

An Application of Value Stream Mapping to Reduce Cycle Time in an Assembly Line

Pratibha Mishra¹ Er. Deepak Agrawal² Mr. Nitesh Kumar Dixit³

¹M. Tech. Scholar ^{2,3}Assistant Professor

^{1,2,3}Department of Mechanical Engineering

^{1,2,3}Dr. Rammanohar Lohia Avadh University, Uttar Pradesh, India

Abstract— Focusing on making an incentive for clients is an essential idea of Lean. Worth isn't just a word to be characterized in Lean, yet additionally it is actually what the entire organization should go for and what isn't characterized as worth ought to be decreased or evacuated. Thinking about this reason, value-stream mapping as a device in Lean Production was followed in writings and help of most experience people for executing this instrument. Because of the way that most improvement proposals are tied in with arranging of process duration decrease, improve work-in-process, improve machine and diminish labor, so an exact and practical guide can make a solid stage for enhancements. In this way, the more precise the present express the more reachable advancements. By executing the worth stream mapping we effectively get the bottleneck procedure and thought for usage and examination the outcomes. So we can lessen the most extreme process duration from 12 sec to 9.0sec and decrease labor from 45 to 20 per move. That is we get the greatest advantage by VSM which is increasingly other lean procedure. So future state gets the clearest view and further distinguished the open door for development.

Keywords: Lean Production, VSM, Reduce Cycle Time & WIP

I. INTRODUCTION

This contextual investigation investigates the relevance of value-stream mapping in gathering businesses. So as to do as such, a contextual investigation is directed in a XYZ Company of mechanical production system industry. This section is trailed by foundation, objective and degree and layout of the report that are utilized in the accompanying parts.

A. Background

Focusing on making an incentive for clients is an essential idea of Lean. Worth isn't just a word to be characterized in Lean, yet additionally it is actually what the entire organization should go for and what isn't characterized as worth ought to be decreased or evacuated.

The assurance and end of waste in different procedures can be decreased by utilizing a lot of standards and practices notice in the lean generation theory. The nature of the item relies on by time, cost, effectiveness, assets and waste decrease. Lean creation advisers for recognize non-esteem included exercises at various stages, for example, plan and generation.

Toyota creation framework presented lean idea which coordinates different devices to take out waste and increment the efficiency. "Lean assembling uses instruments, for example, kaizen, one-piece stream, cell fabricating, synchronous assembling, stock administration,

B. Objective and Scope

Huge development in the deals is normal in the coming years. Endeavors to expand producing ability to satisfy client need with focused lead time, cost, and quality have been set up. In this manner, it will be important to improve the throughput rate so as to fulfill the anticipated need throughout the following couple of years. Likewise, limit extension tasks may turn into a need should the expanding pattern in future interest.

Likewise, current assembling lead times are any longer than absolute preparing time because of over the top work-in-process (WIP). This outcomes in high non-esteem including (pausing) times. It is noticed that accomplishing less WIP will decrease holding up times and thus lessen the assembling lead times. Shorter assembling lead times will thusly empower a snappier reaction to client orders, guaranteeing better client administration and on-time conveyance.

Worth stream mapping (VSM), which starts from lean assembling ideas, is one such apparatus that can be utilized to distinguish and take out waste in the assembling line. This task looks to improve the presentation of the assembling line by lean usage and furthermore distinguish zones where limit extension is required.

C. What is lean?

Lean Production, an idea dependent on the Toyota Production framework, has risen as of late as a worldwide methodology that coordinates diverse instrument to concentrate on waste disposal and to fabricate items that address a client's issues and desires in a superior manner. The primary idea of lean generation comprises in the particular of what makes esteems for the end client and in the achievement of this detail with a creation framework making progress toward flawlessness and portrayed by a stressed and leveled stream, driven by the client's interest.

