Faculty of Engineering
Department of Textile Engineering

Course Code: TH-519

Course Title: Thesis

A case study and implementation of lean manufacturing in an apparel Industry.

Submitted by:

Md. Salauddin Anik

ID: 191-32-397

Department of Textile Engineering
Faculty of Engineering
Daffodil International University

Supervised by:

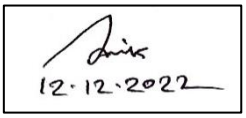
Dr. Md. Mahbubul Haque
Professor & Program Director, M.Sc.
Faculty of Engineering
Daffodil International University

This report submitted in partial perfection of the requirements for the degree of
Master of Science in Textile Engineering

Fall 2022

DECLARATION

I hereby declare that, the research work of this Thesis has been conducted by me under the supervision of Dr. Md. Mahbubul Haque, Assistant Professor Department of Textile Engineering. Faculty of Engineering, Daffodil International University. I also declare that neither this thesis report nor any part of it has been submitted elsewhere for award of any degree or diploma.



Md. Salauddin Anik
ID: 191-32-397
MSC In TE
Department of Textile Engineering
Daffodil International University

LETTER OF APPROVAL

Titled of the thesis **A case study on Process excellence (LEAN) and its implementation in apparel industry.**

This thesis report prepared by Md. Salauddin Anik bearing ID: 191-32-397 is approved in Partial Fulfilment of the Requirement for the Degree of MASTER OF SCIENCE IN TEXTILE ENGINEERING. This student has completed his thesis work under my supervision. During the research period I found his sincere, hardworking and earnest. The whole report is prepared based on proper investigation and interpretation though critical analysis of data with required belongings.

Dr. Md. Mahbubul Haque
Professor & Program Director, M.Sc.
Faculty of Engineering
Daffodil International University

ACKNOWLEDGEMENT

Firstly, I express my gratefulness to almighty Allah for his blessing makes us possible to complete this thesis work successfully.

I appreciate the depth of expertise and active attention of my supervisor, Dr. Md. Mahbubul Haque, Professor and Program Director, M.Sc. Department of Textile Engineering, Faculty of Engineering, Daffodil International University, in carrying out the thesis study. This thesis could not have been finished without his never-ending patience, academic direction, constant encouragement, active supervision, constructive criticism, insightful counsel, reviewing numerous subpar versions and rectifying these at all levels. For his insightful advice, constructive criticism, laborious assistance, never-ending inspiration, and for providing all the support required to finish this job. Additionally, I would like to thank Asit Ghosh, Assistant Professor in the Department of Textile Engineering, for his helpful suggestions, encouragement, and kind supervision as I conducted my study and completed this thesis paper.

In order to complete my thesis report, I would like to thank Mr. Md. Mominur Rahman, Assistant Professor and Head (In-Charge), Department of Textile Engineering, Faculty of Engineering, Daffodil International University. I want to thank Prof. Dr. Md. Zulhash Uddin, Dean BUTex, for giving us the information we needed to finish the report on schedule.

I would like to take this opportunity to thank all those people who coordinated me in this thesis and special thanks to **Nazmun Nahar,** Executive R & D**, Md. Saiful Haque Bhuiya, Director** Aman Graphics & Design Ltd., **De. Harindra De Silva, Consultant ESOne**, related with the thesis at the beginning by boosting guideline and suggestions which helped me a lot.

Finally, I would want to thank my dear parents and my colleague for their encouragement, perseverance, and help in writing the thesis report. I would want to express my gratitude to all the esteemed professors in the Department of Textile Engineering at DIU for their wise counsel, recommendations, and information.

THIS PROJECT REPORT IS DEDICATED TO MY RESPECTED TEACHER

Dr. Md Mahbubul Haque

ABSTRACT

This report is titled **A study on process excellence (LEAN) and its implementation in apparel Industries.** The ability to put a new product or a new process on the market as quickly as possible is becoming increasingly important. For designing affordable and profitable products based on market realities and consumer expectations, systematic management is required. It is important to take into account open innovation, which is currently the subject of intense discussion and widespread adoption. Only a logical user interface and effective information management can make a number of good ideas work together successfully. An strategy for such a systematic innovation management is called "Design for Lean." This idea was created to realize innovations in a target-oriented manner, and it is closely related to the Lean approach, which is presently used globally to improve existing operations.

Lean integrates a number of critical elements, such as the proactive involvement of employees, customer-focused product creation, the lowering of product and process complexity, and the regulation of innovation through a standardized process. The current toolkit exemplifies the tried-and-true strategy used by UMS to implement Design for Lean. Its constituent tools are arranged in a logical and comprehensible manner according to the process paradigm of Define, Measure, Analyze, Design, and Verify. It is simpler to coordinate the development of creative, target-oriented products and processes when the structure, which can be thought of as a red thread, is used.

Through this thesis, I have tried to find out about process excellence (LEAN) & its practical implementation in Unifill Group's Sister Concern Aman Graphics & Design Ltd. Which is a readymade garments(Knit & Woven) specialized in baby's wear.

Table of Contents

List of Figures

Chapter 1

1.1 Background of the study:

According to a recent benchmark study by the American Productivity and Quality Control (APQC), companies with strong growth now generate one-third of their revenue from products that are less than three years old. Innovation is one of the key success factors for every business today. Another important finding is that new product lifecycles have shrunk by an average of 400% during the past 50 years. It goes without saying that successful innovation demands speedy execution in addition to outstanding ideas. For many businesses, however, the implementation stage presents significant challenges because, according to statistics, just one in ten R&D initiatives results in commercial success, and even then, only one in two products actually make it to market on time.

Thus, properly implementing innovation entails bringing a good concept to market as soon as possible while minimizing risk to the business. Only by managing developmental work systematically can this be accomplished.

After closely examining the situation in the years leading up to and immediately following World War II, Kiichiro Toyoda, Taiichi Ohno, and others at Toyota realized that a number of straightforward innovations might make it easier to offer both consistency in process flow and a wide range of product offerings. As a result, they went back to Ford's original ideas and created the Toyota Production System. Toyota has implemented a lean production system. By eliminating process waste, fostering greater communication among team members, raising execution process productivity, and transforming the company into a learning organization, the lean manufacturing concept in the apparel industry can lower operational costs in manufacturing.

Lean should be introduced where it makes sense, not the other way around, in order for a company to experience genuine change as a result of its implementation.

In order to apply lean, it is necessary to comprehend a number of fundamental principles of lean manufacturing. Failure or a lack of commitment from everyone in your organization will most likely arise from a failure to comprehend and apply these ideas. The method becomes ineffective without dedication.

1.2 The Specific Purpose of this study:

Businesses are intended to be profitable. Profitable businesses support the neighborhood, state, and nation where they produce their goods or render their services by creating jobs and paying taxes. Having customers that want your goods or service is the foundation for making a profit. The desire for your good or service is just the start. Each customer has expectations for the goods or service. The goal of the lean process excellence strategy is to identify non-value-added processes and minimize waste while maintaining the best possible quality and shortest lead time.

Lean demonstrates that improving quality and cutting costs simultaneously need not be mutually exclusive goals. Every improvement in quality offers extra value that the consumer is willing to pay for if quality is assessed in reference to the customer. Therefore, the objective of any Lean project is to produce products of marketable quality while dramatically reducing costs using lean procedures. This unique strategy serves as the foundation for the distinctive Lean vision of quality, whose objective is to provide benefits for both the customer and the business.

The main objective will be:

- Improve effectiveness and efficiency by visualization.
- Waste Elimination
- Work place Standardization
- Effective plant layout.
- Quality will be enhanced at source level.
- Increase the Productivity by 30% from the existing level.
- Reduction of Production cost & other Overheads.
- Reduce the Risk of non-compliance and
- Late Delivery Prevention.

Chapter 2

Literature Review

2.1 DNA of Lean:

DNA is -

- Language of human genetics
- Stores information that determines behaviors/traits
- Passes genetic information from one generation to other

Lean DNA concept refers to the cultural change that is coming from behavioral change of a society/Industry. Lean leader behavior contains with 5 characteristics whereas behavior flow with a system. System runs with some processes. To standardize a process lean have 8 tools & 4 rules. By using lean system waste can be identified with specific category & easily eliminate by systematic approach. In lean DNA concept one can mainly learn how to find out the waste.

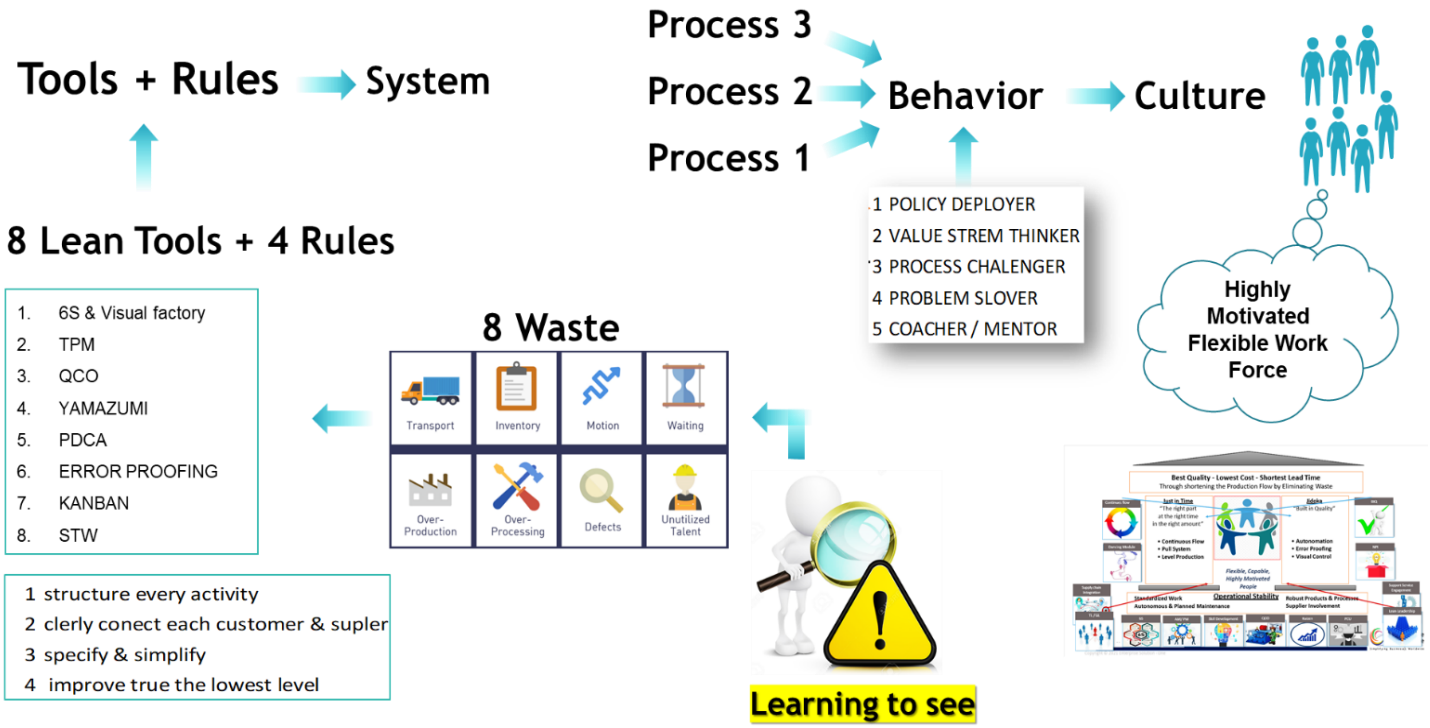


FIG: 2.1 DNA Structure Of Lean

2.2 Lean 8 Tools

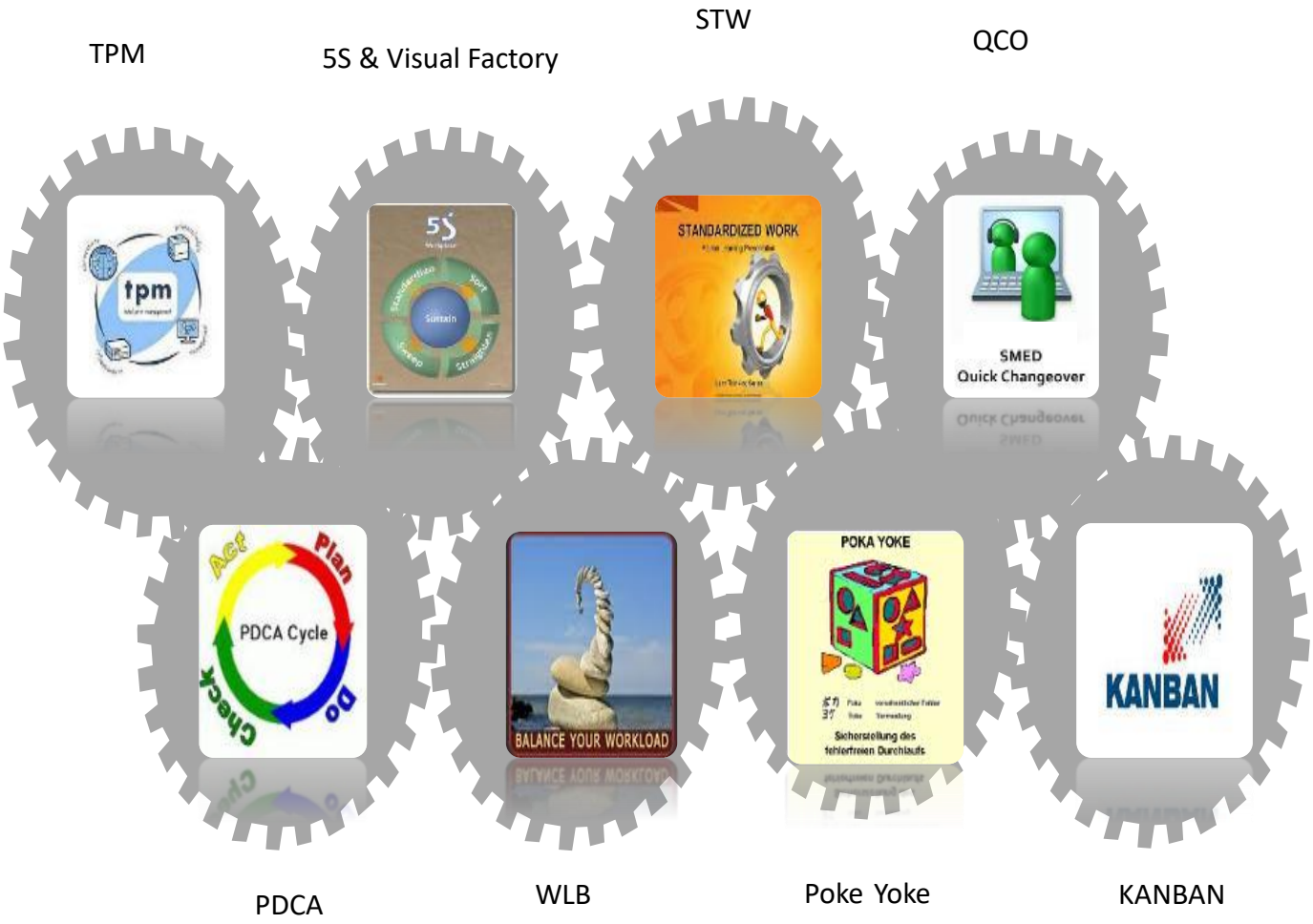
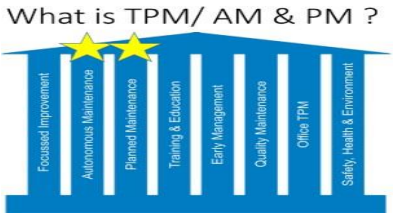


FIG: 2.2 8 Tools of Lean

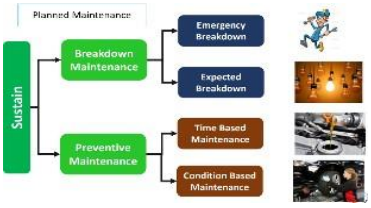
2.2.1 Total Productive Maintenance(TPM)



What is TPM Actually?

Total productive maintenance (TPM) is a strategy that operates according to the idea That everyone in a facility should participate in maintenance, rather than just the maintenance team. TPM has 8 pillars. But we will work with 2 pillars under TPM from that. Those are---

(i) Autonomous Maintenance (AM) (ii) Planned Maintenance (PM)



Why TPM?

To maintain every equipment of a plant before a breakdown occurs.

In lean, our ultimate goal is Best Quality-Lowest Cost-Shortest Lead Time.

To build up the lean house of a plant TPM works as a foundation of that house.

Main goal of TPM is to achieve

- ✓ Zero Breakdown
- ✓ Less Spare Parts Cost
- ✓ Zero Defects from Machine
- ✓ Zero Accident from Machine

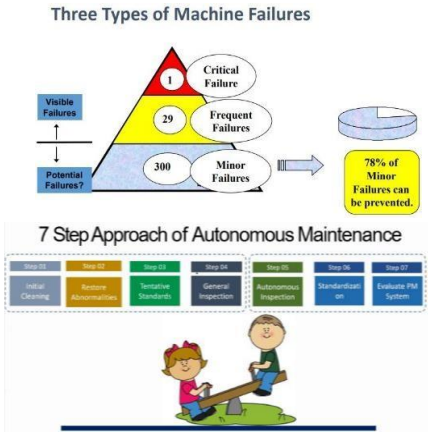


FIG: 2.2.1 TPM Various Type of Step

The sub-projects are helping to drive the TPM (Connectivity)

- ✓ Diagnosis (PLA) to analyze the current data.
- ✓ TL/GL to build up bonding with all employee to Drive the Autonomous Maintenance.
- ✓ QCO to reduce bucket loss.
- ✓ BIQ to analyze the defects due to machine.
- ✓ DS to capture real-time data & synchronize the data. Ø WLB to reduce the downtime.
- ✓ ELT to prepare proper planning to reduce downtime, spare parts cost, accident due to machine & defects due to machine by making A3.

2.2.2 6S & Visualization

6S is a process and method for creating and maintaining a safe, organized, clean and high-performance workplace.

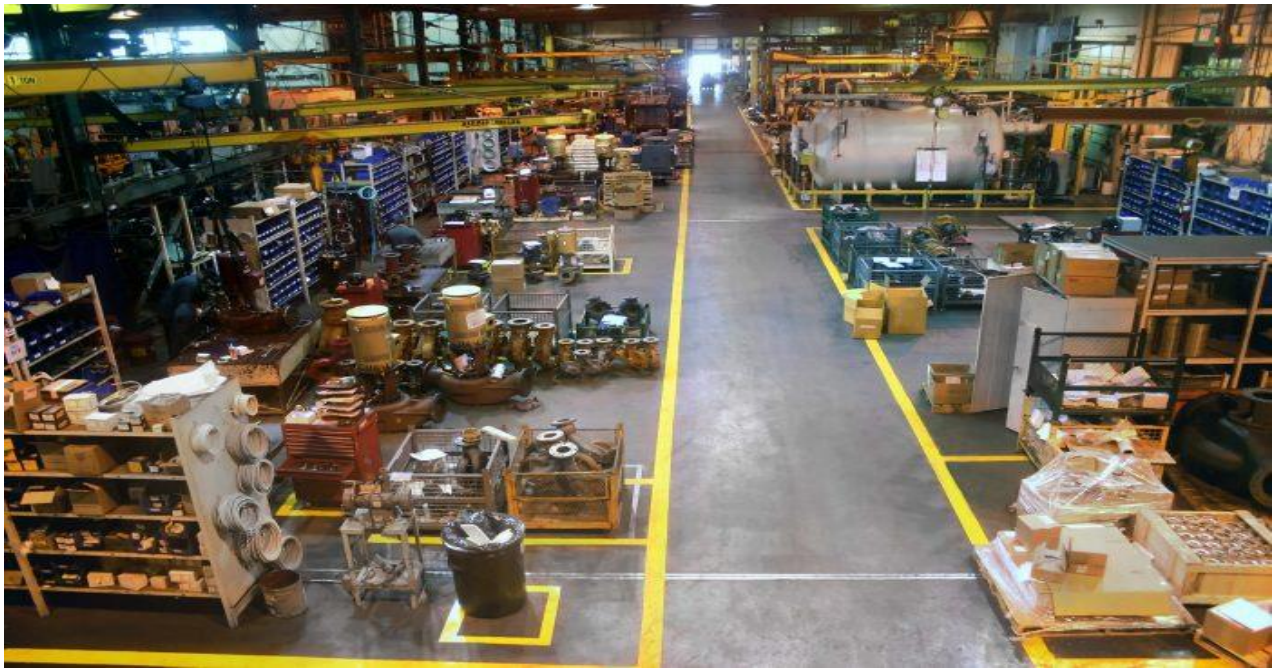


FIG: 2.2.2 Clean Gangway

Origin of 6S

- ✓ Method is composed of 6 pillars and pillars name starts with S
- ✓ Sort, Set in Order, Shine, Standardize, Sustain, Safety
- ✓ Japanese words: seiri, seiton, seiso, seiketsu, and shitsuke.
- ✓ 5S was developed in Japan and was identified as one of the techniques that accelerated Just in Time manufacturing.
- ✓ Just-in-time (JIT) manufacturing, also known as just-in-time production or the Toyota production system (TPS)
- ✓ It is a methodology to reduce flow times.

The 6 step are followed as:

- ✓ Sort: Sort out & separate items that is needed & not needed in the area.
- ✓ Set in order : 1.Arrange needed items so that these would be easy to use. 2. Clearly define locations for all items so that anyone can find them & return them after completing the task.

