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ENHANCING PRODUCTIVITY BY IMPLEMENTING LEAN PM FRAMEWORK ON AN AUTOPARTS MANUFACTURING FACILITY

**BAHRIA UNIVERSITY LAHORE CAMPUS**

SUBMITTED TO: Mr. Kamil Hassan**SUBMISSION DATE:** 11-Jun-2016

CERTIFICATE

This witness statement is issued to the applicant for the fulfilment of their MS (Project Management) program requirements being carried out at Bahria University Lahore Campus (BULC).

It is witnessed that Mr. Adeel Hassan Khan and Mr. Amin Faruki Enrollment: 03-298152-002 and 03-298152-006 Class: **MSPM-II** Semester: **Spring 2016** have contacted / visited our premises /participated in our real-time projects for implementing project management skills.

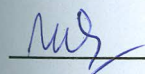
They have been found skillful in applying Project Management techniques in the following highlighted fields

1. Production
2. Lean Manufacturing
3. Process Improvement

Additionally, it is noteworthy to mention that they demonstrated good ethical practices, enthusiastic approach to work, task convergence capabilities, professionalism while their connection with this organization.

Certified By Company Official:

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ACKNOWLEDGMENT

Up and above anything else, all gratitude and praises are due to ALMIGHTY ALLAH alone, the most Gracious, Merciful and Compassionate, the Creator of the universe, who enabled us to complete this report successfully. It is a matter of great pleasure and honor for us to express our deep sense of gratitude for the time devoted to us by **Mr. Sohail Ayoub** (Lead Engineer Mechanical) ***Infinity Engineering (Pvt.) Limited***. Who facilitated us by enabling us to gather the data required for our project and helping us anyway he could along the way.

We are also thankful to everyone who contributed towards the completion of our report including special thanks for **Mr. Kamil Hussain** (Course Supervisor) who helped us immensely during the most difficult phase of our report. Finally, we extend our cordial gratitude and our special regards to our most respectful affectionate and loving parents, who have always prayed for our success and betterment.

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Abstract

Our project is to study and implement Lean PM Framework (An Advanced Project Management Technique) on a Manufacturing Facility and compare its efficiency over its traditional counterpart. The aim is to apply lean principals (Reduce Inventory, Reduction in Movement, Overproduction, Defect Rate etc.) over a running manufacturing facility, potential benefit of which is the increased Organizational Productivity. On a broader spectrum, if this concept is opted at country wide manufacturing, it would definitely polish our country's manufacturing practices, would increase Organizational Profit and eventually would contribute & Improve in the National Financial Standing among the globe.

Project Management

A project is one of a kind in that it is not a normal operation, but rather a particular arrangement of operations intended to fulfill a solitary objective. A task is impermanent in that it has a characterized starting and end in time, and in this manner characterized degree and assets.

Project Management, then, is the utilization of information, aptitudes, instruments, and strategies to venture exercises to meet the undertaking prerequisites.

Project management *processes* are subdivided into five groups:

- Initiating
- Planning
- Executing
- Monitoring and Controlling
- Closing

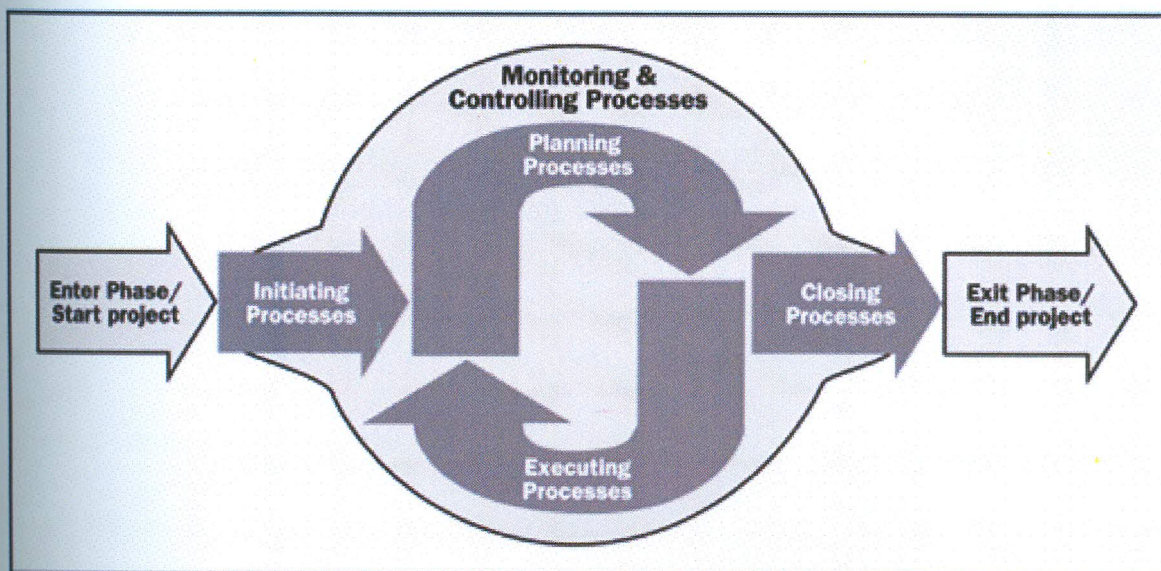


Figure 3-1. Project Management Process Groups

A Guide to the Project Management Body of Knowledge (PMBOK® Guide) – Fourth Edition, ©2008 Project Management Institute, Inc. All Rights Reserved.

The main components of project management are enlisted below:

Defining the motivation behind why a venture is important; Capturing Project prerequisites, indicating nature of the deliverables, assessing assets and timescales;

- ✓ Preparing a business case to legitimize the speculation
- ✓ Securing corporate understanding and subsidizing
- ✓ Developing and executing an administration arrangement for the task
- ✓ Leading and propelling the task conveyance group
- ✓ Managing the dangers, issues and changes on the venture
- ✓ Monitoring progress against arrangement
- ✓ Managing the project's spending plan
- ✓ Maintaining interchanges with partners and the project association
- ✓ Provider Administration
- ✓ Closing the Project in a controlled manner

Need for Project Management?

Interest in successful Project administration will have various advantages to both the host association and the general population required in conveying the undertaking. It will:

- ✓ Provide a more prominent probability of accomplishing the fancied result
- ✓ Ensure effective and best esteem utilization of assets
- ✓ Satisfy the varying needs of the undertaking's partners

Lean

In literal sense Leans means

- "Be in or move into a sloping position"
- "A deviation from the perpendicular; an inclination."

The main objective/center thought is to amplify client esteem while minimizing waste. Essentially, Lean implies making more esteem for clients with less assets.

A Lean association comprehends client esteem and centers its key procedures to constantly build it. A definitive objective is to give immaculate quality to the client through a flawless worth creation handle that has zero waste.

To fulfill this, Lean thinking changes the center of administration from streamlining separate innovations, resources, and vertical divisions to improving the stream of items and administrations through whole value streams that stream on a level plane crosswise over advances, resources, and offices to clients.

Disposing of waste along whole value streams, rather than at disengaged focuses, makes forms that need less human exertion, less space, less capital, and less time to make items and administrations at far less expenses and with many less deserts, contrasted and conventional business frameworks. Organizations can react to changing client wishes with high assortment, amazing, minimal effort, and with quick throughput times. Likewise, data administration turns out to be much less difficult and more precise.

Lean for Production & Services

A common misinterpretation is that Lean is suited just to manufacture. Not genuine. Lean applies in each business and each procedure. It is not a strategy or a cost decrease program, but rather a state of mind and representing a whole association.

Organizations in all commercial projects and administrations, including social insurance and governments, are utilizing Lean standards as the way they think and do. Numerous associations pick not to utilize the word Lean, but rather to name what they do as their own framework, for example, the Toyota Production System or the Danaher Business System. Why? To commute home the point that Lean is not a system or fleeting cost decrease program, however the way the organization works. The word change or Lean change is regularly used to describe an organization moving from an old state of mind to Lean considering. It requires a complete change on how an organization conducts business. This takes a long haul point of view and persistence.

The expression "Lean" was begat to depict Toyota's business amid the late 1980s by an examination group headed by Jim Womack, Ph.D., at MIT's International Motor Vehicle Program.

