaning to one and all and are hence seldom misinterpreted. Furthermore, visual communication neither interferes with another functional system nor allows any interference. Thus there is no disturbance from or of neighboring systems. Other communication modes may not have all these advantages.

Visual communication is often misinterpreted as being advantageous only to the manufacturing facility where it is installed. In reality, it is an opportunity that can be used to enhance, the entire organization's reputation amongst customers. Organizations using visual communication will earn the appreciation of not just factory workers but also external customers. For most customers visual communication is a true reflection of quality with safety being given the highest priority. Today, safety is as important to customers as is value for money. So ensuring safe working conditions necessitates providing value for money to the customer. Visual communication is easier understood than other forms of communication. Researchers believe that visual signs are more thought provoking than words. This is because they have a higher influence on neuroninter connections, present in the visual cortex of the human brain. Hence, the likelihood of conveying the desired message to the concerned is higher.

Visual communication does not mean logos. It encompasses the use of visual modes to communicate information. Few good examples of visual tools are control charts and storyboards. These visual/graphical performance curves/charts should be displayed at the facility as they help employees understand equipment performance and work accordingly.