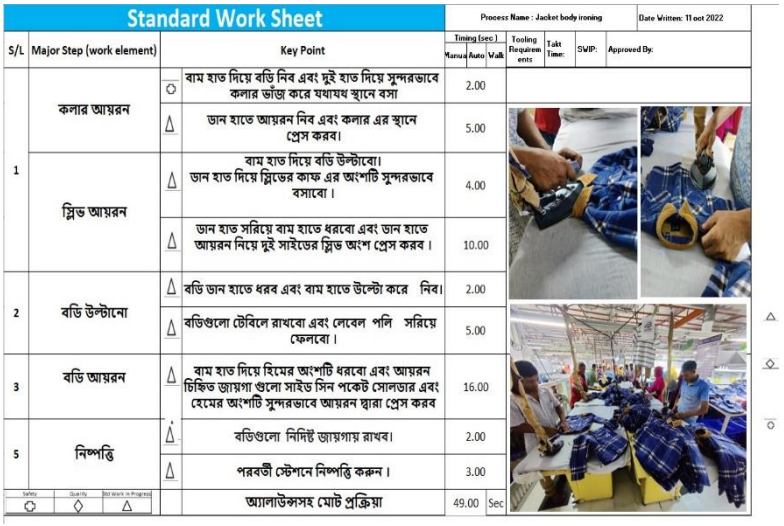
- ✓ Shine: Clean the workplace & equipment on a regular basis.
- ✓ Standardize: Revisit the first three of the 5S on a frequent basis and confirm that 3S are working at defined procedures.
- ✓ Sustain: Keep to the rules to maintain the standard & continue to improve every day.
- ✓ Safety: Start every work maintain proper safety

2.2.3 Standardized Work

The Standard Work Sheet lets participants, document the sequence of production/work steps assigned to a operator in a standard way.

Purpose

- ➢ Best practices for performing an activity or process



Standard Work Sheet

Process Name : Jacket body ironing | Date Written: 11 oct 2022

S/L	Major Step (work element)	Key Point	Timing (sec) Manual	Auto	Walk	Tooling Requirements	Takt Time:	SWIP:	Approved By:
1	কলার আয়রন	বাম হাত দিয়ে বডি নিব এবং দুই হাত দিয়ে সুন্দরভাবে কলার ভাঁজ করে যথাযথ স্থানে বসা	2.00						
		ডান হাতে আয়রন নিব এবং কলার এর স্থানে প্রেস করব।	5.00						
	স্লিভ আয়রন	বাম হাত দিয়ে বডি উল্টাবো। ডান হাত দিয়ে স্লিভের কাফ এর অংশটি সুন্দরভাবে বসাবো।	4.00						
		ডান হাত সরিয়ে বাম হাতে ধরবো এবং ডান হাতে আয়রন নিয়ে দুই সাইডের স্লিভ অংশ প্রেস করব।	10.00						
2	বডি উল্টানো	বডি ডান হাতে ধরব এবং বাম হাতে উল্টো করে নিব।	2.00						
		বডিগুলো টেবিলে রাখবো এবং লেবেল পলি সরিয়ে ফেলবো।	5.00						
3	বডি আয়রন	বাম হাত দিয়ে হিমের অংশটি ধরবো এবং আয়রন চিহ্নিত জায়গা গুলো সাইড সিন পকেট সোলডার এবং হেমের অংশটি সুন্দরভাবে আয়রন দ্বারা প্রেস করব	16.00						
5	নিষ্পত্তি	বডিগুলো নির্দিষ্ট জায়গায় রাখব।	2.00						
		পরবর্তী স্টেশনে নিষ্পত্তি করুন।	3.00						
		অ্যালাউন্সসহ মোট প্রক্রিয়া	49.00	Sec					

FIG: 2.2.3 STW for Jacket Body Ironing

2.2.4 Quick Change Over- QCO

1. **Purpose of QCO:** Vertical Start-Up through Quick Change over (QCO) A Change for Better

There are 8 Lean Tools and 4 Rules in the history of Lean. One of the key tools among them is QCO. can be described as a quick and effective approach to change a process from operating the current product to operating the following product. The setup time is progressively decreased via an orderly approach. Quick change over is referred to as QCO.

After the switchover, the period of time between the last good part and the first good part is referred to as QCO time. We can divide the overall QCO activity into two categories:

1. Internal Activities: Activities that must be performed while the machine is shut down or idle

2. External Activities: Activities that can be performed while the machine is running or producing.

FIG: 2.2.4 QCO Activities

Most important for QCO is converting internal activities in to external activities.

2. Goal of QCO:

i) Observe Changeover

ii) Identify Internal and External Activities.

iii) Eliminate waste and improve the QCO following the four Step methodology.

iv) Stream line the activities

v) Reduce the Bucket Loss (Loss Per Changeover Hours)

vi) Increase Ramp Up & Ramp Down Efficiency (1st & Last 3 Days of Style)

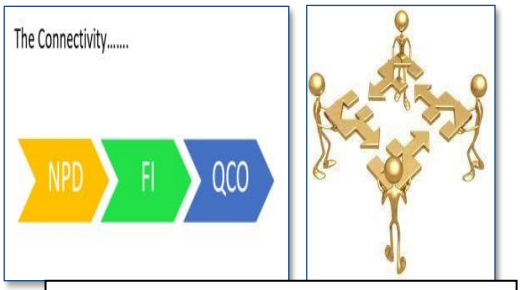


FIG: 2.2.4.1 QCO Connectivity

3. What are we doing under QCO?

i) High level Process Identification

ii) Define changeover time Internal - External Activities

iii) Aligning supporting departments for on time Raw Material In-house

iv) On the job training

v) TL/GL development for changeover activities streamlining

vi) Pre machine set up

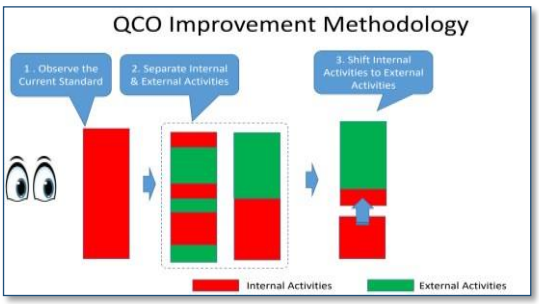


FIG: 2.2.4.2 QCO Improvement Methodology

vii) Layout plan based on micro level yamazumi with WLB

viii) JIT & Multiskilling

ix) Chassy Base Plan (Itemized Plan)

x) Daily QCO Dashboard Monitoring (7 Days Pre- Production Events)

xi) Line Planning & Adjustment based on Dashboard review.

xii) Develop Internal activities to external

4. What are the power/statement words of QCO

Ultimate Goal= Vertical Start-Up through Quick Change Over (QCO) A Change for Better

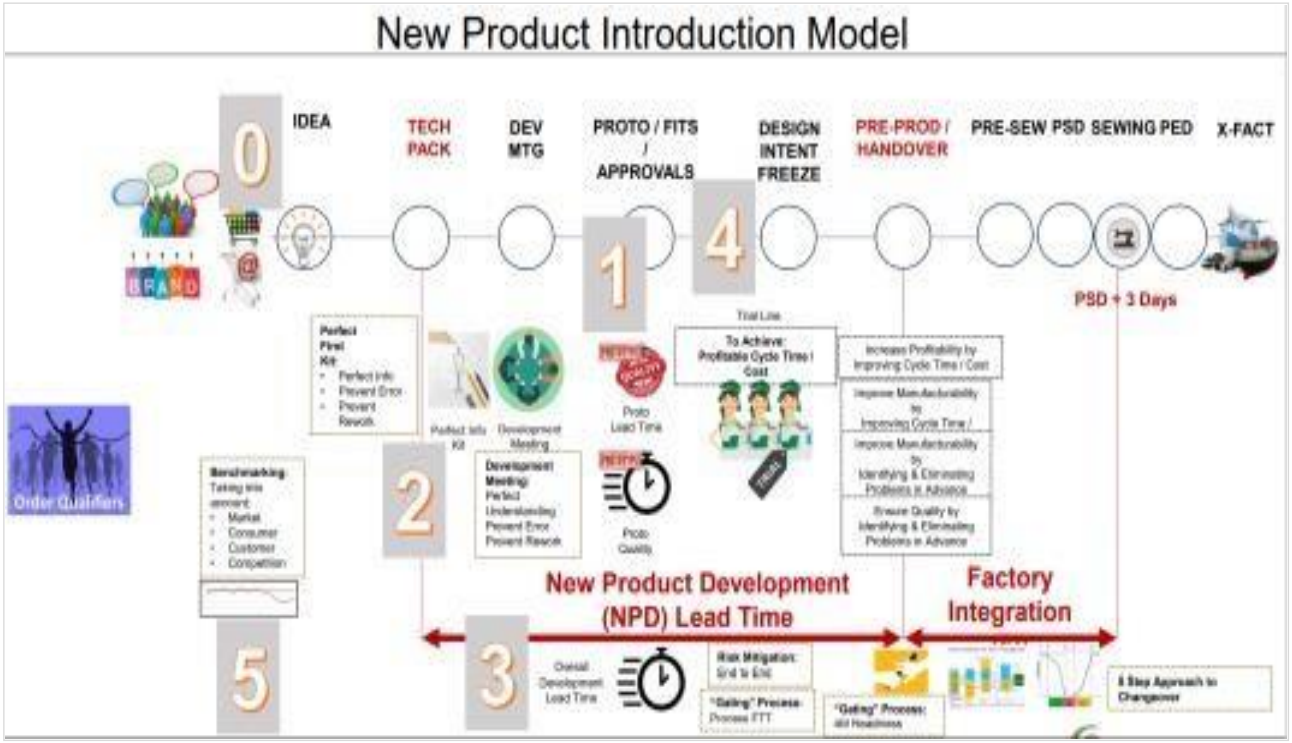


FIG: 2.2.4.3 Step Of NPD

2.2.5 Plan-Do-Check-Action (PDCA)

Definition

PDCA is an iterative design and management method to control and continual improvement of processes and products

Purpose

Problem-solving for continually improve processes, products or services.

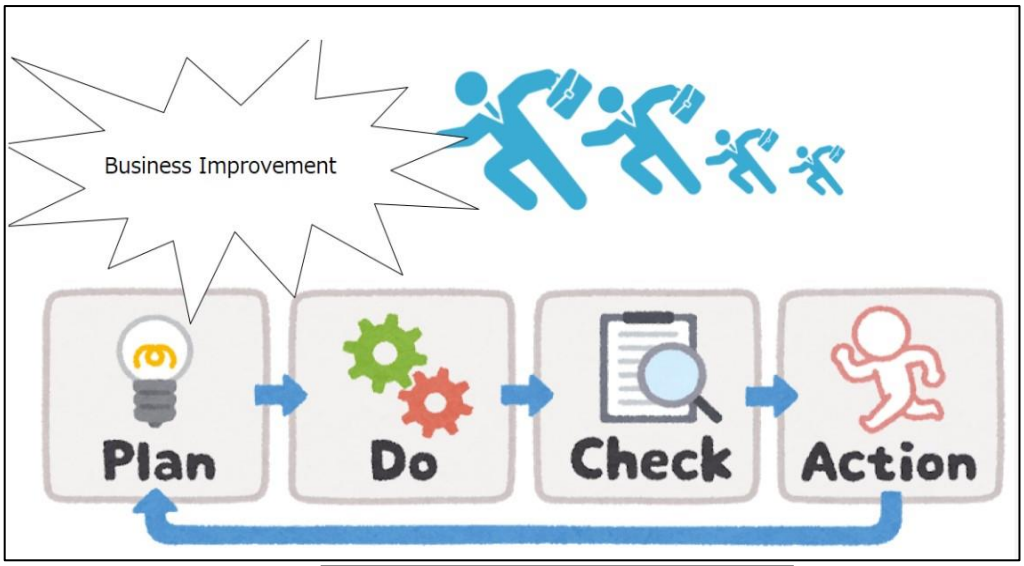


FIG: 2.2.5 PDCA Steps

2.2.6 Work Load Balancing (WLB)

1. Purpose of WLB:

Maintaining factory takt time with higher productivity by balance workload in each section.

2. Goal of WLB:

i) Reduce Balancing Loss.

ii) Reduce WIP.

iii) Increase efficiency.

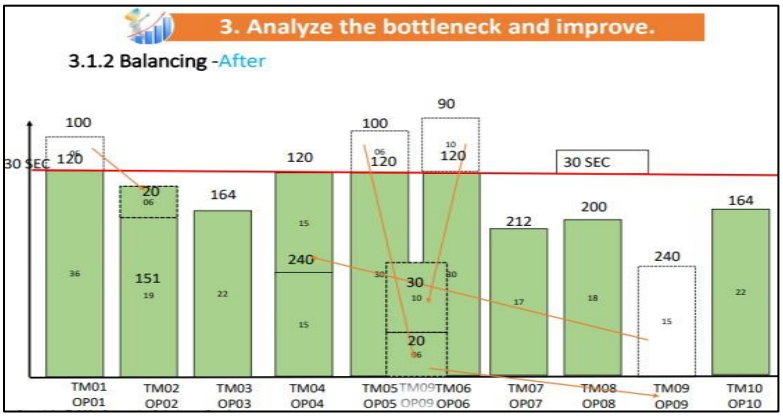


FIG: 2.2.6 Bottleneck Improvement

3. What are the sub-projects we are doing under WLB?

i) Standardize the sewing operation.

ii) Critical operation identification & training according to line demand.

iii) Train the TL on basic machine function.

iv) TM multiskilling program.

4. What are the power/statement words of WLB

Optimize man & machines to create continuous flow.

2.2.7 Poka Yoke (Error Proofing)

2.2.8 "Mistake-proofing" or "inadvertent error prevention" are what poka-yoke means. Any process component that assists a machine operator in avoiding errors and flaws by preventing, correcting, or highlighting human faults as they happen is known as a poka-yoke.

Purpose: To eliminate product defects by preventing, correcting error

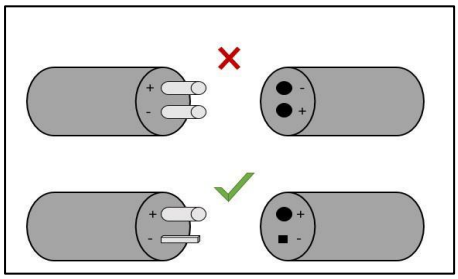


FIG: 2.2.7 Error Proofing Example

2.2.9 Kanban (Signal/Scheduling System)

Definition: System to scheduling or visualizes both the process (the workflow) and the actual work passing through that process.

Purpose:

- visualize work, limit work in progress
- smooth flow of work in any enterprise

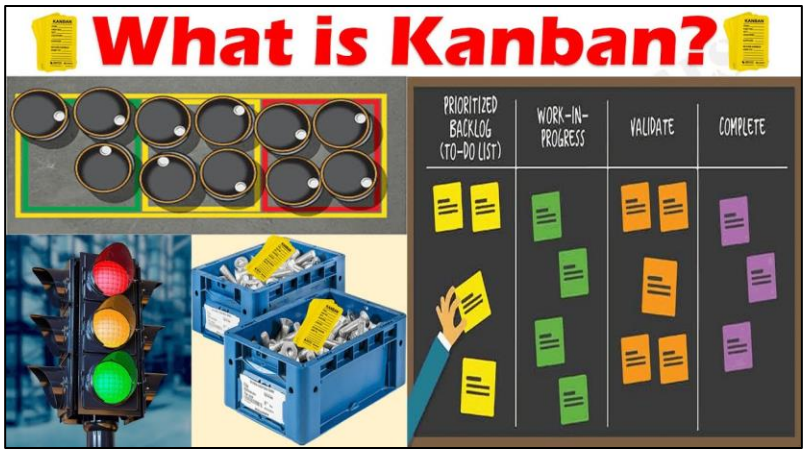


FIG: 2.2.8 Kanban Example

2.3 Elimination Of waste

To developed production system must be eliminating these three types of waste

(i) **Muda** (waste), (ii) **Muri**(overburden) and (iii) **Mura** (unevenness)

MUDA, Waste comes in eight categories, seven of which were identified by Toyota, along with "non-utilized skills." Defects, Overproduction, Waiting, Unused Talent, Transport, Inventories, Motion, and Excess Processing are some of these. The acronym DOWNTIME is created from the first letters of these wastes as a Mnemonic device. Poke Yoke, Kanban, Takt Time, SMED, and One-Piece flow are just a few of the techniques you can use to find and get rid of waste in your process. Each sort of waste is discussed in the article Finding Muda (waste) in your process and linked to methods that may be used to eradicate them methodically.

MURI, Mura and too much Muda (trash) removal from the process can lead to overburden. Operators and equipment become overwhelmed when they are used more than 100% of the time to complete a task. As a result, there will be equipment failures and personnel absence. Preventative and autonomous maintenance can be used to maximize the utilization of machinery and ensure their proper operation. Safety should be the main consideration in all process designs and standard work activities in order to avoid overworked employees. Visit the following article directly for additional details on muri: Finding muri (overburden) in your workflow.

MURA, Unevenness can be seen in variations in client demand, product processing times, or cycle times for several operators. Flexibility is more crucial in production environments with low volume and high product variation than in those with large volume and low product variation. When Mura is not decreased, the likelihood of Muri and thus Muda is increased. Mura may be minimized by encouraging transparency

2.3.1 7 wastes of lean manufacturing:

By removing waste and non-value-adding tasks from the manufacturing process, industrial engineering aims to boost productivity. Therefore, it is crucial to be aware of the wastes and non-value-adding processes that are involved in the production of clothing.

Numerous articles have been written about lean manufacturing and the seven wastes that are related to it, and most of them used examples from other industries. There aren't many examples of 7 wastes in the clothing sector online. Perhaps that explains why I've been asked so frequently to write a quick remark on the subject. I have described the seven types of lean wastes in this article using examples from the clothing industry.

Through the reduction or elimination of wastes, lean manufacturing focuses on increasing time spent on value-added activities.

7 types of wastes and non-value adding activities are as following.

T – Transportation

E – Excess Inventory

E – Excess Motion

W – Waiting

O – Over production

O – Over processing

D – Defects

To make it easy to remember 7 wastes, memorize the word TIMWOOD with initials of 7 wastes. In the following, 7 wastes are explained briefly with examples of garment industry activities.

1. Transportation

Transferring work from one location to another is an action that adds no value. Transporting cuttings from the cutting department to the sewing lines, moving stitched clothes from the sewing floor to the finishing department, and using a center table or trolley to move garment bundles along the line. Where transportation cannot be completely eliminated, consider ways to cut back on travel time. Transportation of bundles or individual parts can be mechanized in sewing lines by using overhead rail.

2. Inventory

The products in a factory's inventories are either being manufactured, are being used as idle resources in the production, or are supplies that are on hand. Additionally, excess inventory refers to keeping or producing more inventory than is needed for the subsequent operation.

Fabric and trim shops, cutting racks, and finishing trolleys all have excess inventory. As per the lean mindset, excess inventories are wastes for the factory. Money is inventory. You block your money and restrict your working space when inventory builds up in stores and on floors. extra work-in-process (WIP) is seen as extra inventory, even on a sewing line.

3. Excess motion

There are excessive motions at workstations where seamstresses sew, pressers press, employees complete, and bundle clothing. Due to inadequate worker training in working procedures and habitual old working practices, excessive motion is observed at workstations. Operators may use excessive motion because of improper workstation arrangement in factories with engineering departments that design workstation architecture.

4. Waiting

People or objects waiting around for the next action are referred to be this waste. This period was mentioned as one of the unproductive eras in production in a previously published article.

Waiting as waste is present throughout all operations in the textile production. Similar to how sewing workers wait for cuttings (instead of feeding), managers wait for final instructions, and quality approvals are granted. Merchandisers wait for permission from customers. Manufacturing workers who are idle while waiting for work or for other reasons represent a wasteful use of resources. Other instances of this waste include delays in material sourcing, cutting delays brought on by fabric approvals, and consumption permission delays.

5. Over Production

Simply said, this waste is the act of doing or producing something that is not now necessary. Overproduction results in too much inventory. In the cutting and sewing departments of clothing factories, there occurs overproduction. For instance, if the daily demand for sewing production is 5000 pieces, and the factory produces/cuts more than that amount (demand), the plant is generating more units of clothing than is required for the day's completing process. Work in progress (WIP) imbalance is caused by overproduction.

6. Over processing

This waste can be defined as doing task or adding features to the product those are not requirement from the customer. In garment construction, some operations may not be essential to give the final look and construction. Example: Multiple checking in finishing (initial checking, pre-final checking and final checking).

7. Defects

Making mistakes while creating clothing is a waste of time and resources. Why make defective items when everyone in the factory is aware that no defective garments can be shipped?

Manufacturing flaws in clothing include things like shade variance, incorrect cutting, stitching flaws, etc. If there are any defective garments produced, the factory must fix them before giving them to the customer. Repairs are expensive and time-consuming. The goal of lean manufacturing is to create clothing accurately the first time.

Advantages of the lean system in apparel industry

- Waste Elimination
- Work place Standardization
- Effective plant layout.
- Quality will be enhanced at source level.
- Increase the Productivity by 30% from the existing level.
- Reduction of Production cost & other Overheads.
- Reduce the Risk of non-compliance and
- Late Delivery.

2.4 Kaizen

Kaizen is a Japanese word that signifies "change for the better." 'Improvement' serves as the finest English equivalent. Improvements that don't cost a lot of money, involve everyone from management to workers, and make extensive use of common sense.