Three Guiding Points for Lean Transformation:

According to Womach and Jones

"Three fundamental business issues that should guide the transformation of the *entire organization*":

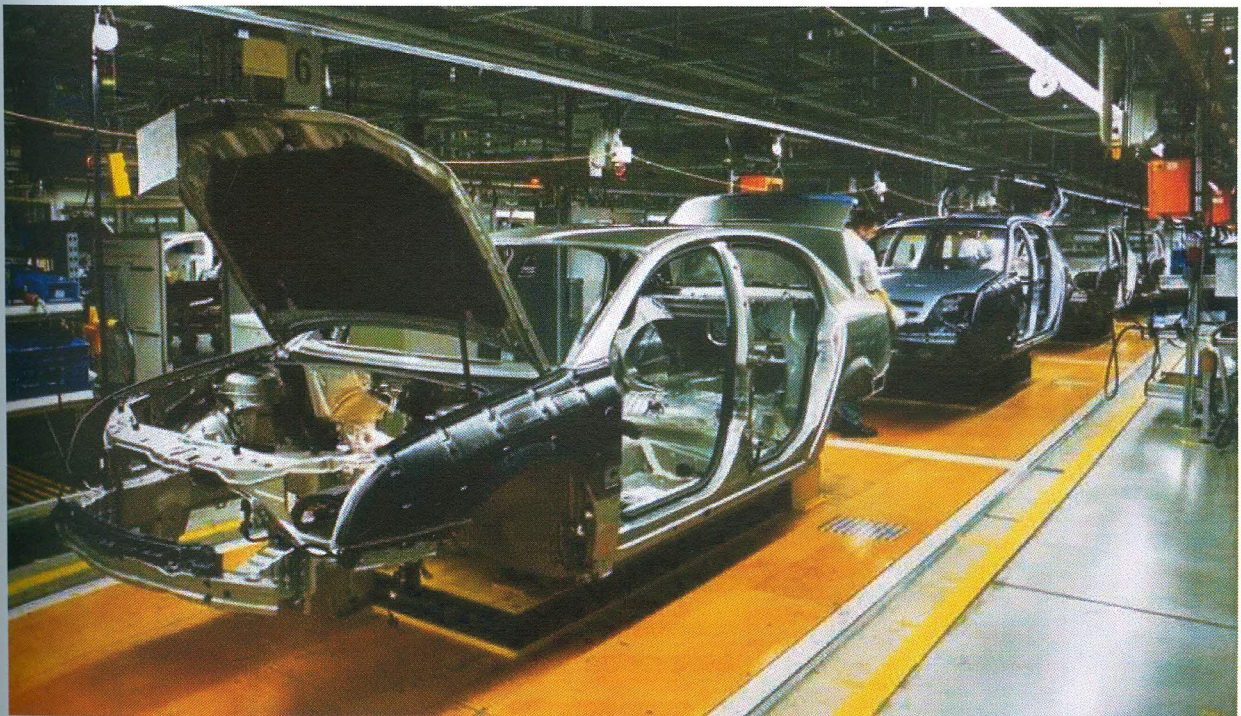
- **Purpose:** What client issues will the project settle to accomplish its own motivation of succeeding?
- **Process:** In what capacity will the association survey every real value stream to ensure every progression is profitable, able, accessible, satisfactory, adaptable, and that all the strides are connected by stream, force, and leveling?
- **People:** By what means can the association guarantee that each essential procedure has somebody in charge of consistently assessing that value stream as far as business reason and Lean process? By what means can everybody touching the worth/value stream be effectively occupied with working it accurately and persistently enhancing it?

History & Evolution of Lean Concept

As Kiichiro Toyoda, Taiichi Ohno, and others at Toyota took a gander at this circumstance in the 1930s, and all the more seriously soon after World War II, it jumped out at them that a progression of basic developments may make it more conceivable to give both congruity in procedure stream and a wide assortment in item offerings. They thusly returned to Ford's unique considering, and imagined the Toyota Production System.

This framework basically moved the center of the assembling engineer from individual machines and their use, to the stream of the item through the aggregate procedure. Toyota inferred that by right-estimating machines for the genuine volume required, acquainting self-checking machines with guarantee quality, coating the machines up in procedure grouping, spearheading fast setups so every machine could make little volumes of numerous part numbers, and having every procedure step tell the past stride of its present requirements for materials, it is conceivable to acquire ease, high assortment, high caliber, and extremely quick throughput times to react to changing client wants. Additionally, data administration could be made much less difficult and more precise.

In spite of the fact that there are occurrences of thorough procedure thinking in assembling the distance back to the Arsenal in Venice in the 1450s, the primary individual to genuinely coordinate a whole creation procedure was Henry Ford. At Highland Park, MI, in 1913 he wedded reliably tradable parts with standard work and



moving movement to make what he called stream generation. The general population got a handle on this in the emotional type of the moving sequential construction system,

yet from the viewpoint of the assembling design the leaps forward really went much further.

Portage lined up manufacture ventures in procedure succession wherever conceivable utilizing uncommon reason machines and go/no-go gages to create and gather the segments going into the vehicle inside a couple of minutes, and convey flawlessly fitting segments specifically to line-side. This was a really progressive break from the shop practices of the American System that comprised of universally useful machines gathered by procedure, which made parts that in the long run discovered their way into completed items after a decent piece of tinkering (fitting) in subassembly and last get together.

The issue with Ford's framework was not the stream: He could turn the inventories of the whole organization at regular intervals. Or maybe it was his failure to give assortment. The Model T was not simply constrained to one shading. It was likewise restricted to one particular with the goal that all Model T body were basically indistinguishable up through the end of creation in 1926. (The client had a decision of four or five body styles, a drop-on highlight from outside suppliers included at the very end of the generation line.) Indeed, it gives the idea that for all intents and purposes each machine in the Ford Motor Company took a shot at a solitary part number, and there were basically no changeovers.

At the point when the world needed assortment, including model cycles shorter than the 19 years for the Model T, Ford appeared to lose his direction. Different automakers reacted to the requirement for some shows, each with numerous choices, yet with generation frameworks whose outline and creation steps relapsed toward procedure ranges with any longer throughput times. After some time they populated their creation shops with bigger and bigger machines that ran quicker and speedier, clearly bringing down expenses per process step, however ceaselessly expanding throughput times and inventories aside from in the uncommon case—like motor machining lines—where the majority of the procedure steps could be connected and mechanized. Much more dreadful, the time slacks between procedure steps and the mind boggling part routings required perpetually refined data administration frameworks coming full circle in mechanized Materials Requirements Planning(MRP) frameworks. As Kiichiro Toyoda, Taiichi Ohno, and others at Toyota took a gander at this circumstance in the 1930s, and all the more seriously soon after World War II, it jumped out at them that a progression of basic developments may make it more conceivable to give both congruity in procedure stream and a wide assortment in item offerings. They thusly returned to Ford's unique considering, and imagined the Toyota Production System.