D. The three M's

Squander disposal is in the core of lean creation and normally while taking squanders, the Japanese expression Muda is utilized. Muda alludes to seven sorts of waste presented by. There are two more M's (Japanese words) which fit together with Muda to shape a genuine framework, According to three M's are characterized as:

Type	Examples	Some Causes
Overproduction	Making too much Making it too soon Making it too fast	Long setups Variable lead time Unbalanced process
Inventory	Product not in a value-added process Idle inventory	Unbalanced operations Unreliable forecasts Time delays Unreliable suppliers Unreliable equipment Unpredictable defects
Quality	Inspect/Reject quality Repairs & Rework	Uncontrolled processes Incapable processes Poor maintenance
Idle equipment	Equipment not performing a value-added process	Over capacity Schedule variability
Idle people	People not working	Schedule variability Fixed Task Assignments Unbalanced work
Talent	Failure to use worker's full mental & physical talents	Poor Hiring Inadequate Training Unmotivated workers
Motion	Unnecessary worker motion	Machines too far apart Mis-located Tools Disorganization

Table 1: Muda characterization

II. VALUE STREAM MAPPING

Worth stream mapping (VSM) is a representation apparatus arranged to the Toyota adaptation of lean assembling (Toyota Production System). It causes individuals to comprehend and streamline work procedures and afterward apply certain particular devices and methods of the Toyota Production System.

A worth stream is "the arrangement of all the particular activities required to bring a particular item through the three basic administration errands of any business: Problem settling, data the executives, Physical change

A. VSM Icons

VSM process symbols: These symbols appeared in table 2 that speak to gear, workgroups, divisions or providers and clients. The time spent in these zones is frequently esteem included.

	Customer Supplier	This icon represents the supplier when in the upper left. The usual starting point for material flow. The customer is represented when placed in the upper right, the usual end point for material flow.
	Dedicated process	This icon is a process, operation, machine or department, through which material flows. Typically, to avoid unwieldy mapping of every single processing step, it represents one department with a continuous, internal fixed flow path. In the case of assembly with several connected workstations, even if some WIP inventory accumulates between machines (or stations), the entire line would show as a single box. If there are separate operations, where one is disconnected from the next, inventory between and batch transfers, then use multiple boxes.
	Shared Process	This is a process operation, department or work center that other value stream families share. Estimate the number of operators required for the value stream being mapped, not the number of operators required for processing all products.
	Data box	This icon goes under process boxes that have significant information/Data required for analyzing the system. Typical information in a Data Box underneath MANUFACTURING PROCESS icons: C/T (cycle time) – time(in seconds) that elapses between one part coming off the process to the next part coming off, C/O (changeover time) – time to switch from producing one product on the process to another. Uptime- percentage time that the machine is available for processing EPE (a measure of production rate/s). EPE stands for 'Every Part Every...Number of operators- use OPERATOR icon inside process boxes. Number of product variations available capacity scrap rate transfer batch size

Table 3: VSM Material Icons

	Inventory	These icons show inventory between two processes. While mapping the current state, the amount of inventory can be approximated by a quick count, and that amount is noted beneath the triangle. If there is more than one inventory accumulation, use an icon for each. This icon also represents storage for raw materials and finished goods.
	Shipping	This icon represents movement of raw materials from suppliers to the receiving dock/s of the factory. Or, the movement of finished goods from the shipping dock/s of the factory to the customers.
	Push Arrow	This icon represents the "pushing" of material from one process to the next process. Push means that a process produces something regardless of the immediate needs of the downstream process. This generally results from the use of a centrally produced schedule and work order system.
	Supermarket	This is an inventory "supermarket" (kanban stock point). Like a supermarket, a small inventory is available and one or more downstream customers come to the supermarket to pick out what they need. The upstream work center then replenishes stocks as required. When continuous flow is impractical, and the upstream process must operate in batch mode, a supermarket reduces overproduction and limits total inventory. A supermarket decouples processes that have differing production rates or batch sizes.
	Material Pull	Supermarkets connect to downstream processes with this "Pull" icon that indicates physical removal.
	FIFO Lane	First-IN-First-out Inventory. Use this icon when processes are connected with a FIFO system that limits input. An accumulating roller conveyor is an example. Record the maximum possible inventory.