Kaizen is made of two Characteristics –

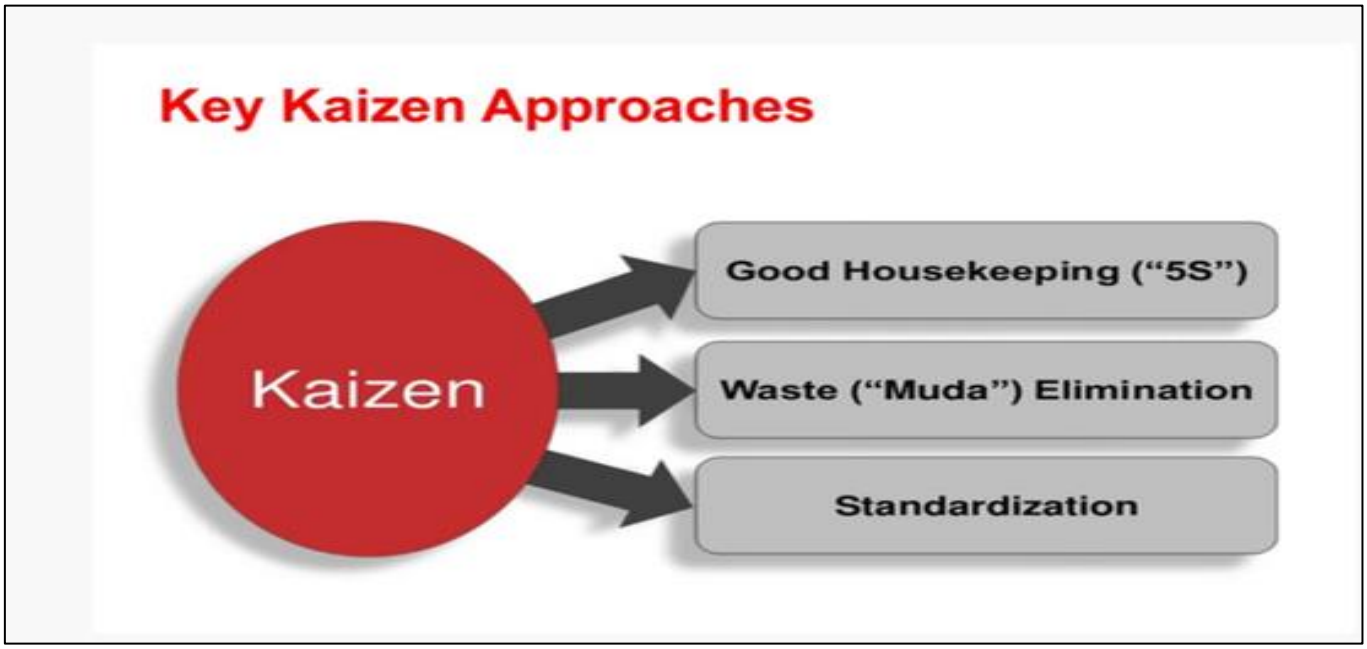
(i) GEMBA

Go and See

(ii)Kaizen

Three Actuals

The 'real place' where ‘real process’ is ‘real people’ works.



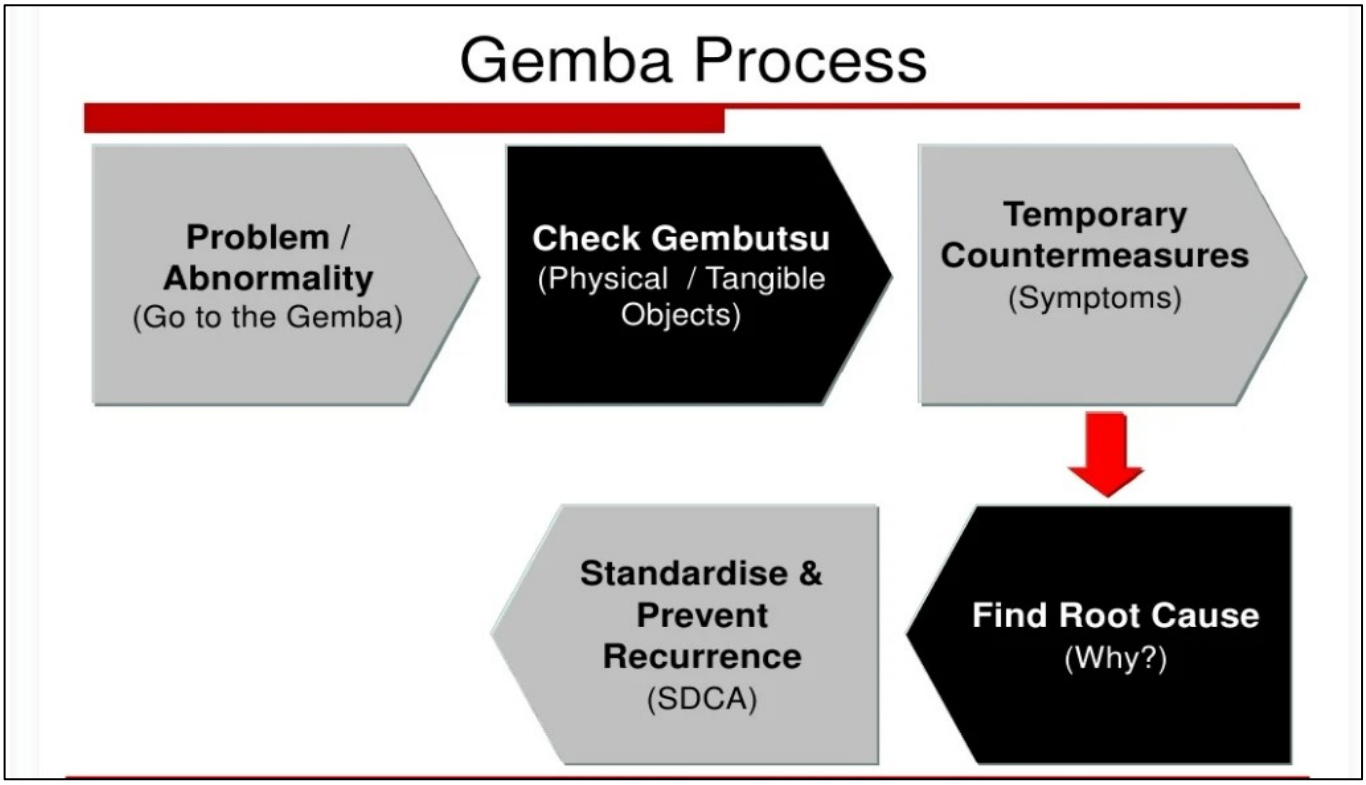


FIG: 2.4 Gemba Process

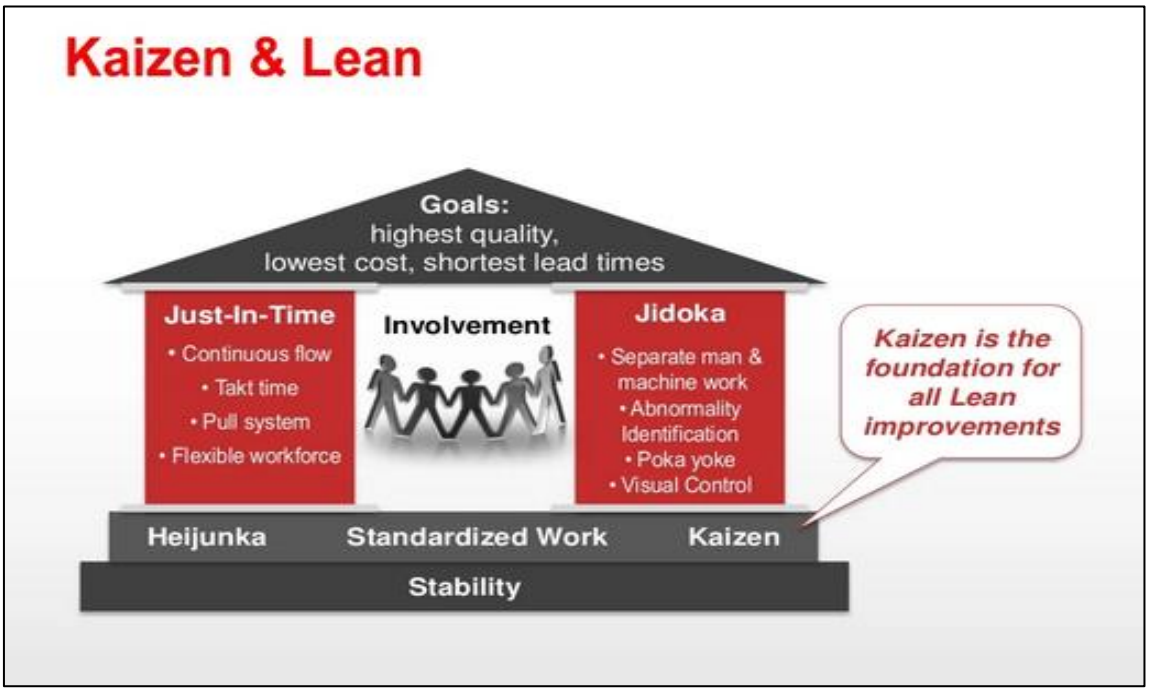


FIG: 2.4.1 Kaizen Activity in Lean House

Benefits

Kaizen is a powerful tool for positive changes. The most relevant benefits are:

- ✓ Empower employees, enrich the work experience and bring out the best in every person
- ✓ Promote personal growth of employees and the company
- ✓ Provide guidance from employees and serve as a barometer for leadership
- ✓ Improve quality, safety, cost structures, delivery, environments, throughput and customer satisfaction

Limitations

As far as limitations are concerned, the application of this program depends how far the company's management incorporates the "lean" model in the execution of its activities.

- ✓ A single Kaizen Week is undoubtedly a potent indicator of the "lean" approach's potential, but it is insufficient to transform a business on its own.
- ✓ If management does not maintain the pressure high through the hold of what has previously been accomplished and the launch of other Kaizen weeks, relevant results that may be acquired during a KW, may be lost.
- ✓ Kaizen events appear to more frequently rely on a top-down method of implementing improvement strategies, with management choosing the parameters of each KW.
- ✓

Chapter 3

Methodology

3.1 Implementation Of LEAN Projects & Tools :

For this thesis I have worked on 13 lean projects & Tools: among them some are under implementation & some are already fully implemented in Aman Graphics & Design Ltd & getting effective outcome. These projects are 6S, TL-GL,QCO,NPD,TPM,BIQ,WLB,PLA,HVS,SI,CI,DS,PS,LL.Very much successfully some projects like - QCO,TL-GL,6S,HVS,PLA,PS are running-& rest others are on going

3.2 Method :

Projects were in the early stages of implementation when I began working. Numerous issues, such as absenteeism, employee turnover, audit failure, disorganized work environment, enormous waste, unhygienic environment, unskilled worker/stuff, massive machine breakdown, lengthy style changes over time, frequently delayed shipment, repetitive problem, delay of raw material in house, improper work balancing, more garments that needed to be rejected and reworked, and disorganized file and data system frequently occurred.

After that, as the projects and tool implementation progressed, I learned how to solve those issues & achieve the best results.

3.2.1 Implementation of 6S & Visual factory :

Purpose

This 6S procedure helps us to produce higher quality products faster with less waste and inventory than the competitors.

6S Oath

Let us Unifill Group commits ourselves to enhance the productivity through a healthy environment created by 6S.

3.2.1.1 General Description of 6S Program

Sort

Separate what is needed and what is not needed, and keep only those things that are needed in the workplace. Discard unnecessary items.

Set In Order

Neatly place and identify needed work items. Designate a place for everything so that anyone can find it. Always put things back in their designated spots

We have 2 important rules for set in order.

30 seconds rule

1) XY Theory

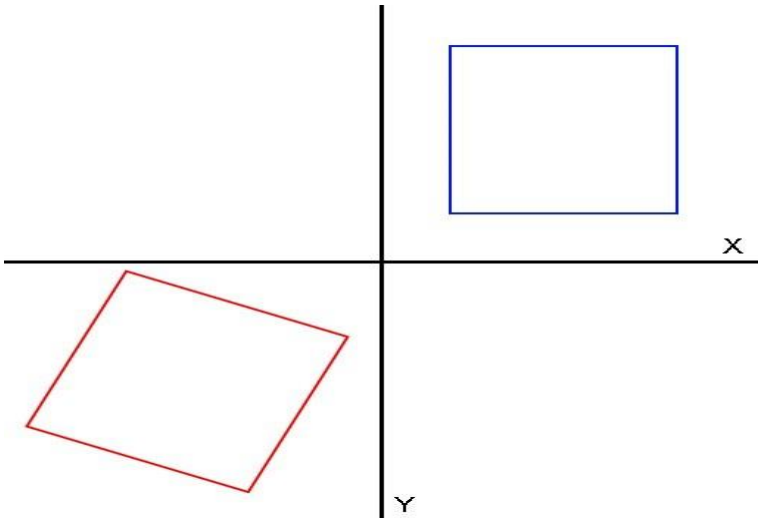


FIG: 3.2.1.1 Red Tag Box

Shine

Clean up. Always maintain a clean and shiny work place. Identify why things are getting dirty.

Standardize

Set an example for others by upholding the first three S's, and motivate them to do the same. Create policies and guidelines to encourage a positive work atmosphere until everyone practices the first three Ss automatically.

Sustain

Maintain and practice the first four S's. Be thorough in Straightening up,

Putting things in order and cleaning.

Safety

One of the most crucial practices included into daily operations should be safety precautions, especially in areas with higher risks. We are going to talk about safety first even though it was included as the final stage to the original 5S process. It is currently a hot topic.

FIG: 3.2 6S Steps

3.2.1.2 6s Zone Structure Aman Graphics & Designs Ltd

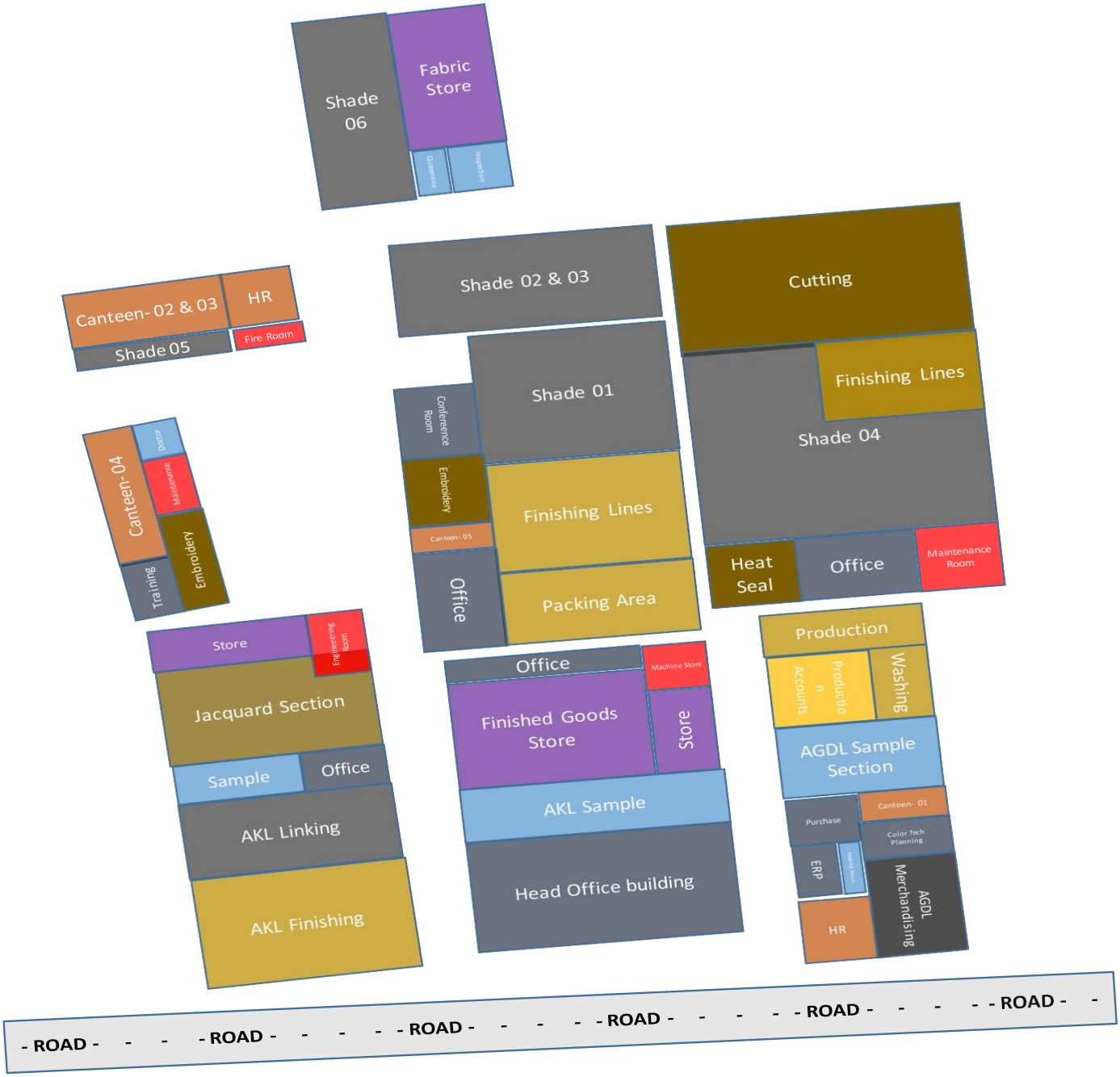


FIG: 3.2.1 6S Geographical View Of Aman

6S Zone Leaders

Table: 3.2.1 PDCA Steps

Color Code	Zone Tag	Department/ Section	Leader
	Zone A	Cutting + Embroidery + Fusing	Mr. Jahangir
	Zone B	Finishing & Packing	Mr. Shamsul
	Zone C	Sample Section	Mr. Shah Alam
	Zone D	Stores	Mr. Mahfuj
	Zone E	Sewing Area	Mr. Amir
	E1	Shade - 01	Mr. Shohidul
	E2	Building Ground Floor Area	Mr. Shofiqul
	E3	Building 1st to 3rd Floor Area	Mr. Hasan
	E4	Shade - 04	Mr. Mostafa
	E5	Shade - 05	Mr. Sohel
	E6	Shade - 06	Mr. Nazmul
	Zone F	Production Accounts	Mr. Rupom
	Zone G	HR & Admin & Factory Office Area	Mrs. Lucky
	Zone H	Head Office Area	HOD's
	H1	Accounts	Mr. Huda

3.2.2 RED TAG – BASIC RULES

1) **Red -tagging** is a simple strategy used to support the workplace organization

Identify the wastes and isolated items that have no commercial value. Evaluate the way of disposing without affecting the environment. Address them appropriately.

2) Four Rules for Red Tagging

a) Red-tag targets and criteria .Identify the items, which have no commercial/ scrap vale and no –need to support the production process or may be wastes that generated from the production process.

b) Make and attach red tags Red Tags are available near Tag zones simply pull out a Red tag, fill the reason for disposal and attach the with the item. Move the item to the nearest red tag zone.

c) Evaluate and take care of yellow-tagged items Item in the Red tag zone shall be removed immediately.

d) Document and share the results Red Tag Log book shall be maintained for this purpose. When it is disposing, all the administrative procedures should be followed.