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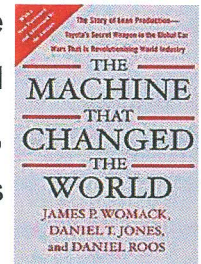
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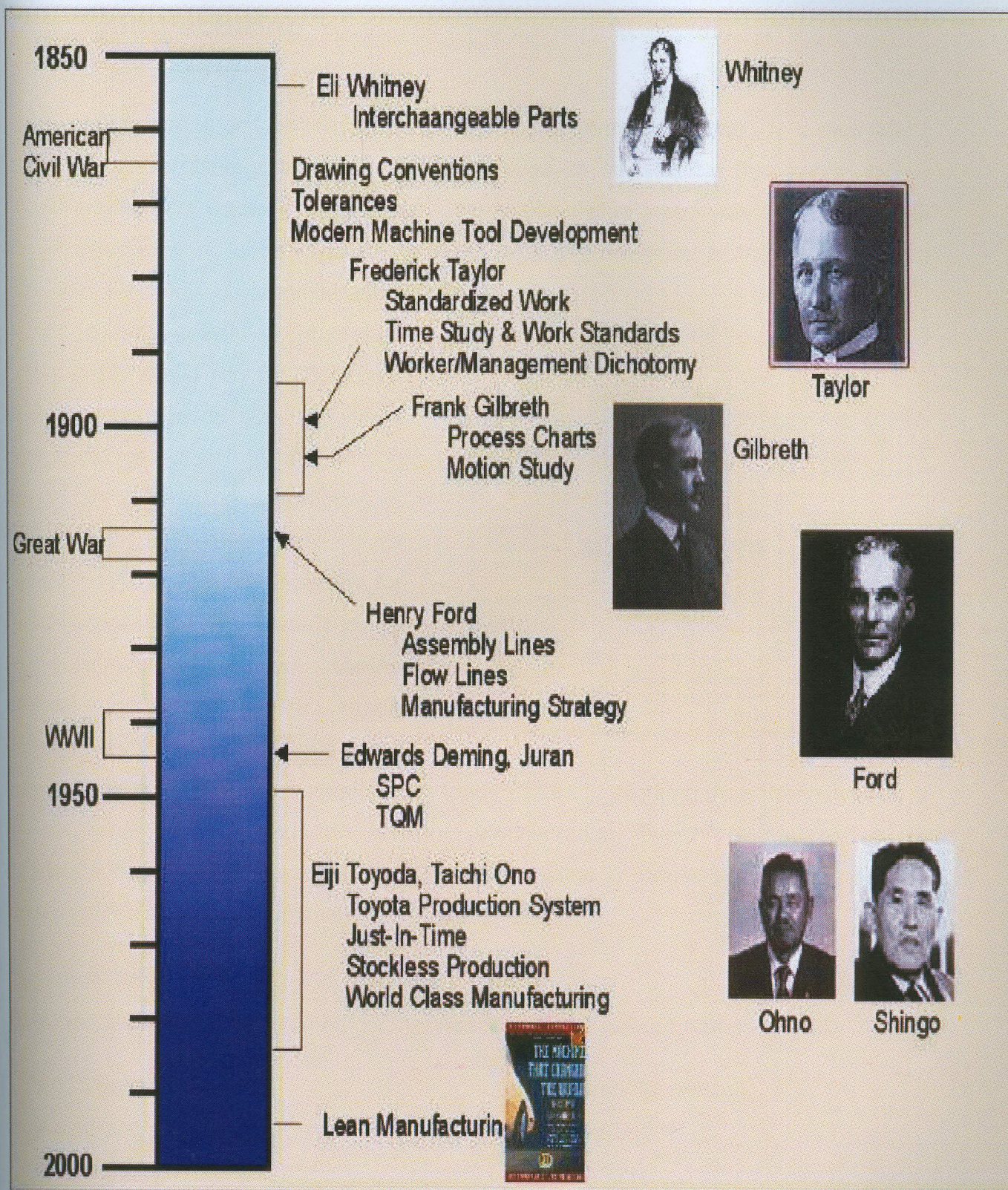
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The manner of thinking of Lean was altogether depicted in the book *The Machine That Changed the World*(1990) by James P. Womack, Daniel Roos, and Daniel T. Jones. In an ensuing volume, *Lean Thinking*(1996), James P. Womack and Daniel T. Jones refined these incline standards much further to five;

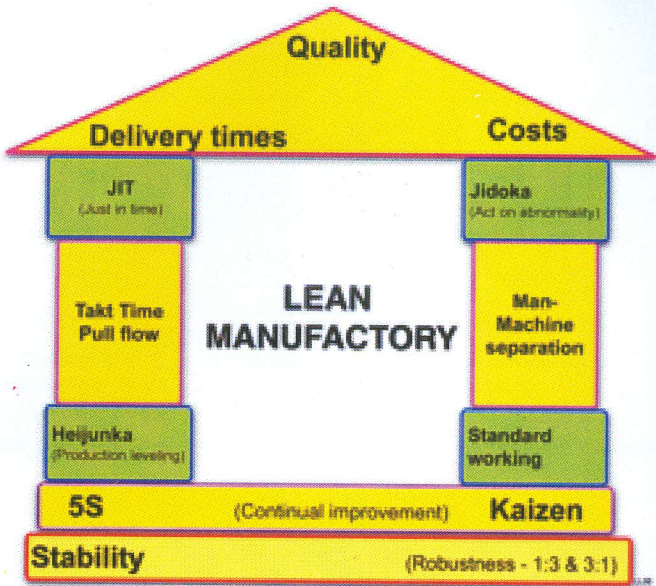


- ✓ Specify the worth fancied by the client
- ✓ Identify the value stream for every item giving that esteem and test the majority of the squandered strides (for the most part the vast majority of) presently important to give it
- ✓ Make the item stream consistently through the remaining worth included strides
- ✓ Introduce pull between all strides where persistent stream is conceivable
- ✓ Manage toward flawlessness so that the quantity of steps and the measure of time and data expected to serve the client persistently falls



Lean Manufacturing

Lean Manufacturing or Lean Production, regularly essentially "incline", is a methodical strategy for the disposal of waste ("Muda") inside an assembling framework. Incline likewise considers waste made through overburden ("Muri") and waste made through unevenness in work loads ("Mura"). Working from the viewpoint of the customer who expends an item or administration, "worth" is any activity or procedure that a client would pay for. Basically, incline is focused on making evident what includes esteem by diminishing everything else. Incline assembling or incline creation, regularly essentially "incline", is a methodical strategy for the disposal of waste ("Muda") inside an assembling framework. Incline likewise considers waste made through overburden ("Muri") and waste made through unevenness in work loads ("Mura"). Working from the viewpoint of the customer who expends an item or administration, "worth" is any activity or procedure that a client would pay for. Basically, incline is focused on making evident what includes esteem by diminishing everything else.



Waste Areas

There are 8 waste areas listed below that needs to be monitored and managed;

- Over Production
- Waiting
- Inventory
- Transportation
- Over-Processing
- Motion
- Defects
- Workforce

The 8 Wastes

To remember The 8 Wastes, you can use the acronym "DOWNTIME."



Implementation of Lean

Implementation and Execution of Lean Manufacturing is a somewhat dinky/strenuous subject. Most firms falter through the execution with experimentation. Others depend on perpetual Kaizen occasions. Some trust that Value Stream Mapping is all that is essential.

There is a shortage of data and some of what is accessible is misdirecting or unrealistic. For instance, one distributed methodology underscores periods/phases of:

- Stability
- Continuous Flow
- Standardized Work
- Pull Systems
- Level Production
- Continuous Improvement

These periods/phases of Lean should move through the whole plant in a steady progression like tidal waves. For most firms this is improbable. It overlooks the collaborations and systemic nature of Lean Manufacturing. This is the thing that Barry Richmond calls "List Thinking." List thinking is pervasive.

Envision a doctor with a rundown of the main twenty medications. He endorses the same rundown to each patient, paying little respect to indications. The idea does not move certainty and the methodology is unrealistic to chip away at an intricate framework like the human body-mind. Nor will it work for a manufacturing plant.

List thinking is particularly dangerous while actualizing. Every one of the components in the Laundry List at right have esteem in a few circumstances. Be that as it may, the rundown gives no direction for needs, priority or effect. Without a doubt, it can't on the grounds that every industrial facility and circumstance is exceptional.