Table 4: VSM Information Icons

	Production Control	This box represents a control production scheduling or control department, person or operation.
	Manual Info	A straight, this arrow shows general flow of information from memos, reports, or conversation. Frequency and other may be relevant
	Electronic Info	This wiggle arrow represents electronic flow such as electronic data interchange (EDI), the internet, E-mail, Intranets, LANs (local area network) or WANs (wide area network). Indicate the frequency of interchange, the type of media used ex. Fax, phone, etc. and the type of data.
	Production Kanban	This icon triggers production of a pre-defined number of parts. It signals a supplying process to provide parts to a downstream process.
	Withdrawal Kanban	This icon represents a card or device that instructs a material handler to transfer parts from a supermarket to the receiving process. The material handler (or operator) goes to the supermarket and withdraws the necessary items.
	Signal Kanban	This icon is used whenever the on-hand inventory levels in the supermarket between two processes drops to a trigger or minimum point. When a triangle kanban arrives at a supplying process. It signals a changeover
	Kanban Post	and production of a predetermined batch size of the part noted on the kanban. It is also referred as "one-per-batch" kanban. This signal is not necessarily a card. It may be a simple visual observation of stock level.
	Sequenced Pull	A location where kanban signal reside for pickup. Often used with two-card systems to exchange withdrawal and production kanban.
	Load	This icon represents a pull system that gives instruction to subassembly processes to produce a predetermined type and quantity of product, typically one unit, without using a supermarket.
	MRP/ERP	This icon is a tool to batch kanban signal in order to level the production volume and mix over a period of time.
	Go see	Scheduling using MRP/ERP or other centralizing systems.
	Go see	Gathering of information through visual means.

Table 5: VSM Miscellaneous Icons

	Kaizen Burst	These icons are used to highlight improvement needs and plan kaizen workshops at specific processes that are critical to achieving the future state map of the value stream.
	Operator	This icon represents an operator. It shows the number of operators required to process the VSM family at a particular workstation. A nearby number shows the number of operators required for the value stream being mapped.
	Time line	The time line shows value added times (cycle time) and non-value added (wait) times. Use this to calculate lead time and total cycle time.

III. EMPIRICAL/MODELING WORK

Organizations that have since quite a while ago depended on conventional ways to deal with their assembling frameworks, it is regularly hard to pick up from the executives the dedication required to actualize lean assembling. Doing as such is hard a direct result of contrasts in various viewpoints including crude material acquirement, stock administration, representative administration, and generation control. For customary makers, the hesitance to actualize many lean thoughts emerges on the grounds that their unmistakable necessities frequently make it difficult to anticipate the extent of the increases that can be accomplished by executing these. Accordingly, the board choices on executing lean assembling frequently descend to their "conviction" in lean assembling, revealed aftereffects of other people who have actualized lean systems, and heuristic general guidelines on the normal recompense. For some directors this is inadequate legitimization, and comes up short on the quantifiable proof expected to persuade them to embrace lean.

IV. METHODOLOGY

The technique should give an auxiliary structure and strategy to pursue the motivation behind the paper and cause the way to satisfy it. Paper system depends on the structure look into philosophy (DRM) presented by. So as to draw the best result out of DRM, this system is modified by Lean point of view and especially value-stream mapping worries in the work technique. From there on information accumulation strategies including direct perception, meeting and meeting, ongoing worldwide experience, and friends inner archives are trailed by the clarification of the dependability of results. At last, investigation and reflection are given dependent on the examination zone and the idea of this exploration.

V. PAPER FRAMEWORK

An assortment of methodologies are accessible to structure the paper system. In spite of the fact that the proper thesis system relies upon the nature and states of the contextual investigation, there are various general and standard structures that can be utilized to respond to exposition questions. The more wide and open the inquiry, the less shut and organized the contextual investigation configuration ought to be.

DRM system has been knowledgeable about numerous looks into as a successful strategy that gives an organized method to approach the normal results. As indicated by such encounters this system may turn out badly in the event that it is pursued inflexibly and well ordered, then again it ought to give adaptable, goal-oriented, and organized

structure. Evidently, the system ought to be balanced and altered to the present circumstance.

VI. WORK PROCEDURE

The paper methodology was appeared in figure 1 that started by issue definition and pursued by a few gathering at XYZ Company to explain the reason. From that point, individual whose position have effect on the issue zone were presented and direct meeting were led to gather the exact information. Writing audit began from early advances, even before the exploration officially began, and proceeded with everywhere throughout the exposition to advance the nature sof results.