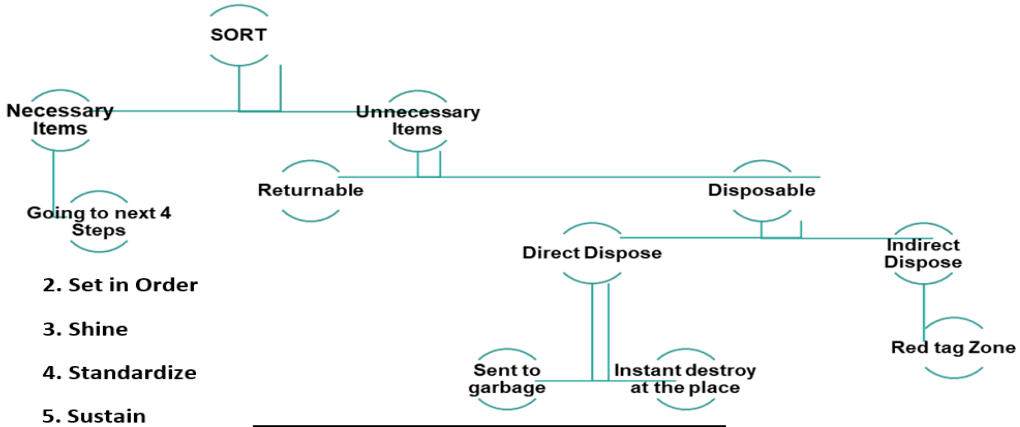
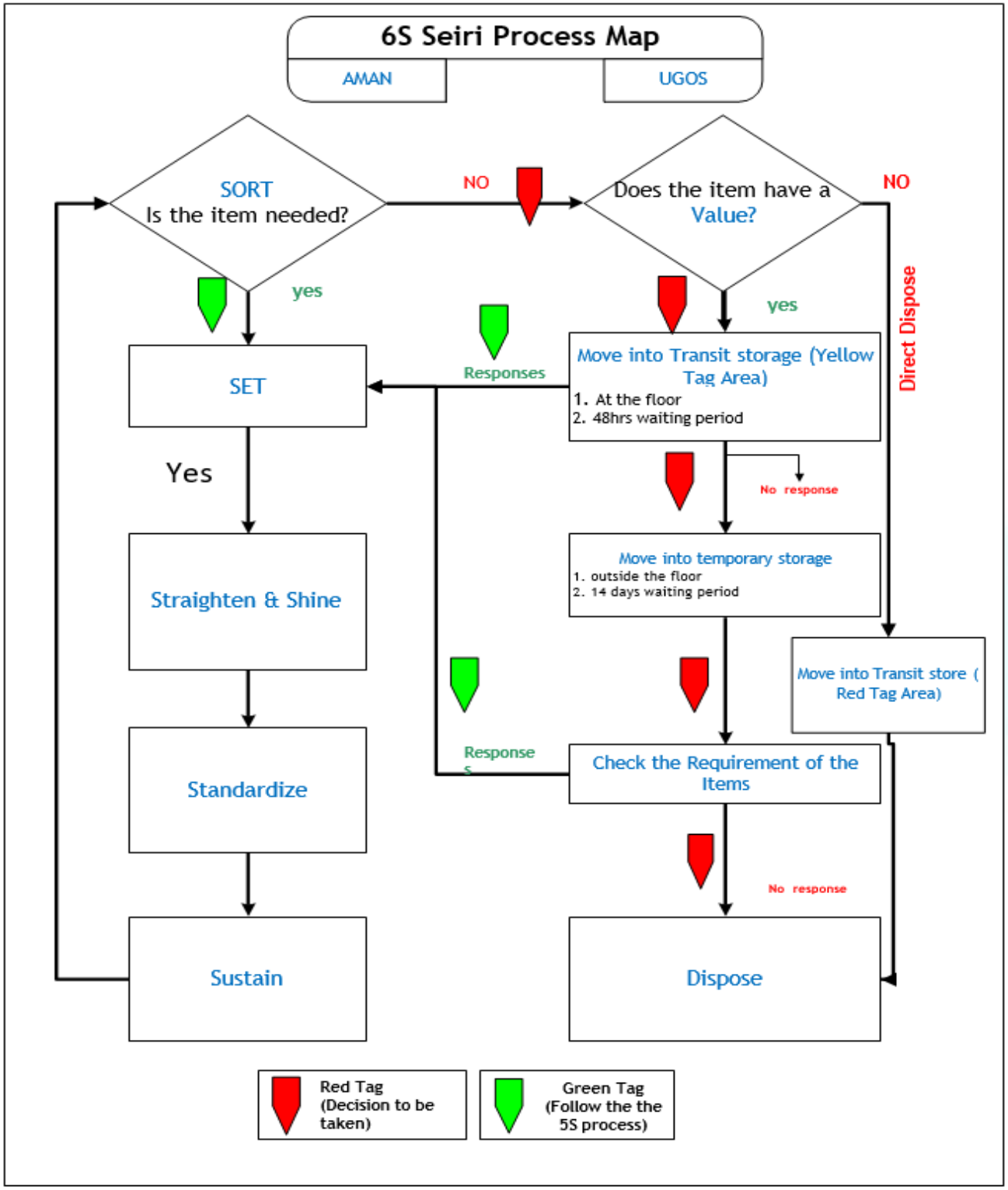


FIG: 3.2.2 Red Tag Area

Table: 3.2.2 PDCA Steps



3.2.2 LAB DEPARTMENT STANDARD

Work Station

- Only necessary items are available
- Everything on tables has a specific location
- Table top is cleaned without gum tape
- Everything is in its location
- Safe access to every item has been ensured
- Sufficient lighting & air ventilation mechanism is ensured
- Light Box for shade check should be clean & calibrated.
- Waiting for inspection fabric should be kept on plastic carpet

Tables, drawers & files

- Unnecessary items are not on the table
- No unnecessary items in drawers
- Everything has arranged accordingly
- Drawers are clean
- Locations are designated to each item using visuals)
- Drawers are maintained according to the standard)
- Safety is ensured in accessing drawers
- Files are storing on the rack
- All the files are numbering & visualize clearly
- All the required items are available in first aid box

Gangway

- Gangway and emergency exits
- Emergency exits are clearly identified using visual aids
- Gangway is clean and clear.
- Emergency exits are not blocked
- Fire extinguishers are available and clear indicated

Display boards

- Only necessary items are available in the display board
- Boards are updated
- Display board is fixed safely
- Display board can easily access
- Boards are clean & clear
- Always follow the 6s schedule

Team members

- Team members knowledge of 6s
- Attitude towards TM about 6s
- TM always use safety equipment & adapt on safety instruction
- Structured 6s mechanism in place
- TM are well follow 6s mechanism

a) Working Area

b) Work Place should be clean

C) Panel Shrinkages rack

d) Drawers

e) Working environment

f) First aid box

g) Well decorated rack

h). Light Box for shade check should be clean & calibrated

Fig: 3.2.2.1 6S Standard for Lab Department

3.2.3 RM STORE STANDARD

Work Stations

- Only necessary items are available
- Everything on tables has a specific location
- They are clean without gum tape
- Everything is in its location (
- Safe access to every item has been ensured.
- Sufficient lighting & air ventilation mechanism is ensuring

Material storage

- All the bins are numbered accordingly
- Store the material to issue easily
- Storing locations are clear & clean not using gam tape
- Red tag procedure is in place

Tables drawers & files

- Unnecessary items are not on the table
- unnecessary items in drawers)
- Everything has arranged accordingly
- Drawers are clean
- Locations are designated to each item using visuals
- Drawers are maintained according to the standard
- Safety is ensured in accessing drawers
- Files are storing on the rack
- All the files are numbering & visualize clearly
- All the required items are available in first aid box

Gangway

- Gangway and emergency exits
- Emergency exits are clearly identified using visual aids
- Gangway is clean and clear.
- Emergency exits are not blocked
- Fire extinguishers are available and clear indicated

Measuring equipment's

- Equipment Locate on the permanent demarcated place
- Equipment are clean
- All the equipment is calibrated
- SOP are available for its
- Store with safely
- Lifter machine is not blocked

Display boards

- Only necessary items are available in the display board
- Boards are updated
- Display board is fixed safely
- Display board can easily access
- Boards are clean & clear
- Always follow the 6s schedule

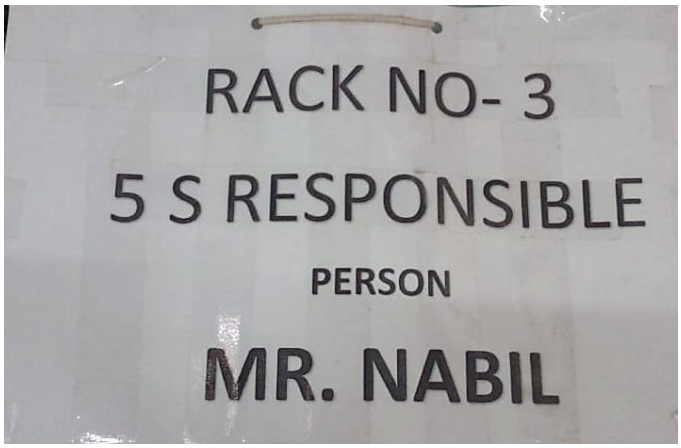
Team members

- Team members knowledge of 6s
- Attitude towards TM about 6s
- TM always use safety equipment & adapt on safety instruction
- Structured 6s mechanism in place
- TM are well following 6s mechanism

- **Working environment should be kept according to the below standard**

- **Rack number wise buyer allocation**

Appoint Responsible person for each location



Gangway clean & clear

Equipment should be calibrated

Fig: 3.2.3 6S Standard for RM Store

3.2.4 Cutting

Work Stations

- Only necessary items are available
- Everything on tables has a specific location.
- They are clean without gum tape
- Everything is in its location
- Safe access to every item has been ensured.
- Sufficient lighting & air ventilation mechanism is ensure

Material storage

- Only one docket available in addition to the running layers
- Min/Max levels available
- Follow the min/max level
- There is only running cutting bundles on the cutting table

Spreaders cutting machine

- All the machines are organize methodically
- All the machine are in running condition
- All the machines are clean & clear
- SOP are available for all machine
- Safety instruction are available on the machines
- Safety equipment are working properly
- TPM is functioning well

Gangway and emergency exits

- Emergency exits are clearly identified using visual aids
- Gangway is clean and clear.
- Emergency exits are not blocked.

- Fire extinguishers are available and clear indicated
- Fire safety and emergency Response
- Fire control equipment is easily accessible
- Drawers, walkways and evacuation exits kept clear
- An approved first aid kit is readily available and stocked appropriately

Display boards

- Only necessary items are available in the display board
- Boards are updated
- Display board is fixed safely
- Display board can easily access
- Boards are clean & clear
- Always follow the 6s schedule

Data records

- Data is display accurately
- Machine break down data is accurate

Team members

- Team members knowledge of 6s
- Attitude towards TM about 6s
- TM always use safety equipment & adapt on safety instruction
- Structured 6s mechanism in place
- TM are well follow 6s mechanism

Cutting Table top

Under the Cutting table

Cut work received area

Band knife m/c area

Cleaning Schedule

Location	Time	Duration
AMAN Graphics & Designs Ltd.	2 times (11:00 am - 11:04 am) & (04:00 pm - 04:04 pm)	4 Minutes
AMAN Knitting's Ltd.		4 Minutes

Use Hand Gloves

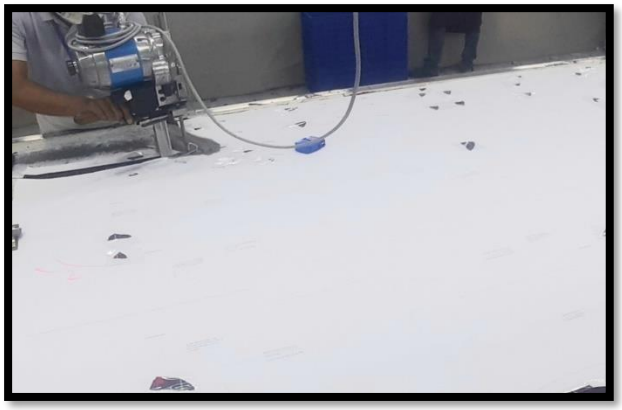


Fig: 3.2.4 6S Standard for Cutting Department

3.2.5 Production

Line in & out

- There are only maximum 3 basket use to keep cut piece at line in area
- Not storing elastic & thread exceeding required qty.
- Trolley should be kept in right position at line out area.

WIP

- WIP cannot exceed the one bundle quantity at one work station
- Only necessary items are in place of running style
- Needle & label Procedure
- Needle count should be accurate.
- Needle exchange area should be clean & clear
- Label locker is organized methodically
- Label files are maintained well
- Sewing machine
- Machine is clean & clear
- Machine wires are tied methodically
- Table tops are clean and clear no glue mark
- Under machine side should be cleaned.
- Measurements chart area is clean.
- Critical operation mockup should hang on the machine
- Rubber mat should use in m/c where needed
- There is a mechanism in place to avoided for contamination
- Needle Guard, Belt Guard, Eye guard fix for relevant machine
- Machine wheels are clean without thread

Examine table

- Measurement chart clean & clear
- Examine table is clean no gum mark
- Maximum 10 pcs store at the work place
- QC Table
- QC table is clean no gum mark
- There are no excess garments
- QC method is available

Visual Display

- Efficiency charts are updated
- SQDCM board should be updated
- Multiskilling chart update accordingly
- Iron, Heat-seal machine using manual should be available.
- SOPs are available

Production Floor

- Demarcated area should be cleaned
- In put & output are visualize
- Gangways are clean not blocked
- Tables, Chairs, Wires & air lines is cleaned
- Checking tables are in good condition
- There are no broken chairs
- Wires & air lines are tied methodically
- Rubber carpet is on the floor

Data records

- Hourly target monitoring system is there
- Machine break down file is update

- Production & Quality file is updated
- File standards should be maintained.
- Team leader file is completed
- Fire register is in place & mark

Trimmers, Scissors, Tool Bag

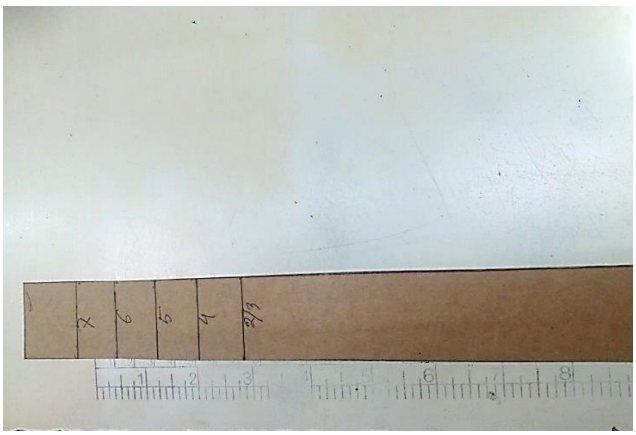
- Trimmers are numbering with tied
- Keep safe sharp materials
- Only necessary items available in the tool bag

Team members

- Team members knowledge of 6s
- Attitude towards TM about 6s
- All the Team members are wearing marks
- Scarf, over coat is wearing well
- TM always use safety equipment & adapt on safety instruction
- Structured 6s mechanism in place
- TM are well following 6s mechanism

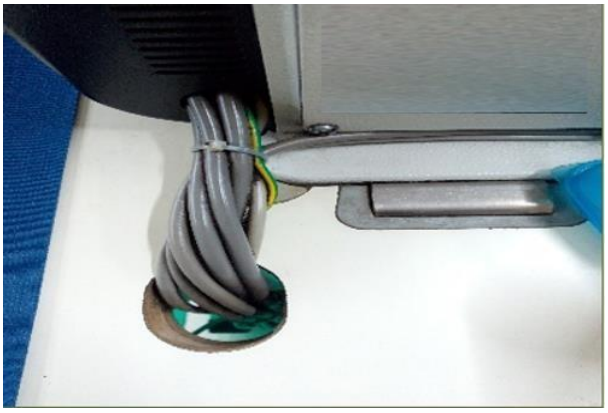
a). Trolley should be kept in right position

b). Measurements chart area is clean



c). Gangways are clean not blocked

d). Wires are tied



e). Clean machine table top

f). Rubber mat use in m/c, no thread in wheel

g) Line Demarcation

h) SQDCM

i) Eye Guard

j). Keep Safe Sharp Material

k). Use needle Guard

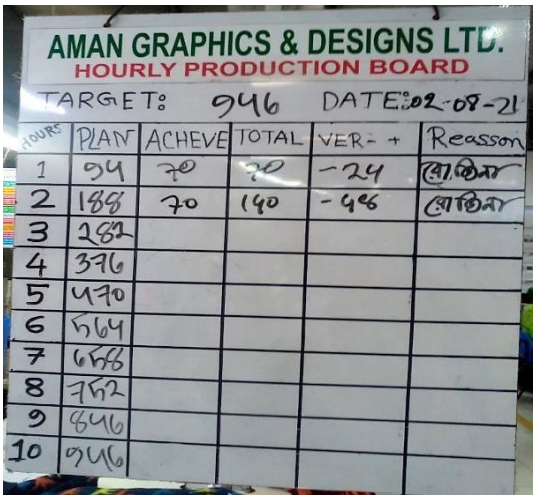
l). Under M/C is Clean

m). Use Rubber carpet

n). Machine is cleaned

o) LED task light should be available in every m/c

p). Hourly Production Board Updated



q). QC Table is cleaned

r). Well needle Exchange Area

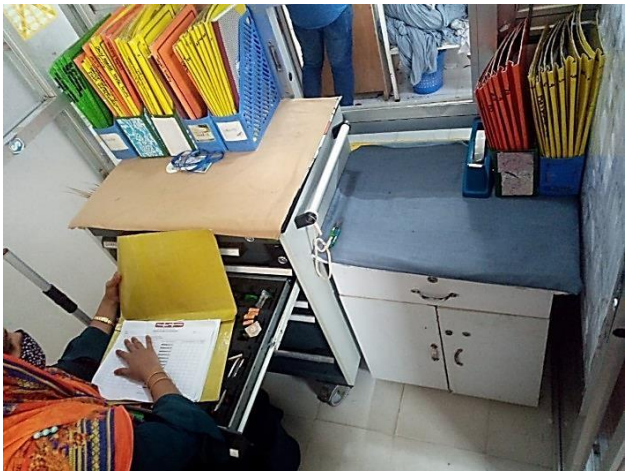


Fig: 3.2.5 6S Standard for Production

3.2.6 Auditing System

6S Standards | ৬ এস মানদন্ড

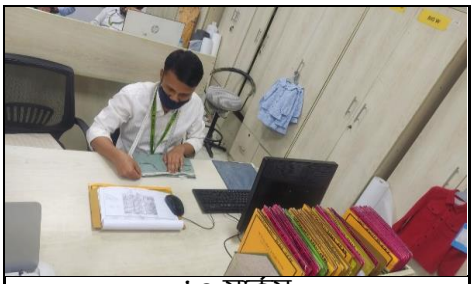
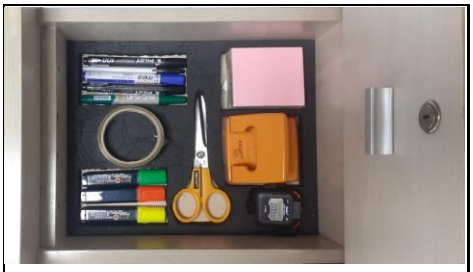
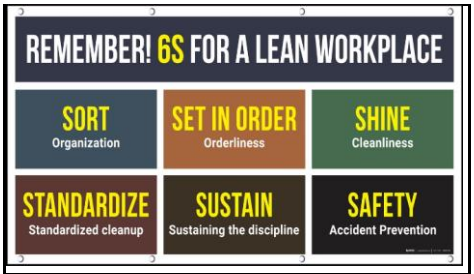
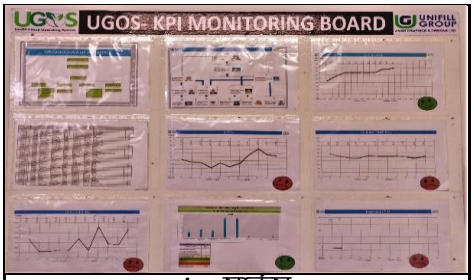
		
১০ মার্কস	১০ মার্কস	১০ মার্কস
অপ্রয়োজনীয় আইটেম আলমারিতে কখনোই রাখবোনা	কর্মক্ষেত্রে শুধুমাত্র প্রয়োজনীয় আইটেম গুলোই রাখবো । ময়লা, গাম মার্ক	ফাইলগুলো র‍্যাকে পদ্ধতিগতভাবে সাজিয়ে রাখবো
		
১০ মার্কস	১০ মার্কস	১০ মার্কস
প্রতিটি আইটেমের জন্য জায়গা নির্দিষ্ট করে দিবো	হাঁটা চলার পথ পরিষ্কার পরিচ্ছন্ন রাখবো	মেশিনের নিচে কোন ময়লা থাকবেনা
		
৫ মার্কস	৫ মার্কস	১০ মার্কস
আয়রনিং এরিয়াতে স্ট্যান্ডার্ড বজায় রাখতে হবে	ডিপার্টমেন্টে সবার ৬ এস সম্পর্কে ধারণা থাকতে হবে	ফ্লোর মার্কিং লাইন স্পষ্ট এবং পরিষ্কার থাকবে
		
১০ মার্কস	৫ মার্কস	৫ মার্কস
মেশিন (টি, পি, এম) স্ট্যান্ডার্ড বজায় রাখবো	মেশিনে সব রকম নিরাপত্তার উপাদান গুলো বজায় রাখবো	অনিরাপদ আইটেম গুলো নিরাপত্তার সাথে ব্যাবহার করবো

Fig: 3.2.6 6S Audit Card

Area wise auditor has been allocated & audited based on standard audit sheet weekly. After finishing the audit, marks has been published to the relevant group & issued the warning letter or reward once a month.If any problem found immediately taken initiative counter measure to solve the problem accordingly.