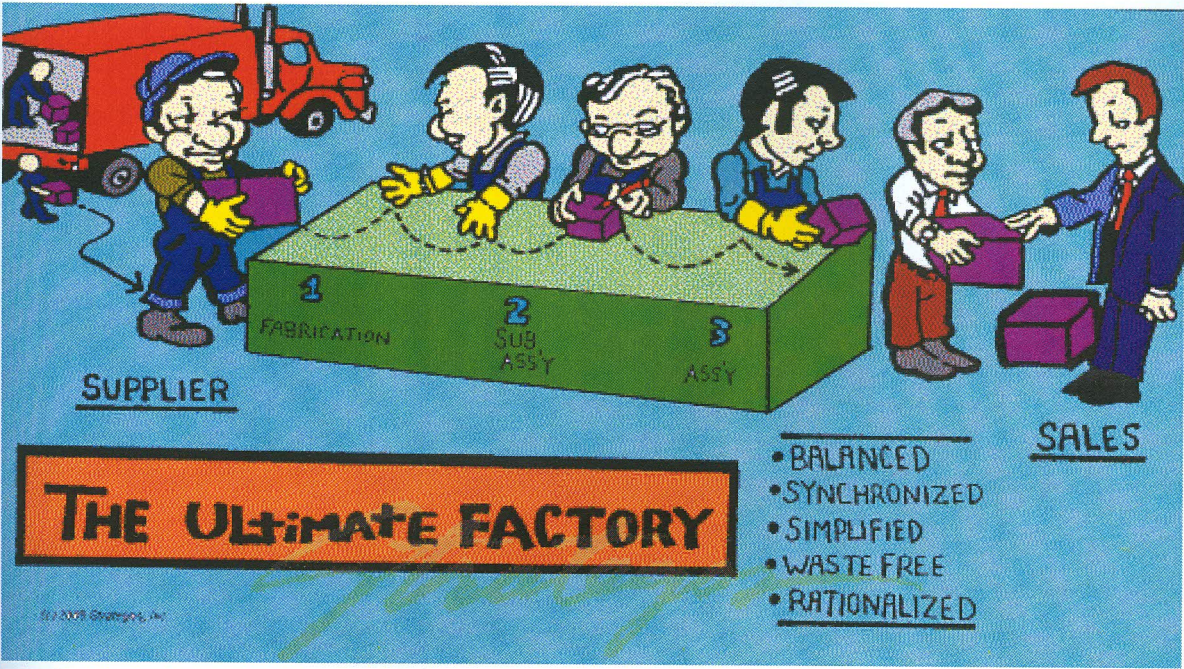
Analyzing this theme deliberately and systemically brings up a few questions/considerations:

- ✓ Do we require the whole rundown of "Apparatuses and Techniques?"
- ✓ If not, which do we utilize?
- ✓ Which components start things out?
- ✓ Do we actualize Lean Manufacturing expansive or in centered territories?
- ✓ How does Kaizen fit into the photo?
- ✓ How definite ought to the arrangements be?
- ✓ How long will it take?
- ✓ How do we know when we are truly Lean?

Mental Model

Taiichi Ohno and Shigeo Shingo created and actualized Lean Manufacturing at Toyota over a time of 20-30 years. Their methodology gives a mental model to different executions.

Ohno initially imagined a perfect generation framework, as far as work process. Ohno's optimal framework was roused Eiji Toyoda's perceptions at Ford Motor Company. The perfect creation framework was a progression of neighboring workstations that were adjusted and synchronized with no stock between stations. It conveyed completed item to the client precisely when required (Just In Time) and drew materials, Just In Time.



As per legend, Ohno (or, perhaps, Eiji Toyoda) solicited what kept the acknowledgment from this extreme, no-stock (no inventory) framework. As the reasons surfaced, Ohno asked for his delegates to "dispose of the reasons."

The subsequent components of Lean Manufacturing go for disposing of (or possibly lessening) the purposes behind stock/inventory. While the genuine objective is to dispense with waste, Ohno comprehended that stock mirrors waste.

This is a case of what Edward DeBono calls "Lateral/Parallel Thinking." By envisioning a perfect, however outlandish circumstance, we can frequently see all the more unmistakably, the way to its acknowledgment.

Ohno and Shingo did not expect to build up some kind of "Unified Field Theory" for all assembling. They essentially needed to tackle Toyota's particular issues. The arrangements they picked, while wide based, don't as a matter of course apply in all circumstances. Your answers might be distinctive.

An Example

In numerous production lines an essential "explanation/reason behind stock" includes interweaved issues of hardware scale, setup, clumping, and work process. The causal outline (beneath) delineates.

The issue begins with gear that is bigger and speedier than required for a solitary item. This causes various items to keep running on the same hardware. Two impacts result:

- Changeovers become necessary.
- Different products follow different routes.

Addition to it, vast scale hardware regularly requires troublesome and tedious setups. The blend of changeover and long setup drives vast clumps that advance high stock. Distinctive courses power useful formats with complex streams that likewise expand stock.

High stock brings a wide range of waste in material taking care of, space and quality (not appeared). This picture is still over-simplified. In actuality, it has various, unobtrusive strengthening circles that intensify the issue after some time.

At Toyota, Shingo assaulted both underlying drivers. In the first place, he built up the SMED framework that lessened changeover times and, along these lines, bunch sizes and stock. Second, he downsized the gear, where conceivable.

Lean Assessment

This appraisal examines, assess, and measure nine key zones of assembling. The outcome is a more profound comprehension of key issues, issue territories, and

potential arrangements. This arrangement utilizes an Excel layout to record data and score the outcomes. It likewise takes into consideration weighting the nine key zones to mirror your own particular procedures, items, and markets. The evaluation delivers a "radar diagram" that outwardly shows results.

How It Works

The Lean Manufacturing Assessment has a poll that investigates nine key zones. There are 3-6 questions for every territory with numerous decision answers. A scoring worksheet adds up to the score for every segment and gives a general Lean Index.

This appraisal permits weighting of the nine key regions. These ranges are not similarly imperative in deciding general assembling execution. In addition, the relative significance of the zones fluctuates with specific items, markets, forms, and different components. The client must assess the relative vital effect of every territory.

The weighting include likewise sets up needs for execution. For instance, in a profoundly computerized manufacturing plant with necessary procedures, a low upkeep score would be a basic lack. In any case, for a get together operation utilizing hand devices and manual strategies, a low positioning on "Maintainance" would have little effect.

The inquiries lead to measurements for Lean Manufacturing project. Managers generally depend on accounting measurements. Be that as it may, these are insufficient for Lean Manufacturing. Accounting information is the final after effect of a long chain of interrelated choices, practices and occasions. What's more, it as a rule has huge time delays. Dealing with an Lean production line requires information that reflects what is occurring upstream in these chains and progressively.

The assessment can likewise be a point of convergence for key decisions. It can arrange and structure a vital open deliberation. It builds an organization's capacity to utilize certainties and lessens the need to depend on assessment and, along these lines, has a tendency to edify the discussion also.

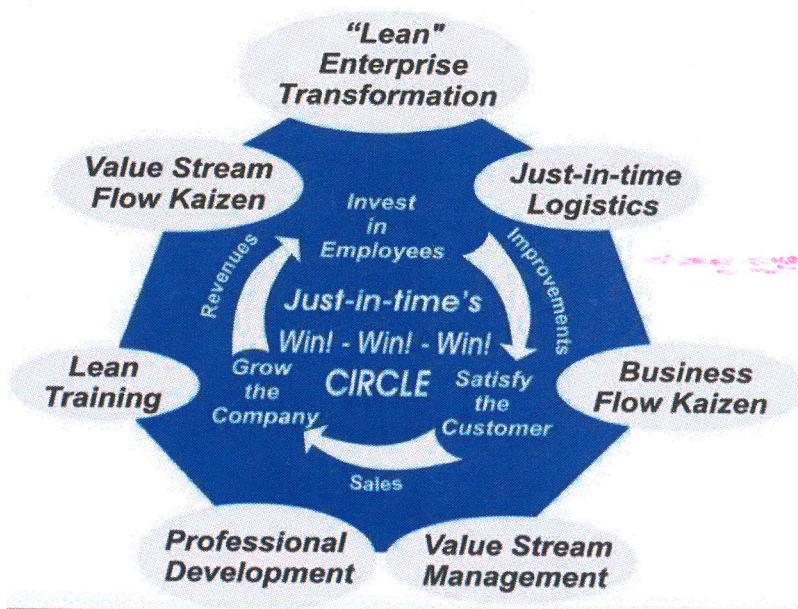
Nine Key Areas

- Inventory
- The Team Approach
- Processes
- Maintenance
- Layout & Material Handling
- Suppliers
- Setup
- Quality
- Scheduling

Tools & Techniques in Lean

Tools & Techniques used in Lean are enlisted and discussed below;

- ✓ process relies upon having assets accessible. Kanban
- ✓ Just in Time (JIT)
- ✓ Single-Minute Exchange of Dies (SMED)
- ✓ Process Mapping
- ✓ Value Stream Mapping (VSM)