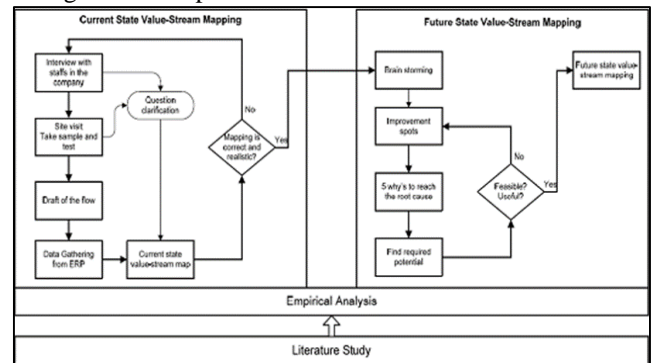


Fig. 1: Value-Stream Mapping Work Procedures

Draft of current state was mapped in the initial steps to have a general perspective on the stream. It was finished and much of the time changed during the meeting time frame. The case organization's ERP framework was utilized to import quantitative information to the

VII. DATA ACCUMULATION

Quantitative information utilized in this thesis has its root in the ERP arrangement of the case organization which has point by point information of the stream. In addition, subjective information is the result of meetings and gatherings with individuals who are really carrying out the responsibility together with direct perception of the present circumstance. Essential information is the direct information that is legitimately gathered by direct perception, overview, and meetings while auxiliary information isn't straightforwardly gone along by the examiner. A few instances of optional information are surveys, inquire about articles, and so forth. Essential and auxiliary information accumulation methodologies have been utilized in this examination to ingest required information.

VIII. DIRECT PERCEPTION

Direct perception on location was led to get the direct, essential, and subjective information and enhance the comprehension of the present condition and limit of progress. In the sequential construction system industry methods occur is straightforward man and machine joined procedure and material dealing with is mostly through push, draw and FIFO path, in like manner direct perception we comprehend the some issue and distinguished the improvement spot and experts ought to legitimately allude to the spot that procedure is occurring to watch the genuine condition and really

comprehend the confinements and furthermore limits of advancement.

IX. RELIABILITY OF RESULTS

Dependability is characterized as "the degree to which results are steady after some time and a precise portrayal of the complete populace under examination is alluded to as unwavering quality and if the consequences of an investigation can be duplicated under a comparable strategy, at that point the exploration instrument is viewed as solid". This definition suits value-stream mapping, since it has both subjective and quantitative perspectives. Current-state value-stream mapping gives a reasonable picture of how things are going on right now and through the time that no change has inferred to the framework it is dependable. Future-state value-stream mapping is a short-term objective.

X. ANALYSIS

The investigation of this paper depends on the worth stream examination steps gave and precise consolidating structure. Having these two methodologies lead to following methodology to genuinely break down the present state guide and reach to a reasonable future state map:

XI. CASE STUDY

This part speaks to the contextual analysis of actualizing value-stream mapping as an instrument in Lean creation to improve the generation chain for item starter engine of bicycle. Likewise, current and future state value-stream mapping are created. At long last the appropriateness if this device in mechanical production system industry particularly in the process duration is broke down.

XII. ABOUT THE COMPANY

- 1) XYZ Company LTD. at Bhilowara.
 - 2) Established in august 2019.
- Items: engine, armature, AC generator, starter engines for cruisers separately appeared in figure 2.



Fig. 2: Products

XIII. PROBLEM STATEMENT

The present assembling limit can deliver a limit of 4504 pieces for each day yet current interest is 10000 pieces for every day. In this way, it will be important to improve the throughput rate so as to fulfill the anticipated need throughout the following couple of years. Likewise, limit development ventures may turn into a need should the expanding pattern in future interest. Additionally, current assembling lead times

are any longer than complete handling time because of over the top work-in-process (WIP). This outcomes in high non-esteem including (pausing) times. It is noticed that accomplishing less WIP will decrease holding up times and thus lessen the assembling lead times.