Table: 3.2.3 6S Score Departmentwise

Ultimate Goal = 100

Zone Color Code	Zone Tag	Department / Section	Leader	Wk-46		Wk-47				Wk-48				Wk-49			
				Prog	R	Ta	Ac	Prog	R	Ta	Ac	Prog	R	Ta	Ac	Prog	R
	Zone A	Fabric Lab	Mr. Badrul	-5	7th	90	85	10	4th	90	90	5	2nd	90	70	-20	
	Zone AA	Cutting + Embroidery + Fusing	Mr. Jahangir	15	8th	90	70	0	8th	90	60	-10	9th	90	65	5	
	Zone AAA	CAD	Mr. Rana	0	1st	90	95	0	1st	90	90	-5	2nd	90	95	5	
	Zone B	Finishing & Packing	Mr. Shamsul	0	3rd	90	85	0	4th	90	85	0	4th	90	85	0	
	Zone C	Sample Section	Mr. Shah Alam	-5	3rd	90	95	10	1st	90	95	0	1st	90	90	-5	
	Zone D1	Stores (Fabric)	Mr. Mahfuj	-5	9th	90	50	10	11th	90	55	5	10th	90		-55	
	Zone D2	Stores (Accessories)	Mr. Mahfuj	20	8th	90	70	0	8th	90	45	-25	11th	90	70	25	
	Zone E	Sewing Area	Mr. Amir	7.78	5th	90	73	-8.33	7th	90	72	-1.67	7th	90	72	0	
	E1	Shade - 01	Mr. Shohidul	5	3rd	90	85	0	4th	90	60	-25	9th	90	65	5	
	E2	Building Ground Floor Area	Mr. Shofiqul	10	6th	90	70	-10	8th	90	70	0	8th	90	70	0	
	E3	Building 1st to 3rd Floor Area	Mr. Hasan	0	3rd	90	80	-5	5th	90	85	5	4th	90	80	-5	
	E3.1	Building 1st Floor	Mr. Jahangir	10	3rd	90	65	-20	9th	90	85	20	4th	90	80	-5	
	E3.2	Building 2nd Floor	Mr. Anis	-5	3rd	90	90	5	3rd	90	80	-10	5th	90	80	0	
	E3.3	Building 3rd Floor	Mr. Alomgir	-5	3rd	90	85	0	4th	90	90	5	2nd	90	80	-10	
	E4	Shade - 04	Mr. Mostafa	10	8th	90	55	-15	10th	90	75	20	6th	90	75	0	
	E5	Shade - 05	Mr. Sohel	35	6th	90	75	-5	6th	90	70	-5	8th	90	70	0	
	E6	Shade - 06	Mr. Anowar	10	6th	90	75	-5	6th	90	75	0	6th	90	75	0	
	Zone F	Production Accounts	Mr. Rupom	5	7th	90	75	0	6th	90	75	0	6th	90	70	-5	
	Zone G	HR & Admin (Head Office)	Mrs. Lucky	0	3rd	90	85	0	4th	90	85	0	4th	90	90	5	
	Zone G1	HR (Factory Office)	Mr. Mainul	0	2nd	90	90	0	3rd	90	90	0	2nd	90	90	0	
	Zone H	Head Office Area	HOD's	-4.57	4th	90	91	6.71	2nd	90	87	-3.57	3rd	90	87	-0.27	
	H1	Accounts	Mr. Huda	-90		90	90	90	3rd	90	90	0	2nd	90	90	0	
	H2	Commercial	Mr. Raich	-90		90	90	90	3rd	90	80	-10	5th	90	90	10	
	H3	Budget	Mr. Iftekhar	-90		90	90	90	3rd	90	90	0	2nd	90	90	0	
	H4	IT & ERP	Mr. Mosarraf	0	6th	90	90	10	3rd	90	80	-10	5th	90	80	0	
	H5	Sourcing	Mr. Belal	-10	6th	90	90	10	3rd	90	90	0	2nd	90	90	0	
	H6	Planning	Mr. Kamrul	0	2nd	90	90	0	3rd	90	90	0	2nd	90	90	0	
	Zone I	Maintenance	Mr. Malek	0	7th	90	50	-25	11th	90	75	25	6th	90	75	0	
	Zone J	Merchandising (AGDL)	Mr. Jafor	5	1st	90	95	0	1st	90	90	-5	2nd	90	90	0	
	Average						80.31				79.44				80.48		

3.3 Human Value Stream

b) The purpose is to create a strong pipeline to attract develop & retain people within the organization. HVS has 4 pillar-

c) **Attract:** Funnel ratio, interview timing, strengthening attraction channels, observing new recruitment, retention rate

d) **Develop**: Employee Development, Training Center,A3 planning, Skill matrix training, COPA training, Documentation skill, Email writing skill, Planning & monitoring mechanism, coordinating skill, Gap finding & Evaluation

e) **Engage:** Problem solving Knowledge & Monitoring mechanism, 6S, Implementation, Kaizen, Grievances, Train the trainers, suggestion

f) **Inspire:** Retention, Reward, Recognition, Promotion, Cultural Program

Fig: 3.3 Lean House

Lean Failure reason: Lean house is built with different tools & rules. To run the rules & implementation of tools highly motivated people is the first priority. HVS is related to human development where's the key factor is indicated.

Table: 3.3 4 Pillar KPI & Activity at a glance:

Pillar name	Responsible Person	Job Role	Competencies	Current Competencies	KPI	KPI Hitrate	Standadization Hit rate
1. Attract Pillar	Rabiul karim(HRD) -Leader	1. Manpower budgeting	1. Knowledge of Capacity	Expert	1. Funnel ratio	36%(Nov-22)	40%
		2. Understanding required skill level	2.1. Knowledge of Capacity	Expert	2. Interview timing	2.89(Nove-22)	4-Hrs
			2.2. Knowledge of TM Skill	Expert	3. strengthening attraction channels	80%	100%
		3. Requirement wise advertisement channel/media selection	3.1. Market & Zone Review Knowledge	Expert	4. observing new recruitment retention rate	87%	100%
		4. Document & Skill(Soft /Technical) varification	4.1. Knowledge of Labour law & Company policy	Expert			
			4.2. Knowledge of TM Skill	Expert			
		5. Right candidate selection	5.1. Recruitement experience	Expert			
2. Development Pillar	Mainul Hasan(HRD) -Leader	1. Competency & Skill matrix preparation & Gap identification	1.1. Knowledge of skill matrix/ competency	Expert(JIT,Yellow belt,TL-GL,Helper to operator,MTO)	1. Employee Development KPI	15%	20%
		2. Training plan preparation & Follow Up	2.2. Planning & monitoring mechanism	Yet to Judge			
		3. Training School Follow up	3.1. Planning & monitoring mechanism	Expert	Training Center A3 KPI	Actual CT-77% Actual FTT-85% Retentation-73%	CT-85% FTT-98% Retentation-100%
		4. Ensure department wise JI trainer	4.1. Knowledge of JI Training	Expert			
			4.2. Co-ordinating Skill	Intermediate			
		5. Follow up training as per trainig plan with proper training materials	5.1. Co-ordinating Skill	Intermediate			
		6. Training Document & KPI Hitrate preservation	6.1 Documentation Skill	Intermediate			
3. Engage Pillar	Shahanaz Parvin(HRD)-Leader	1. Follow up department wise PS status	1.1. PS Knowledge & Monitoring mechanism	Foundation	1. Kaizen/ Suggesion	75%	100%
		2. Follow up department wise 6s status	2.1. Knowledge of 6s & monitoring mechanism	Expert	2. 6s	80%	90%
		3. Follow up department wise Kaizen status	3.1. Knowledge of Kaizen & monitoring mechanism	Intermediate	3. Problem Solving	50%	100%
		4. Follow up department wise Grievence Mechanism Status	4.1. Knowledge of grievence mechanism & monitoring mechanism	Intermediate	4. Grievence Mechanism	60%	100%
		5. Provide training if needed	5.1. TOT(Training of Trainers)	Intermediate			
4. Inspire Pillar	Md. Abdullah Shoman (HRD)-Leader	1. Follow up department wise Retention rate status	1.1. Monitoting Mechanism	Intermediate	1. Retention Rate	77.89%	90%
			1.2. Knowledge of excel	Intermediate	2. Reward(Verbal or moaeytory)	200	N/A
		2. Follow up department wise Reward(Verbal or moaeytory) status	1.1. Monitoting Mechanism	Intermediate	3.Recognition, Promotion		N/A
			1.2. Knowledge of excel	Intermediate			
		3. Follow up department wise Recognition, Promotion status	1.1. Monitoting Mechanism	Intermediate			
			1.2. Knowledge of excel	Intermediate			
		4. Arranging reward recognition ceremony	4.1. Knowledge of event management	Expert			

3.3.1Attract Pillar

g) Recruitment process has some important step to complete for newly hired employee. For operator & stuff has different process of Recruitment. Below process shows operator recruitment process-

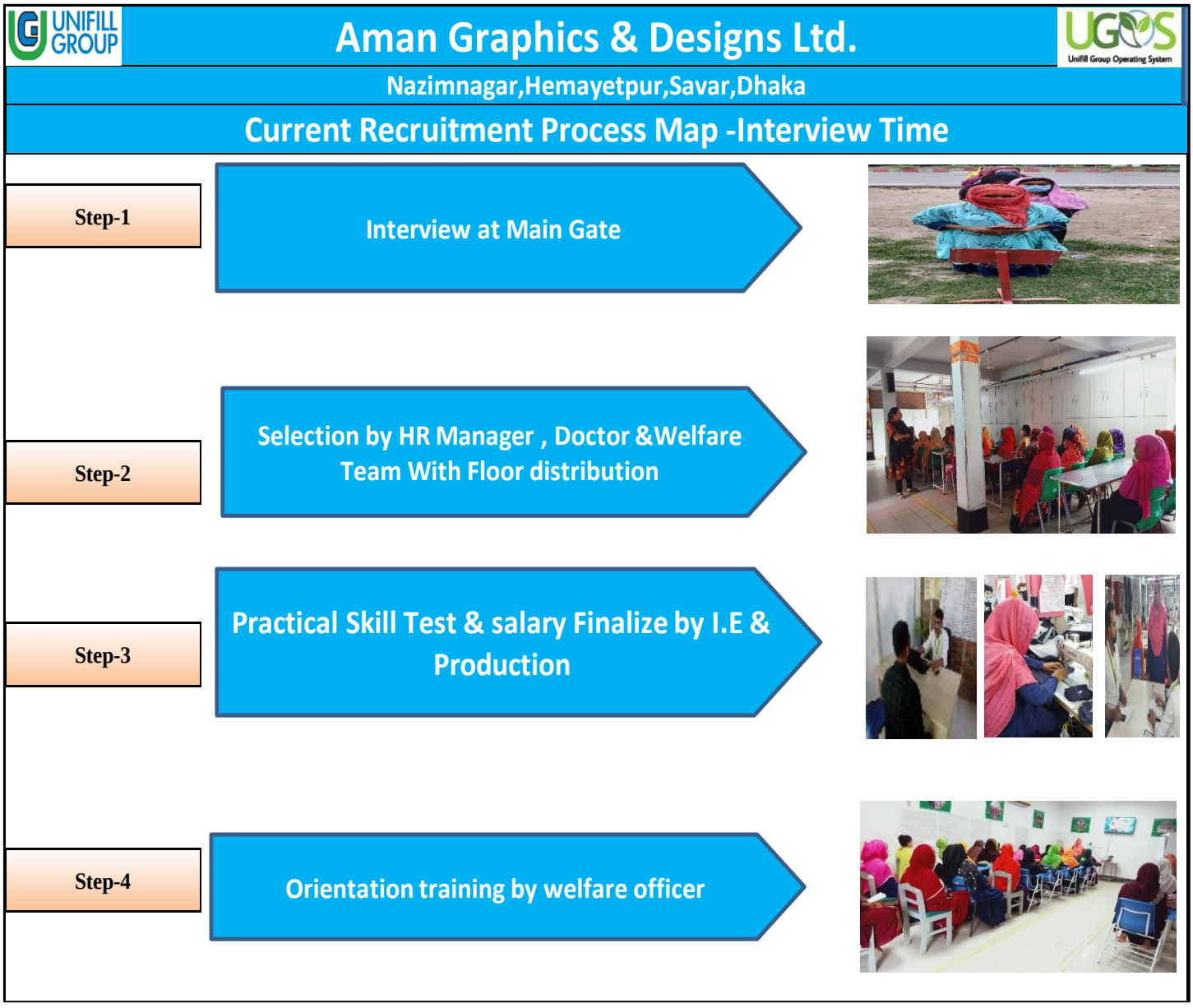
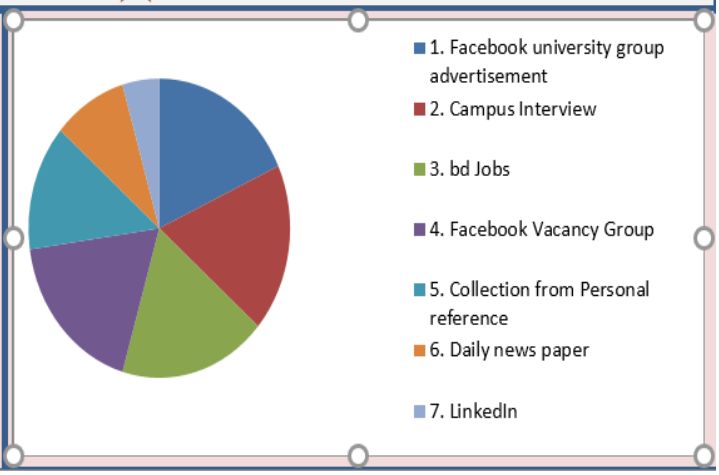


Fig: 3.3.1 Recruitment Process

h) For stuff recruitment there is some process which is different than operator selection.

Table: 3.3.1 Recruitment Process

Recruitment Channels	
1. Facebook university group advertisement	100%
2. Campus Interview	100%
3. bd Jobs	100%
4. Facebook Vacancy Group	100%
5. Collection from Personal reference	75%
6. Daily news paper	50%
7. LinkedIn	25%



i) There are two step of recruitment process for candidate,

j) 1. Internal Channel-Factorial existence employee reference by justifying well known skilled person

k) 2. External Channel-Social link, Pages, Newspaper, Bd jobs, Campus Interview etc.

3.3.2 Development Pillar

l) Development pillar refers different critical path of competencies & skill level to identify the gap & standardization by powerful training method with proper plan.

m) Team leader-Group leader project is the major for developing people within the organization. Beside that multi-skill, skill matrix, COPA analysis training has been given in AMAN monthly basis group wise.

TL-GL:

n) Purpose is creating a possessive working culture that would ensure Team Members to solve problems at the rate of production which enables them to work according to the STW'

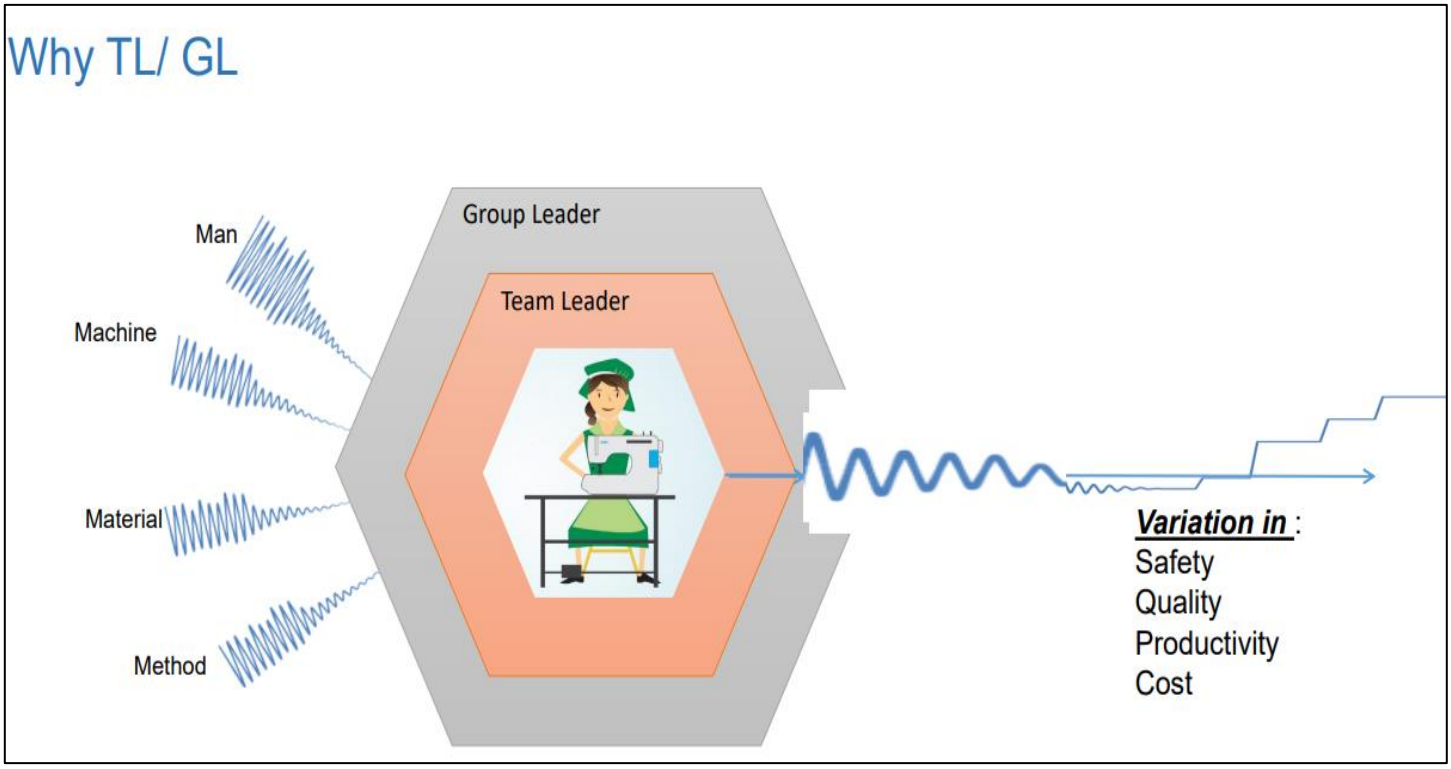


Fig: 3.3.2 TL-GL Requirement

Job Role of TM,TL & GL

Team Member: "Create / Add Value to the Product (Change form, fit or function) by performing Standardized Work"

1. Create / Add Value to the Product (Change form, fit or function) by performing STW.
2. Identify Waste & make Team Leader aware of it.
3. Help TL and GL for problem solving by data capturing & feedback.
4. Alert Team Leader to abnormality.

Team Leader Handle abnormal situations in the process to keep the TMs on the task for making the products"

1. Respond to and address abnormalities in the process.
2. Perform systematic problem solving.
3. Cover-up for absenteeism in the module.
4. Help write and update Standardized Work (With input from the Team Members).
5. Train Team Members on Standardized Work using Job Instruction Training.
6. Monitor process performance against the targets & goals established.

Group Leader: Is the primary business owner" of his or her group. They are responsible for running their group's day-today operation as well as guiding the group to help achieve overall group objectives."

1. Set Group Targets and Goals in alignment with shop's Targets and Goals. Work with Team Leader in achieving those.
2. Support TL in handling abnormalities.
3. Perform Problem solving using a systematic approach.
4. Work with other processes in the value stream.
5. Confirm quality by ensuring adherence to standardized work.
6. Coach & develop team leaders using;

•Real-time problem solving

•Leadership Skills

7. Involve in workload balancing by using Yamazumi.
8. Serve as first line of Human Relations.

KPI/Leading Indicators:

- Efficiency
- FTT (Rejects / Repairs)
- Incentive
- ETO
- Authorized Leave %
- Numbers of change overs (Repeat & New)
- Productivity Per head Key Performer Indicates /

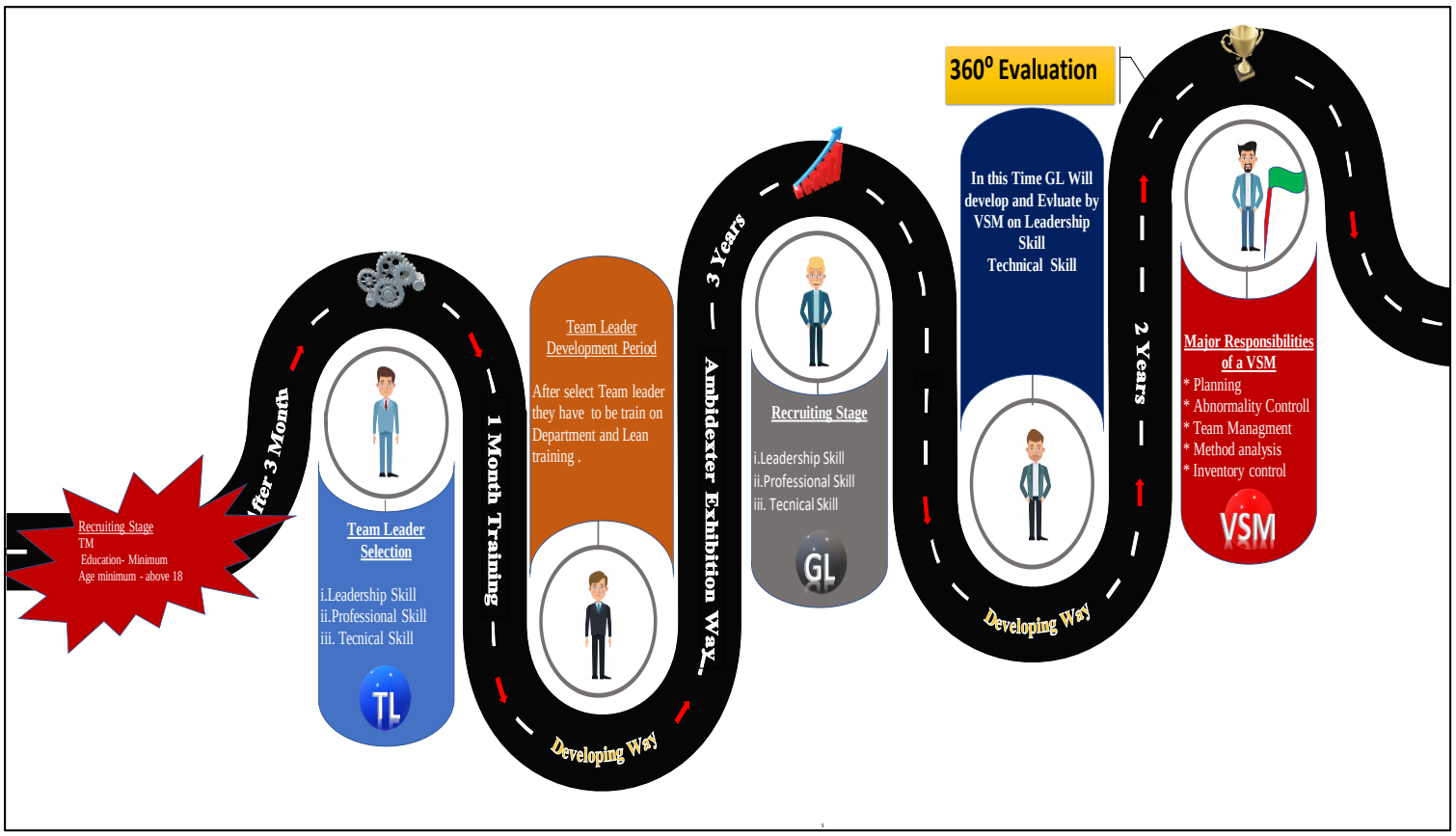


Fig: 3.3.3 TL-GL Road Map

Selection: By verifying minimum qualification as SSC to above TL-GL has been selected from different section to train on certain topics & their implementation.