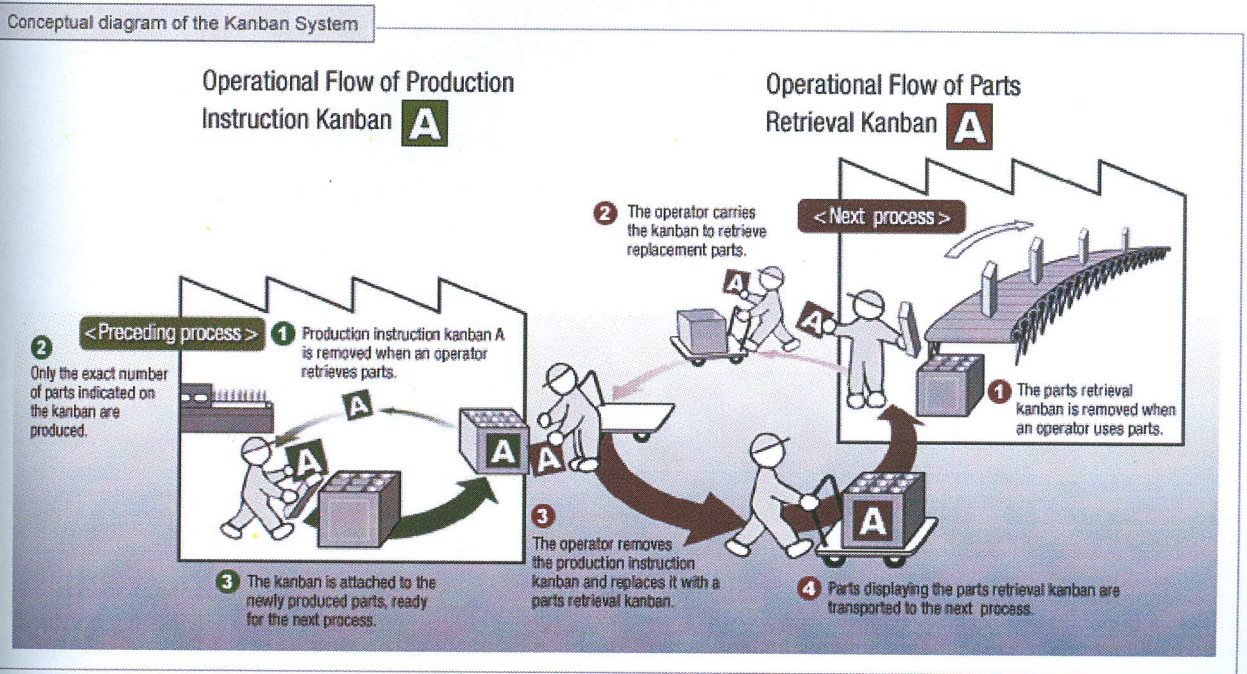


Kanban

Kanban was created as a method for satisfying Just in Time (JIT) stock/inventory framework. By executing kanban, your materials and supplies arrive right when you require them. This declines your inventory/storage and conveying costs.

Kanban is to a great extent connected with assembling/manufacturing. A note worthy worry in assembling is the need a prepared supply of materials, without acquiring surplus stock holding costs. Be that as it may, it can likewise be connected in a nonmanufacturing situation, where the effectiveness of your work

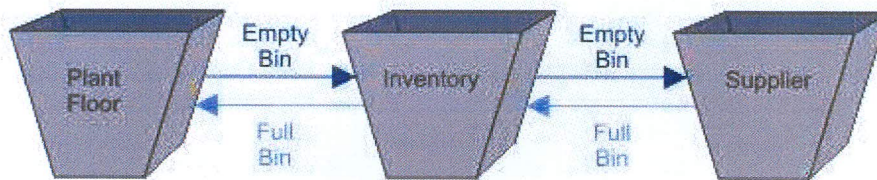
The expression "kanban" joins the Japanese words "kan," signifying "visual" and "ban," signifying "card" or "board." A kanban is a visual card or other prompt that signs something is required. It is a "pull" framework, where supply is dictated by the maker or client.



A standout amongst the most well-known utilizations of kanban is a bin framework with cards. Here is a basic case of how a two-bin kanban framework functions.

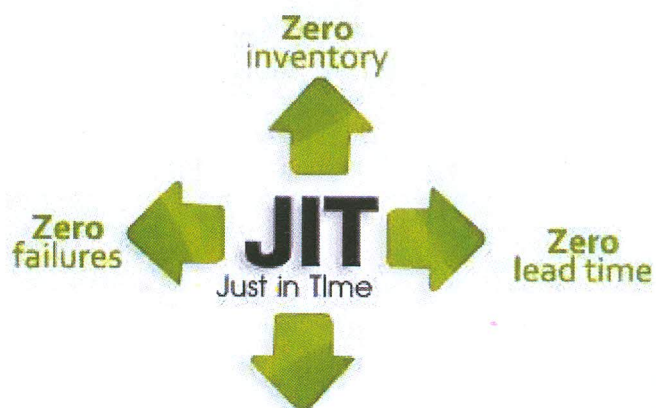
You have one container/bin on the plant floor that contains the assembling supplies, and one canister/bin holding up in supplies stock. Every container has a card with creation points of interest. At the point when the canister in the plant is void, the container and the kanban card are taken to supplies stock. The container and kanban card holding up in supplies are taken to the floor to supplant the void canister. The void container is sent to the supplier, who fills it and sends it back to supplies stock.

The canisters frame a circle, as appeared in Figure beneath. A vacant container flags a substitution and a refilling. You decide what number of full canisters are holding up in stock, and the kanban triggers the movements required to keep the containers full.



Just In Time

Just in Time (JIT) assembling/manufacturing is a generation model in which things are made to take care of demand, not made in surplus or ahead of time of need. The motivation behind JIT creation is to maintain a strategic distance from the waste connected with overproduction, holding up and over abundance stock, three of the seven waste classifications characterized in the Toyota Production System (referred to in North America as the incline generation model).



The JIT concept described by Henry Ford in his 1923 book, *My Life and Work* suggests;

"We have found in purchasing materials that it is not advantageous to purchase for other than prompt needs. We purchase sufficiently just to fit into the arrangement of

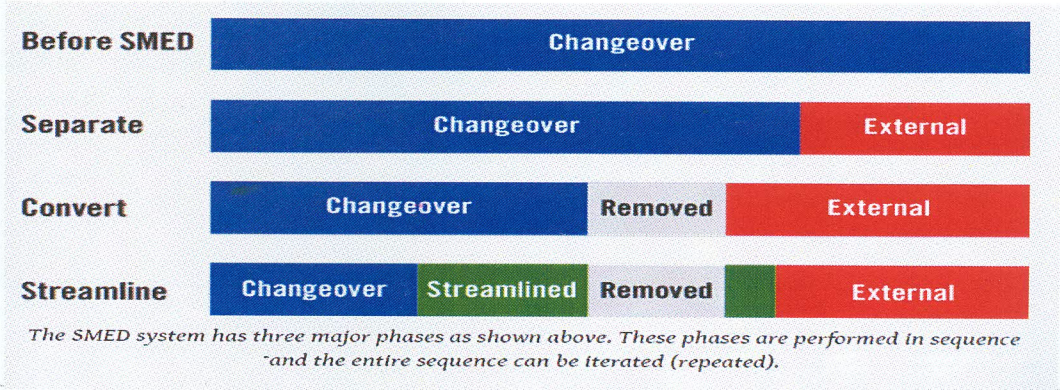
generation, mulling over the condition of transportation at the time. In the event that transportation were immaculate and an even stream of materials could be guaranteed, it would not be important to convey any stock at all. The carloads of crude materials would land on timetable and in the arranged request and sums, and go from the railroad autos into generation. That would spare a lot of cash, for it would give an exceptionally quick turnover and in this way diminish the measure of cash tied up in materials."

Toyota adopted JIT in the Toyota Production System (TPS), as a method for dispensing with the seven squanders. However, it was not at the Ford Motor Company that Toyota delegates saw the JIT model in real life. At the point when Toyota visited plants in the United States in 1956, Ford had not yet completely actualized the JIT model. It was at Piggly Wiggly, the main self-service grocery store, that Toyota delegates saw JIT showed and that was the model they construct their framework with respect to.

JIT model is sometimes referred to as "just-in-case (JIC)" manufacturing.

Single-Minute Exchange of Dies (SMED)

SMED (Single-Minute Exchange of Dies) is a framework for drastically diminishing the time it takes to finish gear/gadget/equipment changeovers. The embodiment of the SMED framework is to perform as many change overs events as could be allowed to "outside" (performed while the hardware is running), and to disentangle and streamline the remaining strides. The name Single-Minute Exchange of Dies originates from the objective of lessening changeover times to the "single" digits (i.e. under 10 minutes).