In the present circumstance the most extreme process duration of a solitary work station is 12.0sec and client takt time is 5.8sec so process duration is a lot bigger than takt time. So as to build limit, process duration of the procedures ought to be decreased so the items can be created quicker. As of now, the organization utilize old machine that required more process duration and labor so the organization as of now has an arrangement on what kind and what number of machines should be obtained, and furthermore what number of laborers will be expected to expand the limit.

Part one: Value-Stream Mapping – current state

Current condition of value-stream mapping is mapped after information gathering about process duration of every get together stations, process time of man and machine at each procedure, change over the long run of each procedure, up time of each machine, stock at each station. Subsequently, gathered information was converted into worth stream mapping language. At long last, an examination of current state value-stream mapping is given.

XIV. PROCESS STREAM GRAPH

The procedure stream graph is the significant information of significant worth stream mapping that appeared. The procedure stream diagram show subassembly parts, heading of item stream, work stations and its sub parts, investigation. YU and SM demonstrate the code of work stations. There is stream outline symbol that depicted in table 61.

Icons	Define
○	Process
○	Transport
▽	Store
◇	Quality check
□	Quantity check
⊗	Mainly as processing parts and doing inspection
—	Flow chart
⊠	Mainly as inspecting quality and doing q'ty inspection

Table 6: Icons of Process stream graph

XV. TIME INVESTIGATION

While we got creation and work guidance information from the organization, just as watched the production lines moving, we needed to lead our own time concentrates to get accurate data on the process durations inside manufacturing plant. The determined process duration is appeared in lime accounting report and we make a different correlation map for man and machine procedure time for each procedure work station. At that point we figure takt time, line balance proportion, line balance proficiency.

XVI. TAKT TIME

Takt is a German expression for mood which in Lean generation is the rate at which an organization must create an item to fulfill its client request or the rate client is purchasing. Takt time isn't equivalent to process duration which is the time span of a procedure on an item. Intelligently procedure time ought to be not exactly or equivalent to Takt time. For example, if the accessible working time is 6 hours out of every day & 20 days of the month and clients are purchasing month to month 1000 tons, at that point the creation volume ought to be 75 tons for each day or 8 tons for each hour. Creating more than this will result in over generation and short of what it prompts bottleneck. Takt should screen the generation pace to keep it in the pace of client request. Takt time can be determined dependent on the accompanying equation:

Working movements every day = 4 movements
Working hours per move = 6 hours
Noon per move = 20 minutes
Break time per move = 10 minutes
Arranged personal time per move = 20 minutes
Client request every day = 10,000 units
So all out accessible time every day = $4 \times 6 \times 60 \times 60 - 20 \times 60 \times 4 - 4 \times 10 \times 60 - 4 \times 20 \times 60$
= 74400 sec every day
= 7.58sec

Next, the determined takt time esteems were contrasted with the process duration for every one of the procedures. In the event that the process duration is bigger than the takt time, it demonstrates that the procedure is a bottleneck.

XVII. LINE BALANCE SHEET

Line Balance Sheet is a graphical portrayal appeared in table 5.2 that show how productive is the line procedure that is each procedure has a similar process duration. Match procedure time to gather time, coordinate creation rate to pace of interest (Takt time). That implies if greatest process duration of mechanical production system is same as takt time so line is 100% equalization. There is a parameter to figure the line balance viability which is line balance proportion, line balance productivity. The line monetary record is appeared in next page.

A. Line Productivity:

That demonstrates the usage of the line as a proportion between the absolute outstanding task at hand and by the process duration duplicated by of number of used machines. As the line effectiveness approaches 1, the closer the line gets to its hypothetical least required number of machines.

B. Line Balance Proportion:

That characterizes how process duration is influencing the deferral underway. Characterize what rate we proficient with takt time if proportion is 1 that implies most extreme process duration is equivalent to takt time that is we fulfill the client need. It is the task of consecutive work exercises into work stations so as to increase a high use of work and hardware, and thusly, limit inert time. It is characterize as = 30.12

C. Lead Time:

The measure of time that slips by between when a procedure begins and when it is finished. Lead time is inspected intently in assembling, as organizations need to lessen the measure of time it takes to convey items to the market. In business, lead time minimization is regularly liked. Organizations take a gander at every segment and contrast it against benchmarks with figure out where stoppages are happening.