Table: 3.3.2 Team Leader List

Team Leader List

S/L	Line	ID	Name	Education level	Date of Join
1	2	0715146	Shuili Akter	S.S.C	15-Nov-21
2	3	0715776	Rehana Akter	H.S.C	8-Feb-22
3	CPU	0715591	Moushumi Akter	H.S.C	16-Jan-22
4	CPU	716125	Sharmin	BSS	12-Mar-22
5	6	0715611	Belly	S.S.C	18-Jan-22
6	7	0715859	Reba Khatun	S.S.C	13-Feb-22
7	CPU	0715531	Sarmin Akter	SSC	10-Jan-22
8	CPU	716018	Bulbuli	H.S.C	#N/A
9	CPU	0716017	Sumi	H.S.C	2-Mar-22
10	Padma	0802433	Runa Laila	S.S.C	2-Aug-21
11	CPU	0802365	Mukta Akter	S.S.C	6-Apr-21
12	Sample	302273	Jahidul	S.S.C	5th jan 19
13	Sample	302353	Azad	S.S.C	7-Sep-20

Well skilled trainer train them by a syllabus of yellow belt topics maintaining a scheduling of 40 days. After completion of training period evaluation has been done by a written test.

Fig: 3.3.4 Team Leader Examination

Key factors to be monitor:

1. TL and above every member must be able to conduct systematic problem solving (5Why & 8 Step)
2. During recruiting stage need to recruit 20% to 30% of Team Members with high literacy level, to fit as TL & GL.
3. TL & GL must be develop within. (TM --> TL --> GL)
4. Sewing Skill is mandatory for TL & GL.
5. All Team members should be aware about 7 waste (TIMWOOD).
6. Andon system for each module with data capturing method (Down Time Hrs./Reason/Process).
7. Measure the offline % of the TL's.
8. CCTV application to understand the TL's offline & online %.
9. Current Individual machine data capturing method.
10. End of module should have the KPI display.
11. TL GL Concept for entire vale chain. Implementation should Happened simultaneously.
12. Operate without jumpers by improving skill and work load balancing.

3.3.2 Engage Pillar

Problem Solving:

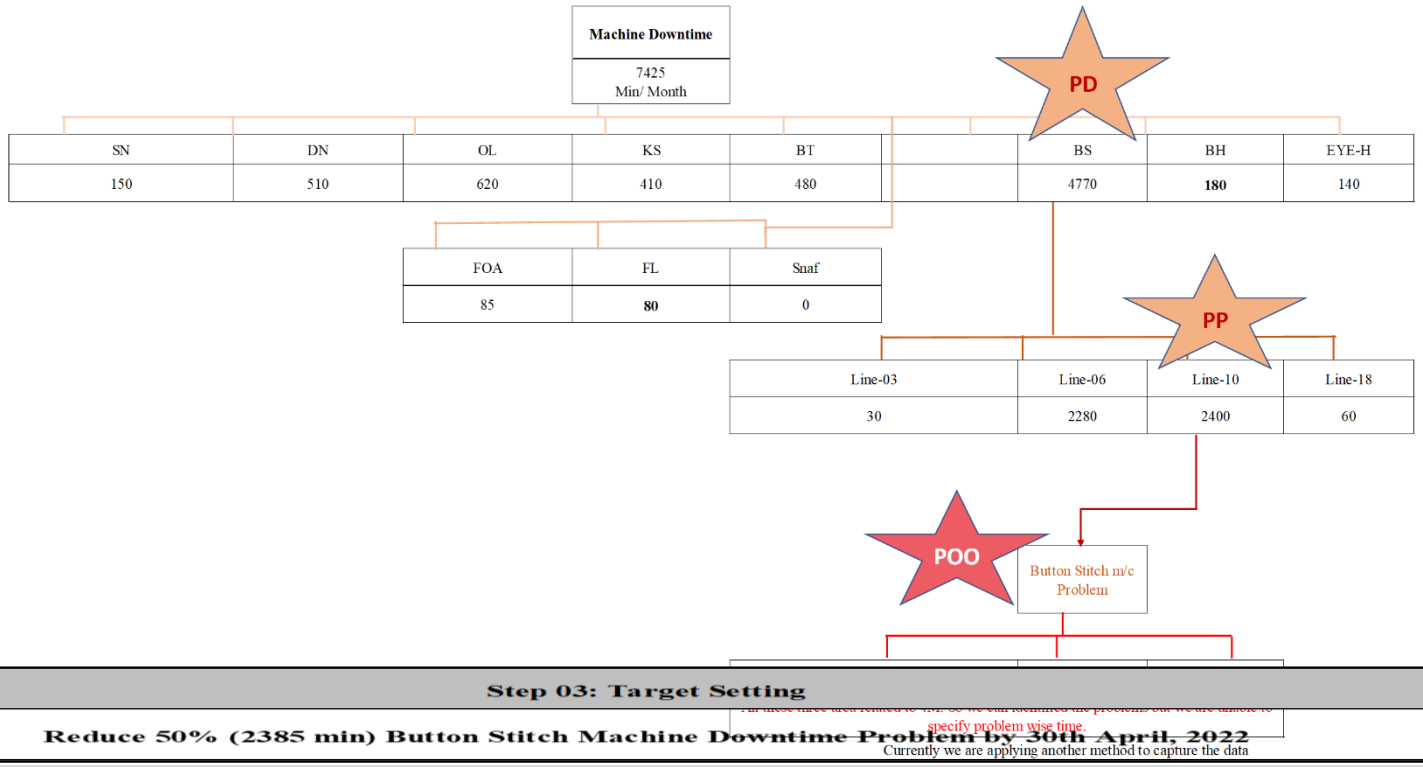
Most repetitive major problem that is occurred which hampering the regular work flow can be solved from the root level using 8 step systematic problem solving tool. For small problem 5 why, fishbone or brainstorm can be used to solve.

8 step problem solving

Step 01: Clarify the Problem

Ultimate goal:	**Provide right quality with right quantity product to the Customer**
Standard:	**3780 Min/ Month**
Current Status:	**7425 Min/ Month**
GAP:	**3545 Min/ Month**

Step 02: Breakdown the Problem

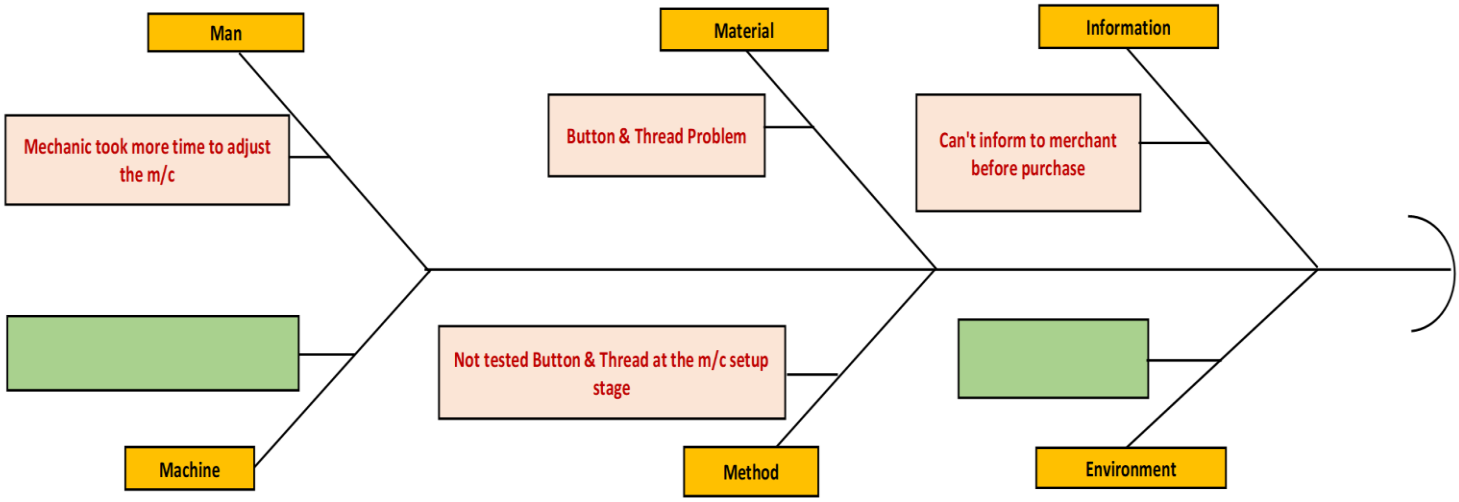


Step 03: Target Setting

Reduce 50% (2385 min) Button Stitch Machine Downtime Problem by 30th April, 2022

Step 04: Analyse the root cause

Fishbone



5 WHY	
Why 1	Button Stitch machine breakdown
Why 2	Needle broken
Why 3	Needle touch on the button
Why 4	Different size of 4 hole in button
Why 5	Receive bad quality of button
Why 6	No checking standard for button test @ RM

Step 05: Develop Countermeasures

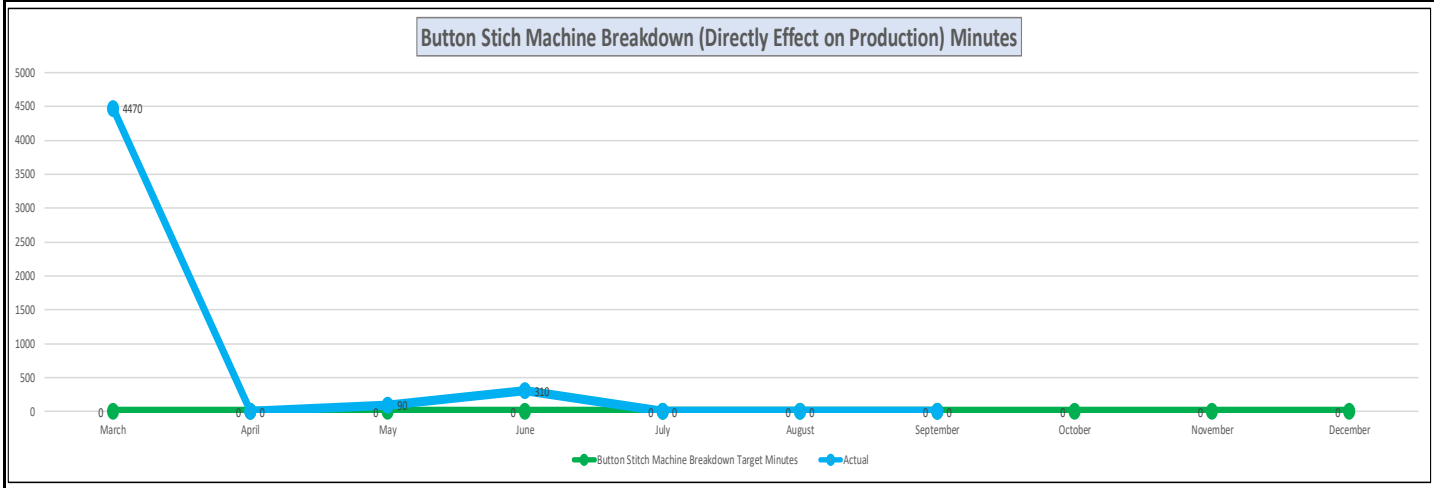
Factors / Options	Expected Effort	Cost / Man Hrs	Technical Difficulty	Quality Problem	Safety Problem	Workability	Impact to Other Process	Overall Judgment
1. Make SOP to check accessories with the sample of actual fabric before purchase	✗	△	△	○	○	○	△	△
2. Special machine setting should be ready with actual sample	✗	△	△	○	○	△	△	△
3. Material related any difficulty should identify at sample stage from the line	✗	✗	△	○	○	△	△	△

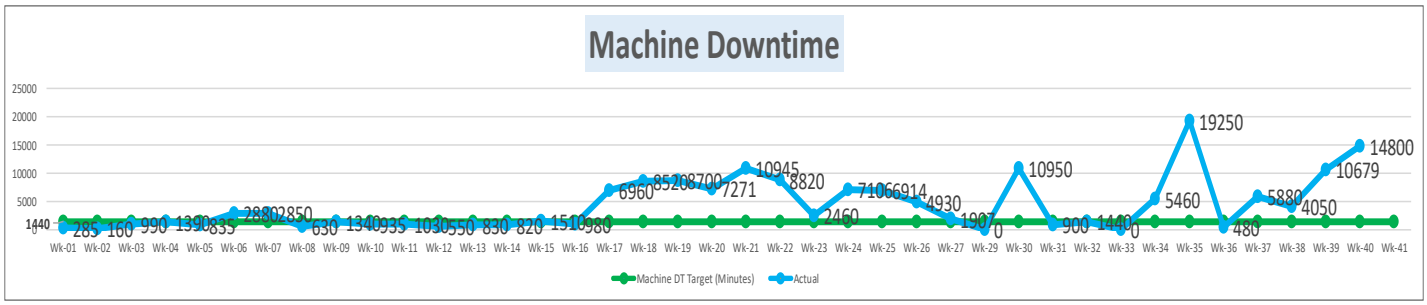
○ Good
✗ Not Good
△ Acceptable

Step 06: See Countermeasures Through								
SL	What	Who	When					
			Wk-38	Wk-39	Wk-40	Wk-41	Wk-42	Wk-43
1.1.	Discuss with related HOD about the actual scenario	Mr. Tuhin						
1.2.	Make SOP for purchasing the thread & accessories	Mr. Tuhin						
2.1.	Need to identify special machine availability for ready with actual sample before 3 days of line feeding	Mr. Kamrul						
2.2.	Make SOP to ready machine before 3 days with the actual sample & accessories	Mr. Tuhin						
3.1.	TL should stitch the sample	All PM						
3.2.	PP meeting should be done 3 days before the line feeding with all staff from the line	Mr. Rabiul						
4	Prepare standard downtime monitoring data base.	Mr. Tuhin						
5	Monitoring every mechanic on daily basis	A. Malek						
6	Work on skill enhancing program for mechanic	A. Malek						

Target Not Done On Going

Step 07: Monitor Both the Process & Results





Step 08: Standardize Successful Processes

Kaizen Event: The term "kaizen" (Japanese for "improvement" or "change for the better"), which combines the words "kai" (for "change" or "to correct") and "zen" (for "good"), refers to a philosophy or set of practices that emphasizes the continuous improvement of processes in business management, engineering, and manufacturing. 3Ms's Kaizen aims for improvement

Avoid all wastage, according to Muda. Muri: - Stress (leading to inefficiency; avoid stress, work more intelligently) Mura: - Discrepancies / Errors (prevent discrepancies)

The Kaizen system involves everyone, from senior management to the cleaning crew. Kaizen is an ongoing process with objectives beyond merely increasing productivity. When done appropriately, it also teaches people how to succeed, lowers overly difficult duties (muri), and humanizes the workplace. Using the scientific method, they conduct tests to understand how to identify and get rid of waste in company operations. All told, the procedure points to a humanized method of treating employees and boosting output: "The objective is to nurture the company's human resources as much as it is to applaud and promote involvement in kaizen initiatives.

Key features of Kaizen:

Instead of the potentially radical changes that could result from research and development, improvements are built on several tiny adjustments. The ideas are less likely to be drastically different because they are generated by the employees themselves, making them simpler to implement. Compared to significant process modifications, small enhancements are more likely to only require minor capital expenditure. Instead of requiring expensive R&D, consultants, or technology, ideas are generated by the skills of the current workforce. Every employee should be looking for ways to consistently elevate their own performance. It can strengthen teamwork and inspire employees to take responsibility for their work, which will increase employee motivation..

Successful implementation

The "participation of workers in the improvement" is necessary. Kaizen involves involvement from all organizational levels. Everyone is urged to regularly offer tiny suggestions for improvement. Kaizen is based on making small, frequent adjustments that constantly increase efficiency, safety, and effectiveness while decreasing waste. It might be anything, from cutting waste reduction to the amount of light at the machine's needle point.

Every little adjustment can make a difference in the factory's working conditions, quality, safety, and working environment. Kaizen describes management's function in continuously promoting and enacting minor changes that involve everyone. Therefore, Kaizen won't start if management isn't prepared to set a good example.

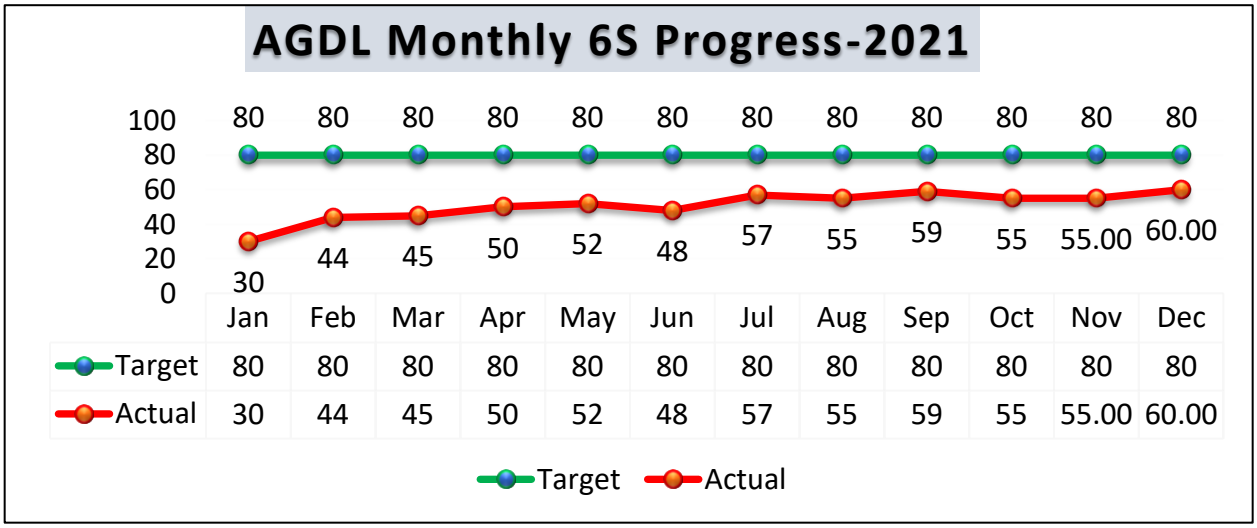
It will help, for instance, if a manager spends a week working with staff members on the shop floor to assist and motivate them to generate proposals. Additionally, that manager ought to make sure suggestions from staff members are promptly implemented. The time to implement suggestions is now, not next week or next month. A suggestion made in the morning may occasionally be executed that afternoon or even earlier. Inform the staff of the progress made with their suggestions.

Chapter 4

RESULT & DISCUSSION

4.1 Process Excellence outcome scenario of AMAN Graphics & Design Ltd:

I have practically worked in the following industries parallel to the training period. At the beginning the way of work was conventional where there was so much opportunity loss area. In my team we are total 14 in number. Different person is allocated for different LEAN project to implement. For some area two or three person was allocated. By maintaining sequence our project result has been given below;



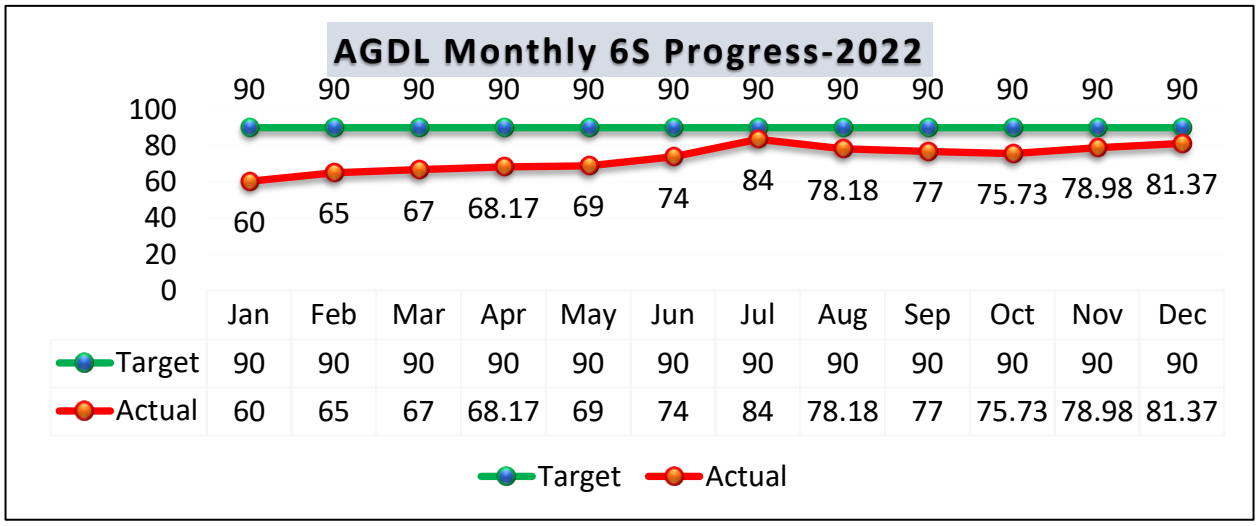


Fig: 4.1 Yearly Comparison of AGDL 6S score Graph

First of all 6S & Visualization project started to every department. We have found the workstation not organized due to some reason code. In the begging year of 2021 the result was below average. Most of the documents was in the desktop unorganized, no summary at a glance was there.