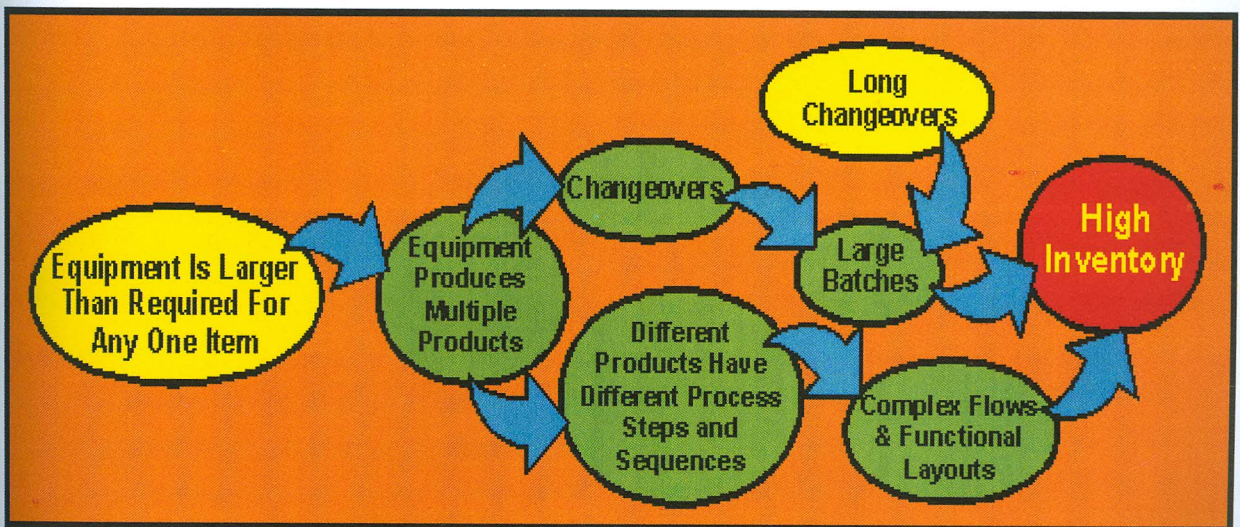


Few benefits of SMED program are indicated below;

- ✓ Lower producing cost (speedier changeovers mean less hardware down time)
- ✓ Smaller part sizes (quicker changeovers empower more incessant item changes)
- ✓ Improved responsiveness to client request (smaller part sizes empower more adaptable booking)
- ✓ Lower stock levels (smaller part sizes result in lower stock levels)
- ✓ Smoother new businesses (institutionalized changeover forms enhance consistency and quality)

In SMED, changeovers are done in steps referred as “elements”, as discussed below;

- Internal Elements (components that must be finished while the gear/equipment/gadget is halted)
- External Elements (components that can be finished while the gear/equipment/gadget is running)

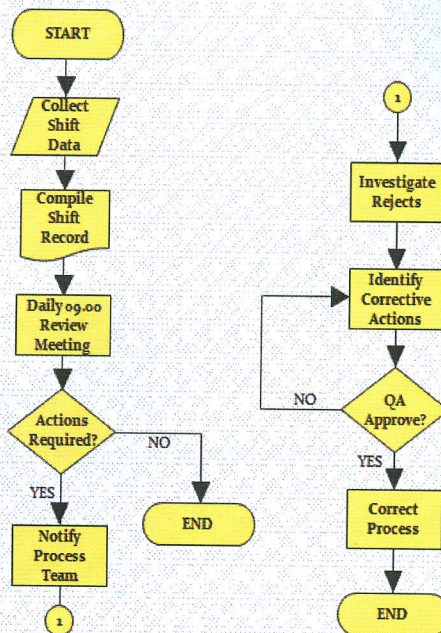


Process Mapping

Process Mapping is otherwise called Process Charting or Flow Charting. It is one of the most seasoned, least complex and most profitable strategies for streamlining work. It is likewise unpretentious and requires experienced facilitators for best results. a portion of the advantages of Process Charting (Mapping) are:

- ✓ Spotlights on waste
- ✓ Streamlines work forms
- ✓ Defines and institutionalizes
- ✓ Promotes profound comprehension
- ✓ Builds accord

Process Mapping



A procedure/process map portrays the arrangement of occasions to assemble an item or produce a result. It might incorporate extra data, for example, process duration, stock, and gear/ gadget/ equipment data.

A few traditional frameworks also exist. At Strategos, we find that the first framework imagined by Frank Gilbreth in the mid 1900's is still the most valuable.

The Gilbreth methodology is exceedingly visual and segregates amongst waste and esteem included (value added) action. It is additionally straightforward, instinctive and effectively utilized by untrained gatherings. An accomplished facilitator, in any case, is required.

The characteristics of a successful process are:

- Several tasks/jobs are combined into one

- Workers make decisions at the lowest possible level and monitor their own progress
- Steps in the process following a natural order
- Work is being performed where and when it makes sense (with the fewest possible people involved)
- There are as few interfaces and handling points as possible • there are as few backward movements possible
- There are as few activities possible.

Process mapping enables an organisation to:

- Establish what is currently happening, how predictably and why
- Measure how efficiently the process is working
- Gather information to understand where waste and inefficiency exist and their impact on stakeholders
- Develop new improved processes to reduce or eliminate inefficiency.

It is also important to remember that process mapping is merely the first stage in a continuous cycle of incremental improvement and refinement of processes which is ultimately aimed at:

- Eliminating duplication of tasks and to reduce costs
- Improved efficiency and co-ordination of working practices
- Reducing the transportation of materials eg files between locations
- Improved quality and timeliness in the organization
- Improving the effective deployment of staff

Value Stream Mapping (VSM)

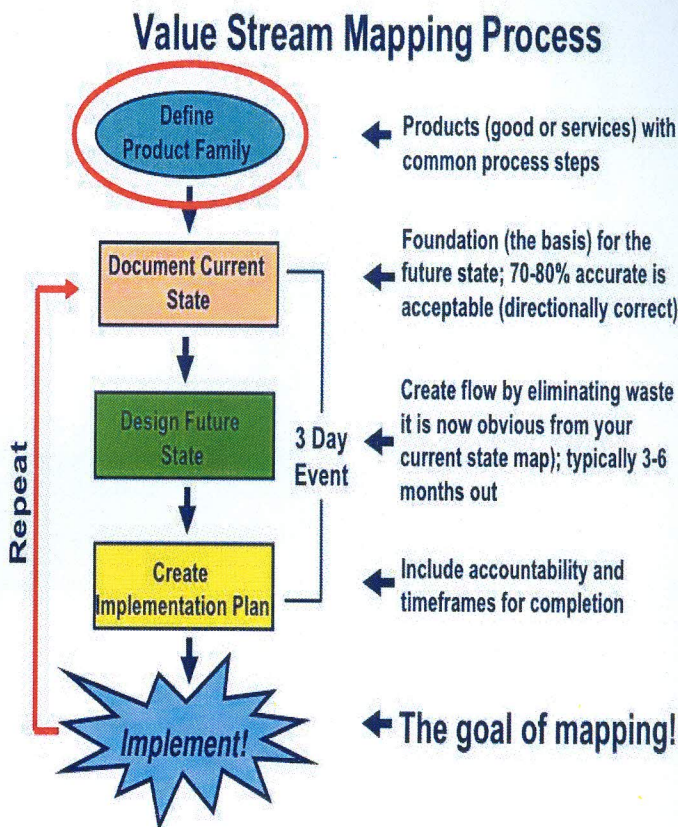
As characterized by Womack and Jones "A Value Stream is "the arrangement of all the particular activities required to bring a particular item through the three basic administration/managerial assignments of any business: ... critical thinking, ... data administration, ... physical change".

Value Stream Mapping (VSM) is a representation apparatus arranged to the Toyota form of Lean Manufacturing (Toyota Production System). It comprehends and streamline work forms utilizing the instruments and strategies of Lean Manufacturing.