The Lead time of current Value Stream Mapping = 6hrs 48min 1.2sec

The all-out process duration of line = 1 min 1.2sec

The present state worth stream mapping appears in figure 5.3 that demonstrate the issue spots like magnet addition and squeezing, oilless metal squeezing, driven apparatus squeezing, bearing squeezing, burden fixing, trademark check and so forth work stations are issue of high process duration and poor work station courses of action that expansion work-in-process. Second issue is a great deal of stock in store in the work place in light of the fact that the store is far away from sequential construction system work place so every time convey stock from store to work spot is preposterous that take 30 min time so we store 8 hr. stock in the work place. The parcel of stock is store in work place that weight of all the more so pick that parts is progressively troublesome

XVIII. PROBLEM DISTINGUISHING PROOF AND USAGE

Work station: Magnet inclusion and squeezing process

Procedure detail: In this procedure magnet is embedded in the burden unit by machine and the man do stacking and emptying work.

Obtained more space in the work station. The quality is influenced by manual emptying. The issue is appeared in figure 3.



Fig. 3. Magnet inclusion and squeezing process

Improvement: In this activity we diminish the labor and utilized machine computerization as we seen that in this procedure burden emptying consequently so the lessen the assembling time. The working region is decreased. The process duration is diminishing up to 6sec and part of stock is decreased in that procedure. There are 4 moves in the organization so per move one labor is decreased with the goal that one day move all out 2 labor is diminished. Small time month to month pay is 6000 rupees so absolute sparing is $2 \times 6000 = 12000$ rupees. The interest in the new machine is 150000 rupees. Figure 4 demonstrates the improvement in Magnet inclusion and squeezing process.



Fig. 4: Improved in Magnet addition and squeezing process
Issue 2:

Work station: oilless metal squeezing

Procedure detail: Brg., Plain Metal, is press in the burden inward face that must be at same level.

A. Issue Proclamation:

- 1) In this procedure oilless metal are put 550mm good ways from the dance and administrator pick the oilless metal physically individually, it is extremely troublesome in light of the fact that oilless metal are gather in a receptacle and administrator pick one oilless metal from that container. The process duration is progressively because of stock is some good ways from the laborer. The process duration of that procedure is 7.9sec. Issue appear in figure 5.
- 2) Prior in the event that Oilless Metal was twofold squeezed or metal ID is discovered NG, at that point sub get together of burden was rejected having cost (Rs. 37.89) per get together. In month of July it was discovered 12 Nos. Issue appeared in figure 5.6

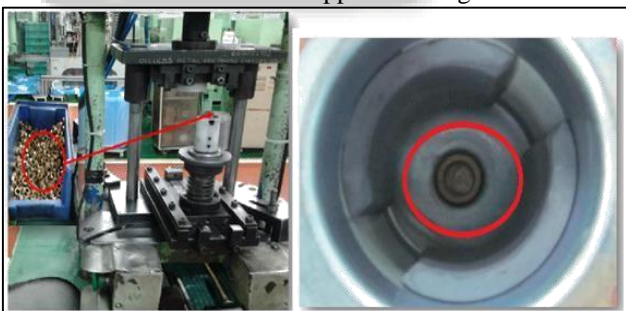


Fig. 5: oilless metal squeezing and oilless metal burden imperfection

B. Improvement:

- 1) In this procedure we decrease the separation upto 250mm (for example 250mm separation between oilless metal and dance) by moving the receptacle course of action and we utilize single part encouraging framework, so they diminish the process duration upto "7.58sec". Figure 6.
- 2) Presently with the assistance of tap we can expel the oilless metal from the burden, and we can reuse the Yoke and magnet so we can spare (Rs. 37.89) per gathering. From February onwards Yoke sub get together dismissal is zero.



Fig. 6: Improved oilless metal squeezing and reuse the burden

Issue 3:

Work station: driven apparatus squeezing

Procedure detail: the determined apparatus is press over the burden unit with shaft.

Issue articulation: In this procedure rigging are put 50mm good ways from the dance and and more apparatuses are networks with one another so process duration is more in that procedure. The process duration of that procedure is 10.6sec which is more than takt time. Figure 5.8 demonstrates the issue.