4.2 Key Performance Indicator Board:

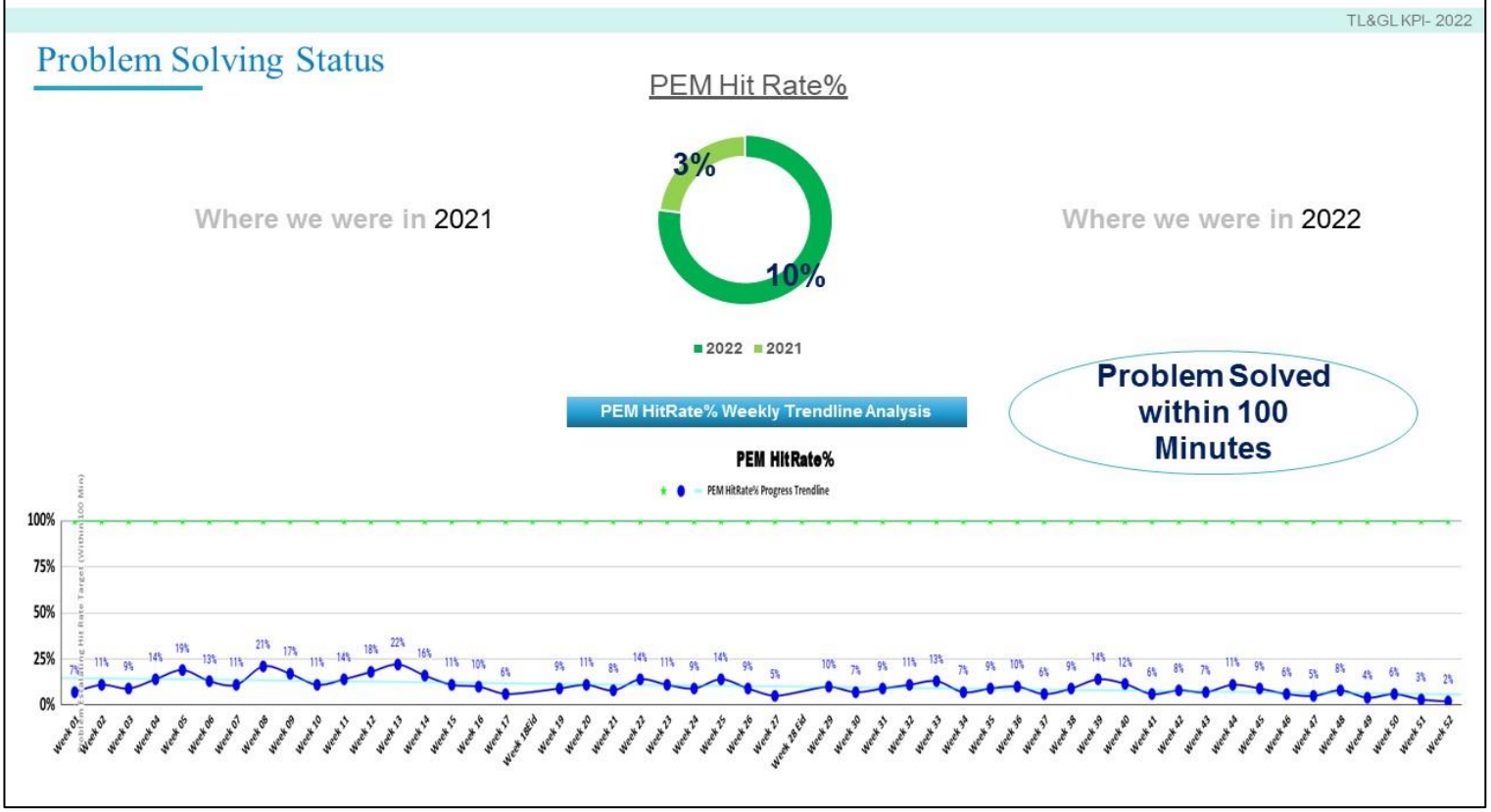
Fig: 4.2 KPI Board

Daily/Weekly basis monitoring target has fixed by project champion by sitting with the management then target vs actual with reason code refers the problem related to the KPI. Some problem can be solved immediately & some repetitive problem need to solve using systematic problem solving method.

Table: 4.2 Factorial Overall KPI

AGDL KPI-2022														
KPI	Target	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
Efficiency	75%	52%	55%	59%	61%	65%	67%	65%	75%	72%	71%	69%	66%	65%
No of Changes	100	133	121	118	84	77	100	82	95	93	129	87	106	102.083333
Ramp up Eff	65%	41%	46%	51%	49%	56%	56%	49%	62%	59%	60%	60%	55%	54%
Ramp Down Eff	65%	36%	43%	46%	46%	48%	50%	56%	67%	69%	65%	63%	59%	54%
Pcs Achieve	1000000	977967	869111	1031547	869105	872467	1102972	830353	1128441	848925	849176	929648	959465	939098
Head Count(Sewing)		2308	2467	2407	2394	2378	2353	2327	2403	2415	2405	2378	2326	2380
Head Count(Total)		4241	4478	4508	4479	4510	4511	4525	4627	4575	4573	4526	4405	4497
Productivity per Head	185	231	194	229	194	193	245	184	244	186	186	205	218	208.95
Sewing FTT%	96%	96%	96%	96%	96%	97%	96%	97%	97%	97%	96%	96%	96%	96%
No of Reject Gmt	3500	5202	5180	5809	4985	5452	4936	4909	5889	5450	5072	5602	5642	5344
In Coming Material Hitrate	85%	89%	85%	83%	85%	89%	86%	87%	67%	69%	67%	84%	93%	82%
Shiping DIFOT	100%	79%	81%	82%	80%	84%	86%	89%	86%	87%	83%	88%	86%	84%
Ship Qty	12000000	869165	860426	1225645	810407	770304	1029445	859521	1108574	1074062	691803	766836	1012546	923228
No of OT Hrs(Sewing)/Cost	0%	7476460	3313911	6029378	1529934	2931759	1728073	413678	1109902	0	1882065	1293678	777177	2373835
Abseentism	2%	2.5%	2.5%	2.4%	1.5%	2.5%	1.8%	2.9%	1.9%	3.5%	2.3%	2.6%	2.0%	2.37%
ETO	1%	6.1%	3.7%	5.0%	2.6%	5.6%	5.2%	6.5%	6.8%	3.2%	5.7%	5.0%	4.5%	5%

4.3Efficiency Comparison YTD



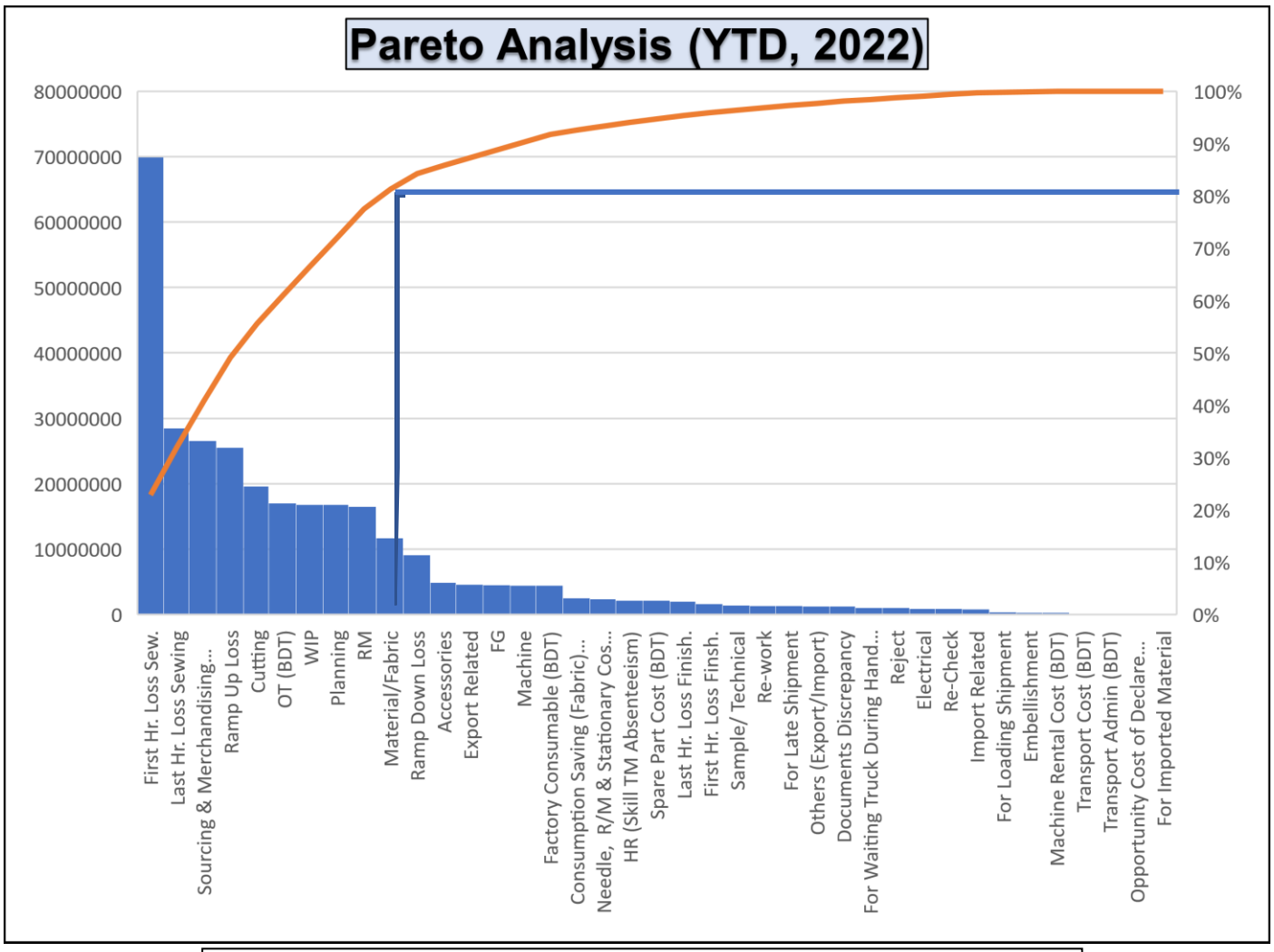


Fig: 4.3 Pareto Analysis of Production loss analysis

4.4 OPPORTUNITY LOSS AREA

Fig: 4.4 Factorial efficiency & PS rate Data

In the beginning have started so visualize the problem one by one using the lean concept. A massive number of wastage has been found. Every monthly review meeting was so much effective as there is a clear visualization & problem reason code. After identifying all the problems systematic problem solving tools help us to overcome the situation. To perform with all for improvement we basically used-

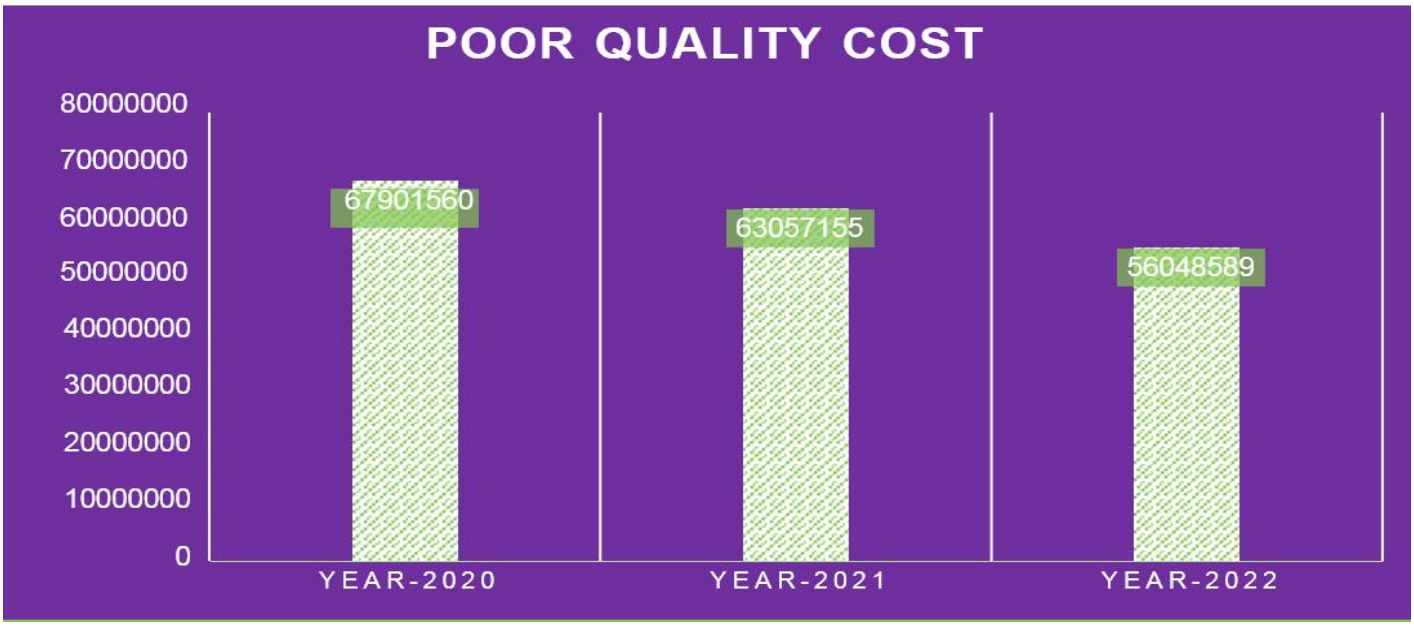
Sl NO.	What Is Needed For Improvement	TQM Tools
1	Know the sequential steps at details. For Example, Operation Name, M/C Name, SMV , Material Parts etc	**Flow Chart**
2	As we are trying to improve, so we need to know the frequency of problem (e.g. No of Defect, Absenteeism, Machine Breakdown etc.)	**Check Sheet**
3	Is there any factors that can change performance (e.g. Auto M/C vs. Manual M/C, Skill, shifts etc.)	**Scatter Diagram**
4	Input: Check Sheet. To Categorize each problem in terms of frequency (e.g. For defect: No of oil spot, broken stitch, puckering)	**Histogram**
5	80-20 Rule. Pareto chart is used to identify the limited number of tasks (20%) that produce significant (80%) overall effect/problem.	**Pareto Charts**
6	Cause And Effect (CE)Diagram: To Identify Root Causes	**Cause And Effect Diagram**
7	Is running System is okay or not?	**Control Charts**

A Pareto chart contains both bars and a line graph. The lengths of the bars represent frequency or cost (time or money), and are arranged with longest bars on the left and the shortest to the right. The cumulative total is represented by the line. This is a simple statistical chart, also known as Pareto diagram, but very useful in quality control. Alfredo Pareto was an economist who noted that a few people controlled most of a nation's wealth. "Pareto's Law" has also been applied to many other areas, like materials management, quality control etc. In quality control-where a few causes are responsible for most of the problems.

When to Use

- ✓ When analyzing data about the frequency of problems or causes in a process.
- ✓ When there are many problems or causes and you want to focus on the most significant.
- ✓ When communicating with others about your data.

4.5 Built In Quality Related Improvement



Poor Quality Cost Breakdown

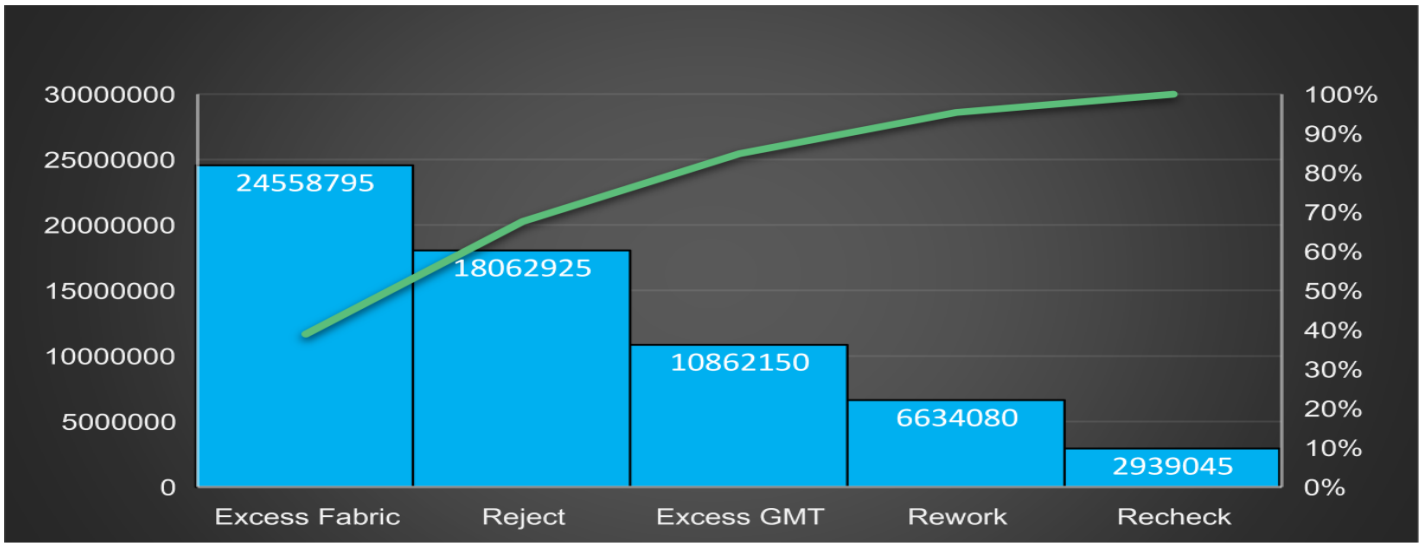
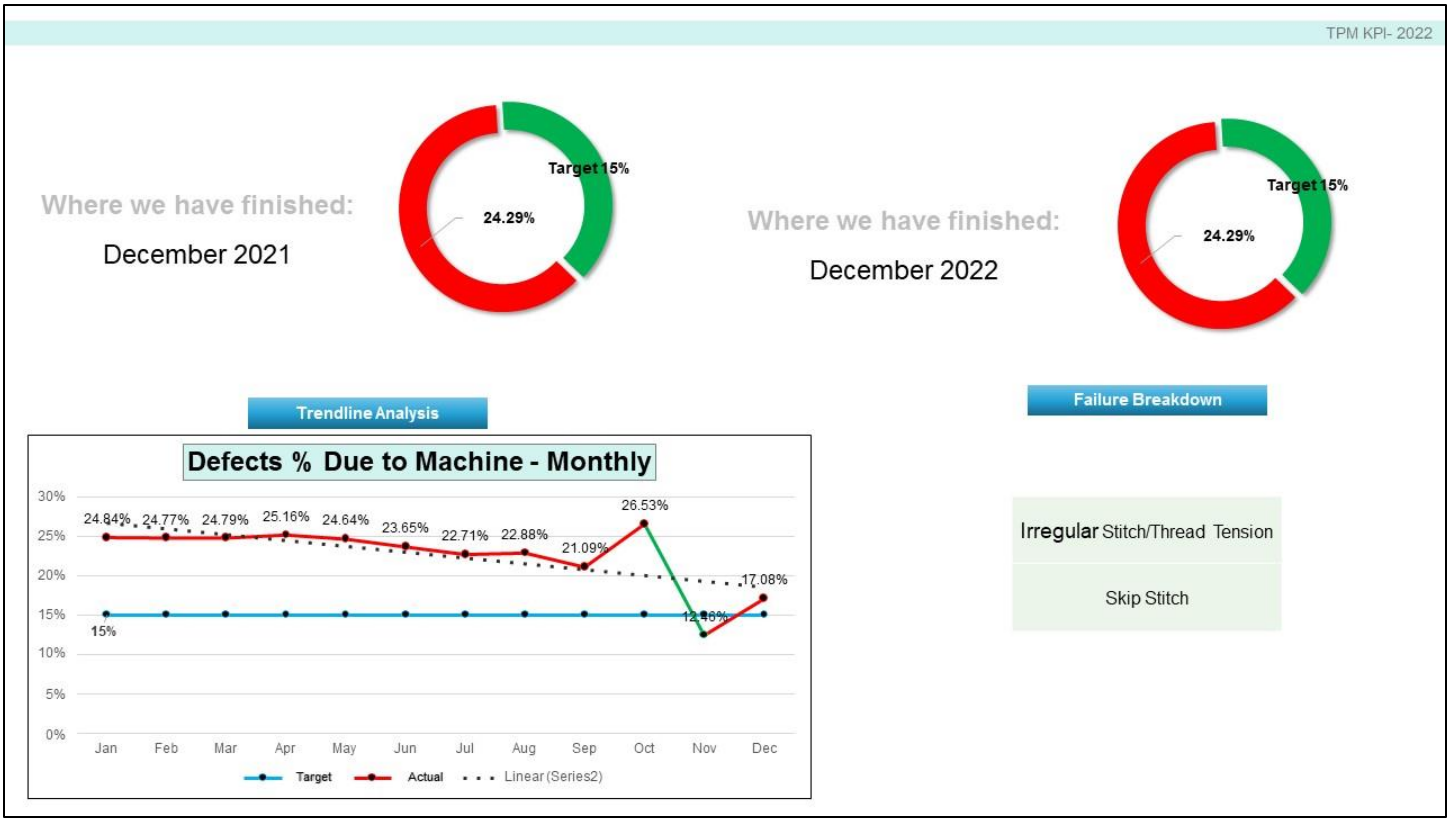