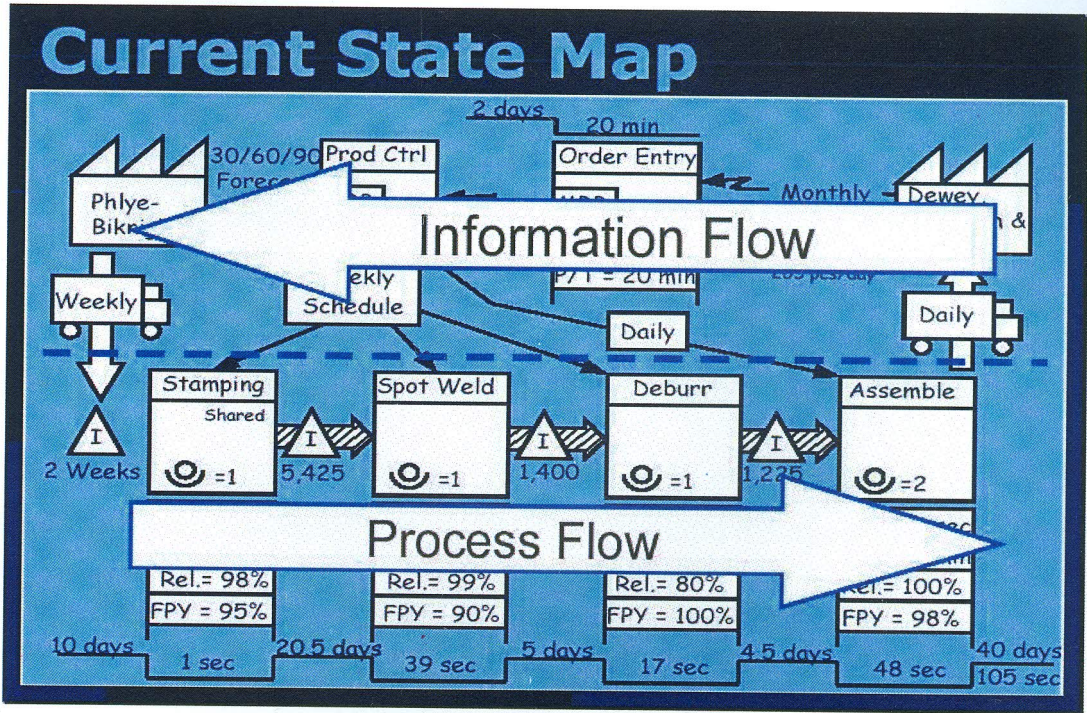
VSM addresses material procedure groupings and streams and additionally data streams that effect this development. It energizes information securing in a precise way that regularly gives extra bits of knowledge. The different symbols and images have genuinely particular implications and it requires learning of these images and in addition information of TPS to translate a Value Stream Map and utilize it well.

Value Stream Maps mirror an expansive perspective of the procedure, as a rule from outside supplier to outer client at a given office. Broadened Value Stream Maps take a significantly more extensive perspective and regularly fuse level two and level three suppliers and merchants.

Like Process Mapping, VSM is most profitable in a gathering setting. A large number of the issues it uncovered span crosswise over hierarchical lines of obligation and aptitude. At the point when a mapping group has representation from all the distinctive



capacities and claims to fame, it picks up a typical comprehension of the procedure and a superior position for creating and actualizing great arrangements.



Implementation of Lean Project Management at Infinity Engineering



Introduction

Infinity Engineering (Pvt.) Ltd built up in 1994, represents considerable authority in Designing, Forging, Precision Machining and Heat Treatment of automotive and engineering components. Focusing on our organization's aim of 'Consistent Pursuing' on development and quality improvement, we have come to secure quality overseeing endorsements of TS16949: 2009, ISO 9001: 2008 and ISO 14001: 2004.

After over two decades of endeavors and commitment, we are furnished with professional group of engineers supported by current technology and machinery to professionally fabricate engineered auto parts.

Vision/ Mission

Company's philosophy is

**“Consistent Pursuing on innovation and quality improvement for
automobile parts.”**

Company focuses on the fabrication of highly engineered parts in a friendly environment that best suits to the client requirements. Infinity Engineering (Pvt.) Ltd defines its corporate policy as, “On time delivery of defect free Auto Parts & Engineering Components as per specifications / requirements of the customers while preserving its Environment”.

Business Areas/ Facilities

➤ **Designing:**

- ✓ CAD/ CAM Solutions
- ✓ CAE/Linear/ Non Linear Static and Dynamic Analysis
- ✓ Rapid Prototyping

➤ **Production Facilities:**

- ✓ Hot Forging 0.1-35 kg
- ✓ Iron Casting Grey; Steel & Nodular
- ✓ Pressure Die Casting 1200 Tons
- ✓ CNC Machining

➤ **Testing & Inspection:**

- ✓ Coordinate Measuring Machines
- ✓ Tensile/ Elongation Testing
- ✓ Hardness Testing
- ✓ Metallography
- ✓ Ultrasonic/ Megra Flux Crack Detection
- ✓ CAM Profile Tester (Adcole)
- ✓ Gear Involute & Roll Tester
- ✓ Optical Comparator
- ✓ Roundness Tester

Improving Productivity

Productivity is the usefulness of productive work, particularly in industry, as measured in terms of the rate of output per unit of input. Key to great manufacturing is to do basic things exceptionally well. At the end of the day - good results can come from mastering a simple technique and applying it constantly.

One of the most effective approaches to lessen down time for each of your production line is to identify and fix one problem each day. One small, incremental win that can be identified and fixed within the same day. The key to success is to follow these three simple steps to make it happen thus improving the manufacturing productivity can be summed up as:

- Precisely capture data that identifies your wastes (Information)
- Utilize that data to identify your needs (Focus)
- Take thoughtful, thorough, and sustained action (Action)

Identified Wastes

We studied and analysed the manufacturing process of a shaft at “Infinity Engineering” in detail for the identification of wastes. Here we are discussing about any outflow of resources that does not add value to the product. During our observation we identified the following wastes at the manufacturing shop floor,

- Inventory – Over-production of product
- Idling Time – Wasted time by operators in doing non-value added activities and machines start-up time
- Handling – Needless and redundant movement and transportation
- Old methods of manufacturing process
- Storage of excess stock of raw material
- Defects Repairs – Quality Inspections

Whilst we discuss these in terms of their origins in the automotive manufacturing industry, this same thinking can apply to almost all industries.

Effectiveness of People and Machinery

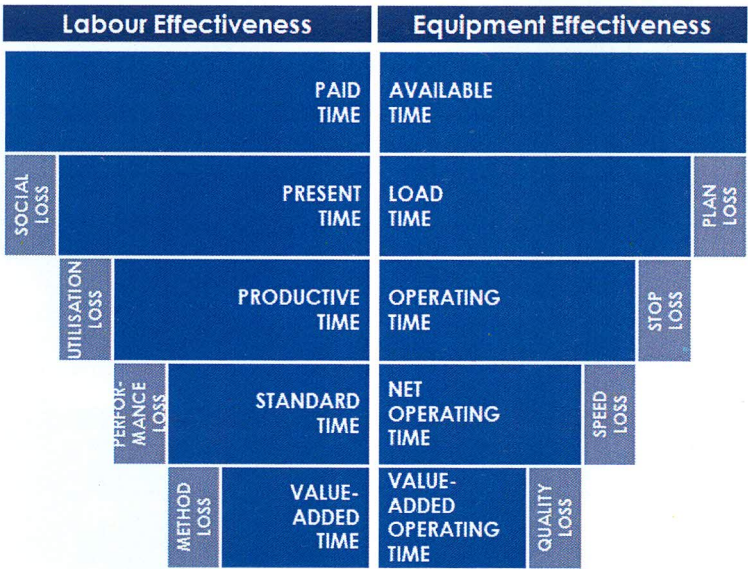
The effectiveness of people working on job and the machinery/ equipment being used is vital part of the study. There's a clear difference between the time for which a person/ resource is paid for to do the job and the time that he adds value to the job. This striking difference is identified above as the "Idling Time" and can be summed up as the series of losses mentioned below.