Fig. 7: issue in driven rigging squeezing

1) Improvement:

In this procedure apparatus are set 40mm good ways from the dance and administrator in this rigging comes naturally in the hand of administrator, it is simple as contrast with past and they increment the generation , so we diminish procedure process duration up to "6.8sec". Appeared in figure 8.



Fig. 8: Improved driven apparatus squeezing

Issue 4: Work station: Bearing squeezing

Procedure detail: the bearing press with neckline in the burden shaft get together.

Issue articulation: In this procedure bearing are put 650mm good ways from the dance and administrator pick the bearing physically individually, it is troublesome on the grounds that the working separation is all the more so process duration is more and the process duration of that procedure is 10.2sec. issue appear in figure 9.



Fig. 9: issue in bearing squeezing

2) *Improvement:*

In this procedure we decrease the separation upto 620mm (i.e 30mm separation among bearing and dance) and we utilize single part sustaining framework, so we diminish procedure process duration upto "8.2sec". appeared in figure 5.11.



Fig. 10. improved bearing squeezing Issue 5: Work station: Bearing squeezing and oil apply

Procedure detail: subsequent to bearing press someone else is apply the oil over the get together

Issue explanation: Earlier 3 administrators were utilized. One was doing driven rigging squeezing taking practically 6.8 seconds , one for doing bearing squeezing taking 8.2 seconds and third one was doing oil apply in 4 seconds. The oil apply is a little work process that required additional labor which is misuse of cash as far as pay of that individual.

3) *Improvement:*

Now we have decreased 2 labor in 4 movements. One administrator is doing driven apparatus squeezing in 6.1sec and second administrator is doing bearing squeezing and oil applying in 7.5sec.

Issue 6: Work station: trademark check

Procedure detail: After the gathering the engine the trademark is check to discover burden and empty state of engine execution.

Issue articulation: Earlier administrator need to embed Sprocket on the engine shaft without fail and afterward he was checking engine by embeddings engine shaft into the Jig, so administrator was taking 3.8 seconds to present Sprocket on the pole. Henceforth process duration was more. Prior complete process duration was 11.2seconds.

4) *Improvement:*

Now new Jig is presented in which Sprocket is now mounted so administrator need to just embed the pole of engine into that Jig . Henceforth 3.8 seconds spared. Presently process duration diminished to 9.0 seconds.

Issue 7: Work station: burden fixing

Procedure detail: burden screw is fix by the Pneumatic Air Gun

Issue explanation: Earlier we were utilizing two labor for M 10×20 screw fixing and furthermore 2 Pneumatic Air Gun were utilized for fixing of 2000 engines in a single move. 5 man forces were required for entire day. Figure 11.



Fig. 11: Pneumatic Air Gun for burden fixing

5) *Improvement:*

We have supplanted the Pneumatic Air Gun; with the assistance of this we can fix a similar amount with the assistance of 1 Pneumatic Air firearm and 1 labor. So 2 Manpower spared and furthermore it is modest. Figure 12.



Fig. 12: Improved Pneumatic Air Gun for burden fixing Issue 8: Higher Lead Time: the present state lead time is 6hrs 48min 1.2sec so we need to lessen them by some improvement like store present in work station. Proposed improvement:

The figure 13. demonstrates that as grocery stores come nearer to the line-side and diminish the muda brought about by pointless development and transport, so the requirement for customization increments and the arrangement must be adjusted to the area to guarantee that workstation profitability remains the need.



Fig. 13: Supermarket

Manual movability is basic for some reasons. The first is that pressing segments into little holders implies that dynamic stream frameworks can be utilized. This is accomplished using general stores and line-side stream racks. The progression of segments decreases the key wellsprings of muda. Also, shipping lighter loads permits the utilization of little multipurpose trains, which are significantly less exorbitant than forklift trucks.

XIX. LINE BALANCE SHEET AND VSM MAP

After progress we make another line accounting report which is improved. That sheet demonstrate that we decrease the bottleneck procedure and close to accomplish the objective process duration which is 7.0sec. The line balance effectiveness and line balance proportion is improved in that sequential construction system. The table 5.3 demonstrates that future line monetary record.

Line balance productivity = .88 Line balance proportion = 63.68

Both the improvement parameter is expanded that shows enhancements are valuable to sequential construction system. By apply grocery store lead time of future state = 1hrs 15min 35.9sec The all-out process duration (esteem included time) = 2min 35.9sec

The future state demonstrates the all improvement in the line and further distinguished the issue in sequential construction system. The future state Value Stream Mapping is appeared in figure 13.

Improved future state.

Table 7. Work station with when improvement Work station Before After

Magnet inclusion and squeezing process 2 machine, 2 labor and more space obtained Process duration is 12sec 2 machine, 1 labor and less space obtained Process duration is 9.0sec oilless metal pressing distance from the dance and administrator is 550mm process duration is 9.sec dismissal every month 12nos distance from the dance and administrator is 200mm process duration is 7.2sec dismissal every month zero driven rigging pressing distance from the dance and administrator is 600mm process duration is 9.1sec distance from the dance and administrator is 50mm process duration is 6.3sec

Bearing pressing distance from the dance and administrator is 500mm process duration is 10.0sec distance from the dance and administrator is 20mm process duration is 8.5sec

Bearing squeezing and oil apply 2 labor of various work 1 labor for various work so every day spare 3 labor trademark check cycle time is 11.4sec By supplanting dance process duration is 8.0sec burden tightening 2 Pneumatic Air Gun and 6 labor required for 2000 engine fixing for every day By supplanting Air Gun 1 Air Gun and 3 labor required for 2000 engine fixing for every day

XX. COST SPARING INVESTIGATION

Worth is characterized as far as cost that is worth included is movement is just give benefit yet non-esteem included action is loss of the organization. VSM is advantage just when it give cost putting something aside for evacuating non-esteem included movement.

Before greatest process duration = 12sec
Before generation rate = accessible working time/most extreme process duration
= 74400/12 every day
= 6200 units for each day
= 2066 units for each move (there are 3 movements) After progress most extreme process duration = 9.0sec
After generation rate = accessible working time/most extreme process duration
= 74400/8 every day
= 9300 units for each day
= 3100 units for each move
Before number of labor per move = 20
Before expense of one unit item in term of labor = compensation of 20 man/generation for every move
= 22x6000/1869x20
= 3.53 rupees per unit
After number of labor per move = 20
After expense of one unit item = compensation of 22 man/creation for every move
= 20x 6000/3037x20
= 1.97 rupees per unit
So complete cost sparing per unit item = 3.53 – 1.97
= 1.56 rupees per unit
Absolute interest in over sequential construction system
Cost of new computerized machine for magnet squeezing = 300000 rupees Cost of new course of action in oilless metal squeezing = 4500
Cost of new course of action in driven apparatus squeezing = 40000 Cost of new game plan in bearing squeezing = 9000
Cost of new dance in trademark check = 20000
Cost of new Air Gun for burden fixing = 25000 rupees
All out interest in over mechanical production system = 567000 All out sparing in month to month = 1.56x8112x20 rupees
= 253094 rupees for every month Recompense period = speculation/sparing
= 567000*20/253094
= 45 days

That demonstrates that the venture will be return in 45 days after that the entire sum is over benefit of the XYZ Company. So paper help in worth mean cost improvement for the situation organization with the assistance of significant worth stream mapping which is a viable apparatus of lean assembling.

XXI. CONCLUSION

This contextual analysis is expecting to evaluate the materialness of value-stream mapping in mechanical production system industry. Thinking about this reason, value-stream mapping as a device in Lean Production was followed in writings and help of most experience people for executing this instrument. As per the contextual investigation, the focal point of actualizing value-stream mapping in mechanical production system industry ought to be on precision of the present state map. Because of the way that most improvement proposals are tied in with arranging of process duration decrease, improve work-in-process, improve machine and diminish labor, so an exact and practical guide can make a solid stage for enhancements. In

this way, the more precise the present express the more reachable advancements. By executing the worth stream mapping we effectively get the bottleneck procedure and thought for usage and examination the outcomes. So we can lessen the most extreme process duration from 12 sec to 9.0sec and decrease labor from 45 to 20 per move. That is we get the greatest advantage by VSM which is increasingly other lean procedure. So future state gets the clearest view and further distinguished the open door for development.

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