Social Loss – Meetings

Utilization Loss – Lead time to setup the components and make things ready

Performance Loss – Inefficiency of operator to follow SOP's

Method Loss – Wrong methods of manufacturing



Plan Loss – Results from setting up wrong equipment not to run

Stop Loss – Results from a switching or power interruption

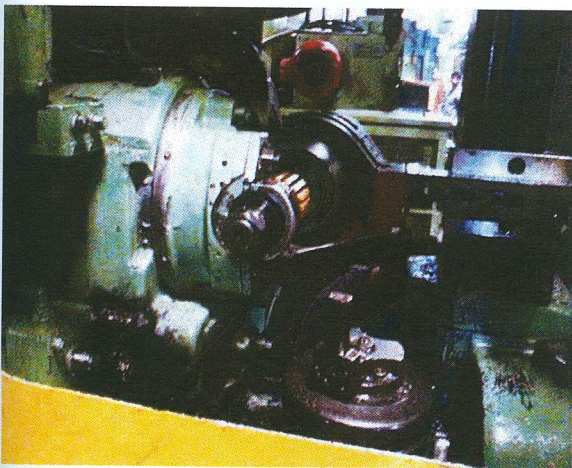
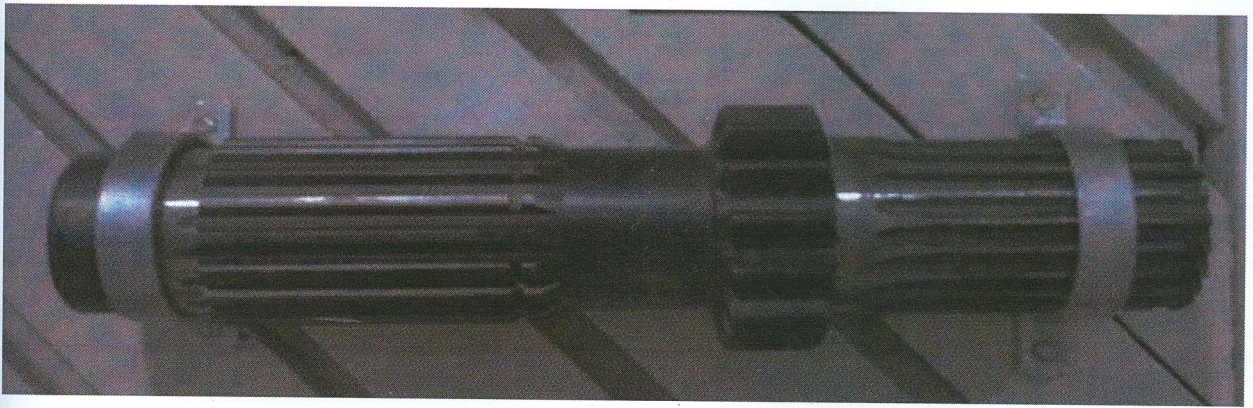
Speed Loss – Results from running machinery below the design speed of the machine

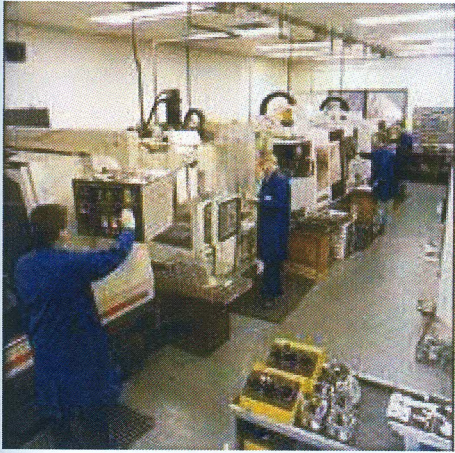
Quality Loss – Results from producing defective parts and materials

Study of equipment effectiveness is particularly important when dealing with high-cost equipment, like in drilling, mining or the airline industry. In such circumstances a business is only providing value when its equipment is functioning.

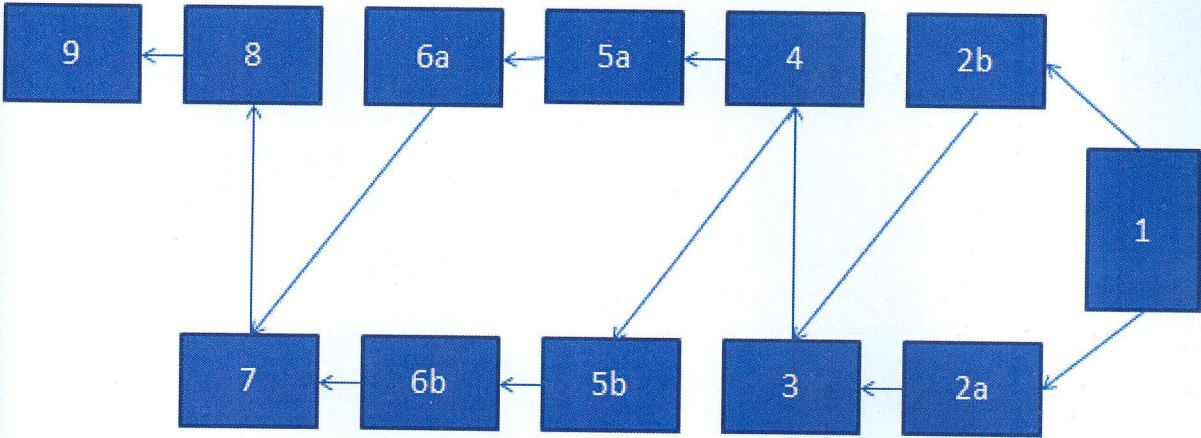
Engine Shaft cell

At infinity engineering we studied floor layout of shaft cell and based on manufacturing process of the the shaft we reccmmended some changes to the floor layout to improve productivity and reduce the wastes identified above,





Shaft manufacturing process includes the following machinery, the floor plan improved is as follows,



Machinery/ Equipment

- 1 Centre and Facing Machine
- 2a Boring Machine
- 2b Boring Machine
- 3 Drill machine/ chamfering
- 4 CNC turning (Outer Diameter)
- 5a Hobbing spline cutting machine 20 teeth
- 5b Hobbing spline cutting machine 20 teeth
- 6a Hobbing spline cutting machine 17 teeth
- 6b Hobbing spline cutting machine 17 teeth
- 7 Hobbing gear cutting machine
- 8 Tooth rounding machine
- 9 Shaving Machine

Process Flow

Sr#	machine number	description	operation	Move	Inspection	Delay	Store
1		storage	○	→	□	⌋	▽
2		handling	○	→	□	⌋	▽
3	1	centre and facing machine	○	→	□	⌋	▽
4		handling	○	→	□	⌋	▽
5	2a,2b	bornig machines	○	→	□	⌋	▽
6		handling	○	→	□	⌋	▽
7	3	drill machine, chamfering	○	→	□	⌋	▽
8		handling	○	→	□	⌋	▽
9	4	CNC turning, outer dia	○	→	□	⌋	▽
10		handling	○	→	□	⌋	▽
11		delay	○	→	□	⌋	▽
12	5a,5b	hobbing, spline cutting 20t	○	→	□	⌋	▽
13		handling	○	→	□	⌋	▽
14	6a,6b	hobbing, spline cutting 17t	○	→	□	⌋	▽
15		handling	○	→	□	⌋	▽
16	7	hobbing, gear cutting	○	→	□	⌋	▽
17		handling	○	→	□	⌋	▽
18	8	tooth rounding machine	○	→	□	⌋	▽
19		handling	○	→	□	⌋	▽
20	9	shaving machine	○	→	□	⌋	▽
21		handling	○	→	□	⌋	▽
22	10	storage	○	→	□	⌋	▽

Suggestions & Recommendations

Suggestions to improvements includes,

- Strictly monitor the workers, and ensure that workers are strictly following the work timings, in order to reduce actual observed delays.
- Small inventory level must be maintained on each work station, to ensure smooth assembly line flow.
- Properly monitor that the workers are adopting the new improved processes, not shifting the trend to old one.

- Implement production charts over each station, and ensure worker must enter their hourly production in chart, this implementation will help to achieve the estimated production rates.
- Ensure that not any worker who is working on assembly station attend any rectification work, to ensure smooth production.
- Trolleys of assembly stations should not be used by workers of test rig, in order to avoid production fluctuations.
- Each month Check concentration of washing solution in order to ensure proper cleaning of parts.
- Carry out washing off all parts one day before use in order to avoid washing delay, which possessing more proportions then all other delays.

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