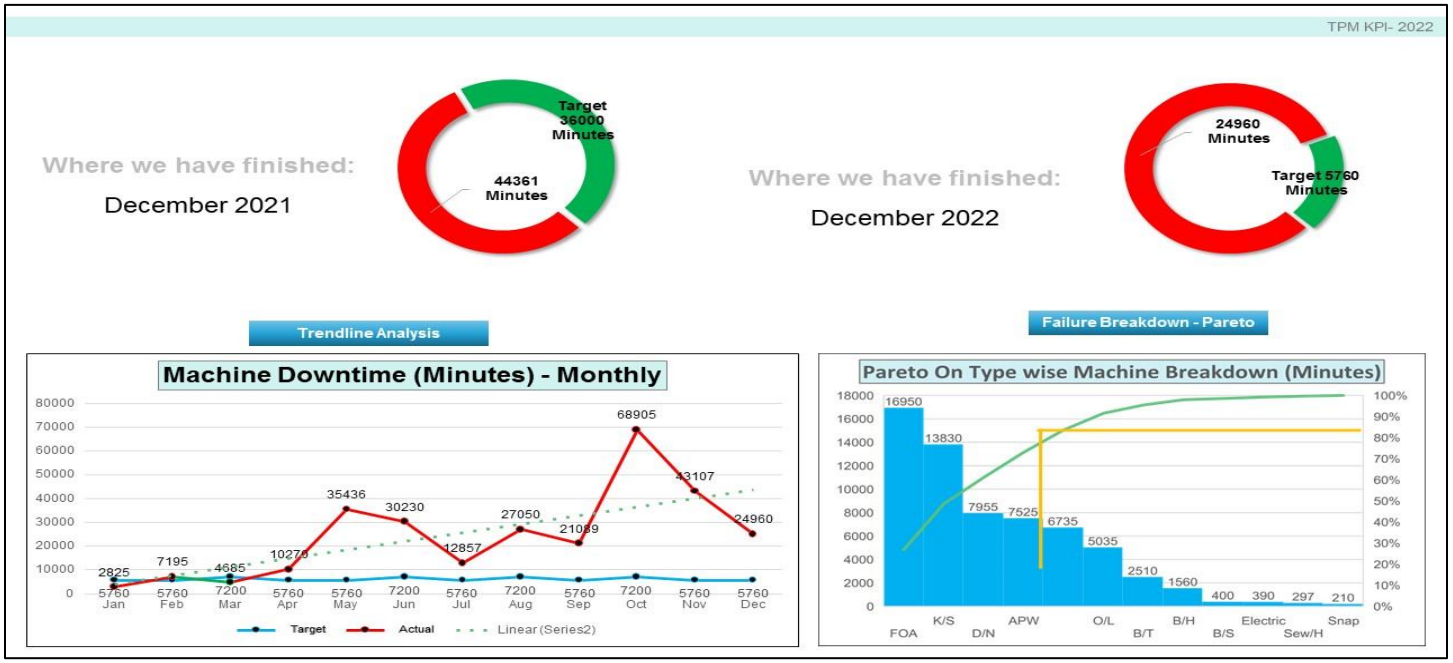
Fig: 4.5 Poor Quality Costing related graph

Working Flow

- List of Number of QI in every section.
- Review their performance
- Training & Development plan
- FTT% analyze based on

4.6 Total Productive Maintenance





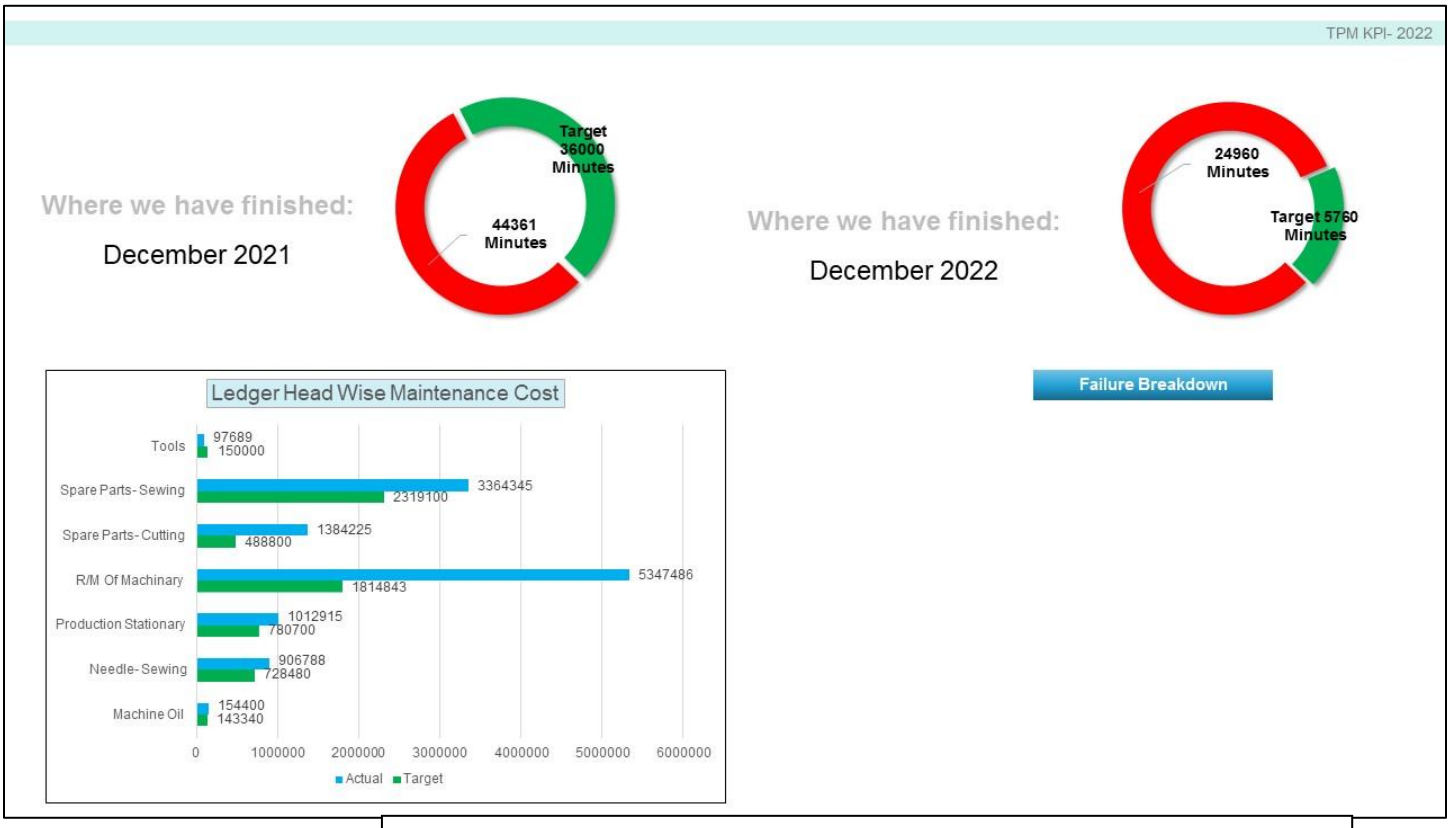


Fig: 4.6 Defects Due to M/C & Downtime Graph

4.6.1 How to maintain:

Autonomous Maintenance

1. Fuguai = Abnormality

2. When in initial cleaning, identify abnormalities using 5 senses

3. If the team member can repair the abnormality, he/ she do it and put a white Fuguai tag

4. If the repair should be done by Engineer/ Mechanic a red tag should be placed.

5. Engineering department will be measured on how efficient they are in attending to the tags

6. Team members will be able to attend to more abnormalities when they progress through TPM journey

Planned Maintenance

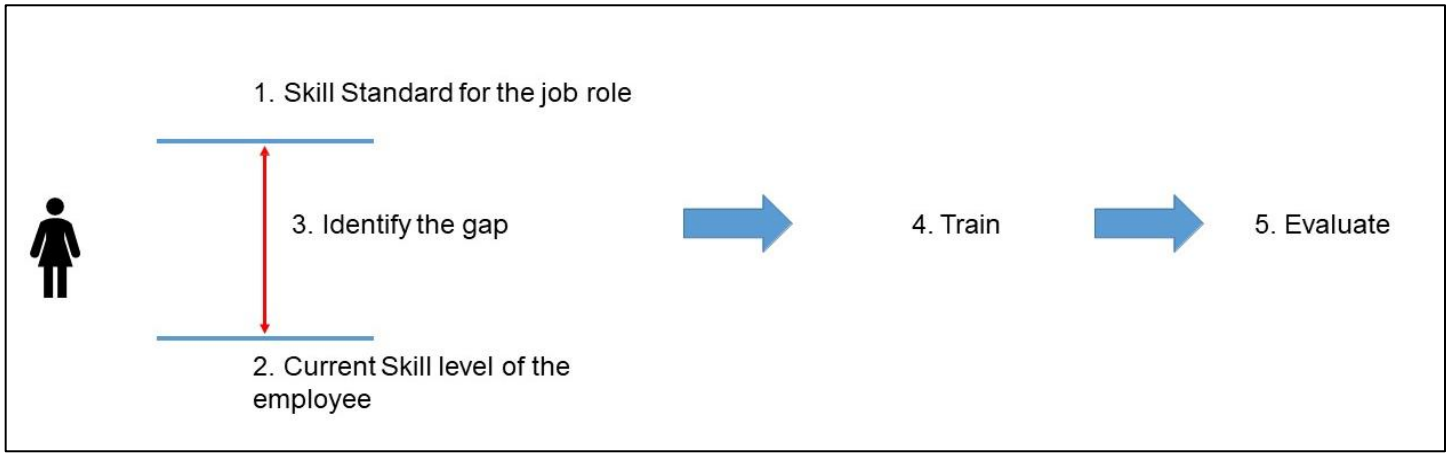
1. List down all the available machine
2. Sequentially make group wise or type wise category of the machine
3. Schedule planning to service the machine by identifying with Red Tag
4. Allocate experienced engineer to repair the machine for sustainability

4.7 Employee Development Summary

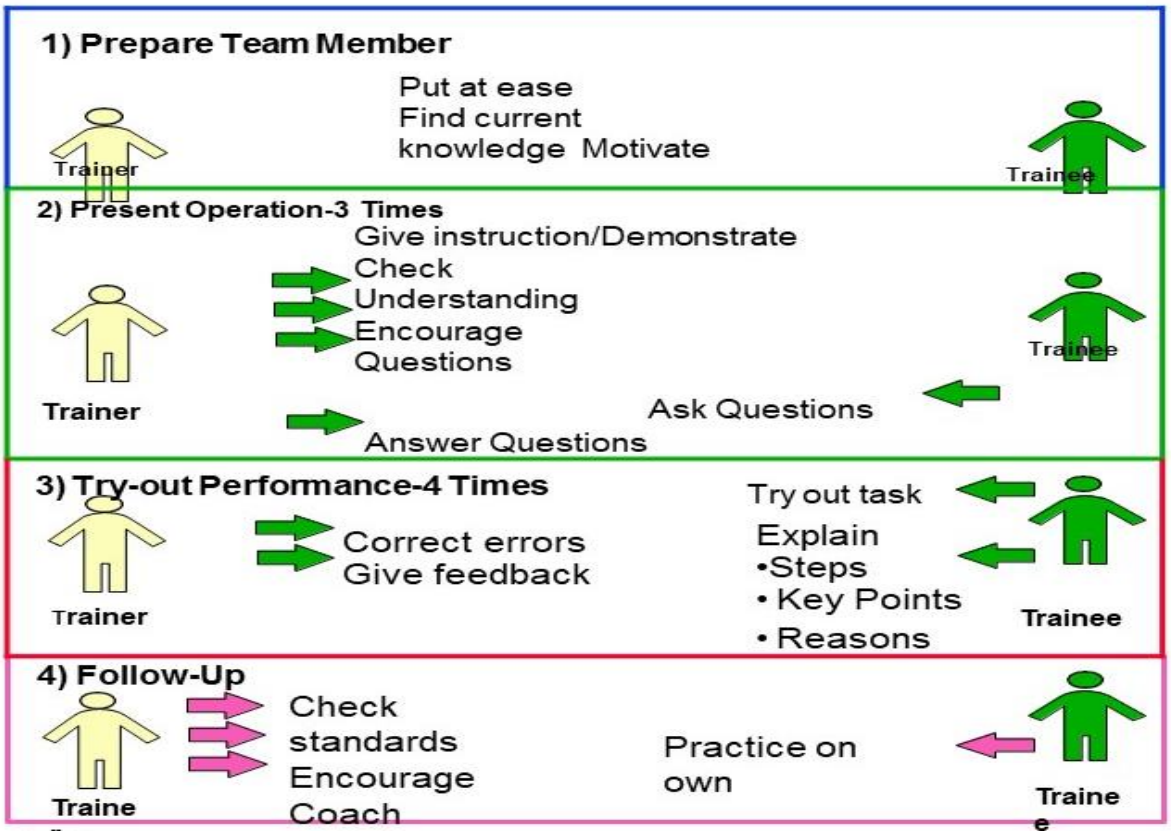
Table: 4.7 Employee Development Summary

Employees Development Report								
SL.	Topic	Training Date	Trained	Total Trained	LTO	Total LTO	No of Retention	Retention%
1	JIT	28th Feb 2022	12	54	3	4	9	75%
		10th Nov 2021	19		0		19	100%
		14th Nov 2021	12		1		11	92%
		20th Sep 2021	11		0		11	100%
2	Helper to Operator	Oct-21	4	17	0	3	4	100%
		Nov-21	5		0		5	100%
		Dec-21	8		3		5	63%
		Jan-22	21	95	4	10	17	81%
		Feb-22	7		2		5	71%
		Mar-22	18		1		17	94%
		Apr-22	3		0		3	100%
		May	0		0		0	0%
		June	13		3		10	77%
		July	9		0		9	100%
		August	8		0		8	100%
		September	9		0		9	100%
		october	5		0		5	100%
		November	2				2	100%
3	Multiskiled Operator	Till August-2022	237	237	0		237	100%
4	TL	17th March 2021	12	118	7	18	5	42%
		23rd May 2021	16		4		12	75%
		9th Aug 2021	11		3		8	73%
		4th Jan 2022	17		4		13	76%
		9th April 2022	13		0		13	100%
		May	13		3		10	77%
		June	0		0		0	#DIV/0!
		July	12		2		10	83%
		August	12		0		12	100%
		September	12		0		12	100%
		october	0		1		-1	#DIV/0!
	GL	9th Aug 2021	13	43	1	2	12	92%
		4th Jan 2022	10		1		9	90%
		9th April 2022	5		0		5	100%
		May	5		2		3	60%
		June			0			
		July	5		1			
		August	5		0			
		September			0			
		October			0			
5	MTO(Lean)	7th Sep 2020	21	29	0	0	21	100%
6	Yellow Belt	th December 20	56	42	1	0	55	98%
	Total		641	635	47	37	594	93%
			Percentage	14%				

4.7.1 Approach of Job Instruction Training



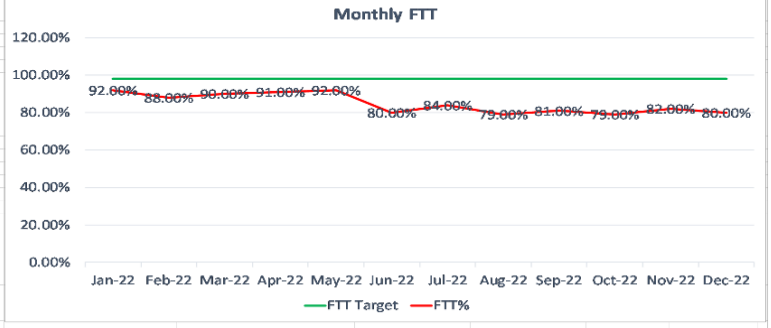
4.7.2 Four Step of JIT training



4.7.3 Training Center KPI

Training Center KPI

Topic	Training Date	Trained	Total Trained	LTO	Total LTO	No of Retention	Retention%	FTT Target	FTT%	CT Target	CT%
Helper to Operator	Jan-22	21	116	1	37	20	95%	98.00%	92.00%	85.00%	83.00%
	Feb-22	7		1		6	86%	98.00%	88.00%	85.00%	79.00%
	Mar-22	18		4		14	78%	98.00%	90.00%	85.00%	81.00%
	Apr-22	3		3		0	0%	98.00%	91.00%	85.00%	82.00%
	May-22	0		0		0	0%	98.00%	92.00%	85.00%	83.00%
	Jun-22	13		4		9	69%	98.00%	80.00%	85.00%	70.00%
	Jul-22	9		8		1	11%	98.00%	84.00%	85.00%	71.00%
	Aug-22	8		4		4	50%	98.00%	79.00%	85.00%	73.00%
	Sep-22	9		2		7	78%	98.00%	81.00%	85.00%	74.00%
	Oct-22	5		5		0	0%	98.00%	79.00%	85.00%	79.00%
	Nov-22	2		2		0	0%	98.00%	82.00%	85.00%	76.00%
	Dec-22	21		3		18	86%	98.00%	80.00%	85.00%	74.00%



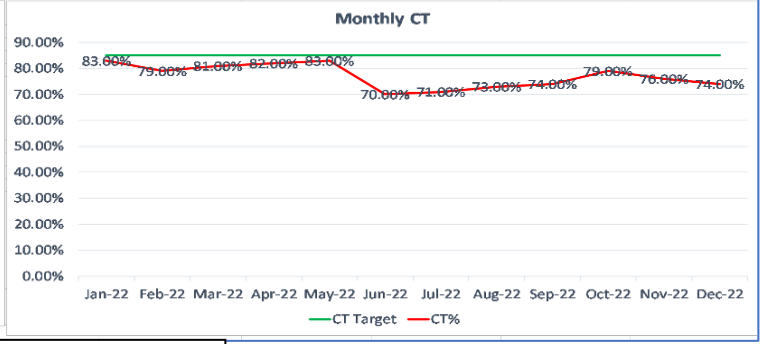


Fig: 4.7.1 Training Center KPI

4.7.4 Training Center Process audit system

Table: 4.7.4 Training Center Process Auditing System

SL	What to look	How to look	Status
1	Manpower Allocation Board	Each section required manpower mentioned with the operation	
2	Job card of New TM	Every TM are using Job card	
		Trainers signature availability	
		Ensuring Sequence training	
3	TM Allocation Plan Board	All TM are mentioned on the board	
		Evaluation are up to date	
4	Training Center A3	Action plan are updated	
		KPI Updated	
5	Training Instructors	They are using JI to train them TM	
		They are following 4-step method	
		Align with the training manual	
6	Training Material Rack	Maintain the Min-Max	
		Following Completed material disposal method	

After selection new TM for training some are mainly focused-

- Company overview video
- Orientation & career path
- IE, HR & welfare discussion
- Introduce the department of AMAN
- M/C running & speed control, needle insert
- Evaluate 1st day training
- Paper exercise as per given sample
- Evaluate 2nd day training
- Fabric exercise as per given sample

- Proper threading knowledge
- Basic of threading (videos of threading)
- Threading of SNLS
- Bobbin attached and understanding of proper tension
- Select process STW teaching and showing
- Trainee sit to machine and start sewing on extra fabric
- Evaluation on first three days performance
- Trainees sit to machine and start sewing on extra fabric
- Continuously monitoring their work based on JIS
- Method and process handling from real body
- Sewing quality aspect and defect pcs
- Directly stitch body from line and get a line to standard SMV
- Given exam of training evaluation by IE and QA
- Closing ceremony in presence of responsible HR head, QA, HR and lean concern
- Sweet party

By using visual displays as much as possible to communicate with people working in the factory which help to find necessary information for quick access. Production board at the end of the line, Mocks of sewing operations at each work stations, quality inspection procedure on the quality checking tables, displaying right and wrong product, displaying exit sign and labeling every items are few example for visual displays factories can easily adopt. Also helps to identify the problem to be escalated easily.

If we can apply these above instructions then we could be minimize the waste. And finally, we will be able to increase productivity to earn remittances in the country. Which take in important contribution worldwide market of textile sector.

Chapter 5

Conclusion

After finishing this thesis, I have a very clear understanding of process excellence, how to execute it, and how to maintain it. This investigation was done to determine how LEAN was being implemented in the textile sector. In some industrialized nations, the idea of lean manufacturing is very new, and proactive firms have already been seen using this approach in their functional divisions. This is mainly because having lean manufacturing processes results in a wide range of cost benefits.

The basic objective of LEAN process excellence is to increase production by eliminating waste and non-value. adding steps from the production process. Therefore, it is crucial to be aware of the wastes and non-value-adding processes that are involved in the production of clothing. Numerous articles have been written about lean manufacturing and the seven wastes that are related to it, and most of them used examples from other industries. There aren't many examples of 7 wastes in the clothing sector online. I have provided examples from the clothing industry to illustrate each of the seven types of lean waste. By decreasing or eliminating wastes (non-value adding time), lean manufacturing focuses on boosting time spent on value-added activities. Although the waste kinds were first focused on manufacturing, they can be applied to many different types of business. The idea of waste elimination is to review all areas in any organization, determine where the non-value added work is and reduce or eliminate it.

Following the identification of pertinent projects, LEAN manufacturing has been used to eliminate all types of waste in connected areas. One of the main points of lean is to alter behavior in order to alter culture. Lean includes five characteristics for leaders' behavior to improve. All of these guidelines and resources have a significant cultural impact that enables people to face any future challenges.

It is necessary to employ a number of various tools and strategies in process excellence. I discussed the major popular technical tools in Chapter 2. I looked at the tools that a LEAN team would employ in that chapter. Due to the fact that they are frequently not technical or mathematical, these tools are sometimes referred to as "soft" tools. Despite being labeled as "soft," they could pose a greater barrier to a lean project team than the technical tools discussed in Chapter 3. This is due to the fact that although the technical tools are more difficult at first, they can eventually become second nature.

The tools discussed in chapter 3 have the drawback of being used on individuals. As a result, their use can cause them to become complex. There are two main sections to this chapter and the tools it contains.

The first five tools are used to help a lean project team's solutions be accepted more readily. They consist of resources including threat/opportunity matrices, planning for strategies, and stakeholder analysis charts. This chapter's second half was devoted to resources that will improve team dynamics.

In order to become competitive, stay in business, and create jobs, maintain a commitment to improving products and services. We are in a new economic age; adopt the new outlook. Management must become aware of the challenge, understand its duties, and assume change leadership. By including quality from the start, you can do away with the necessity for extensive examination. Put an end to the practice of awarding contracts based only on price. Instead, reduce the overall cost. Move in that direction.

Supplier for a single item with whom there is a long-standing bond of loyalty and trust. Improve the system of production and service continuously and eternally to raise standards and boost output, so driving down costs. To improve the performance of people, tools, and machines should be the goal of supervision. Both the management and the manufacturing worker supervision need to be overhauled. Remove anxiety so that everyone may perform their jobs well for the organization. Break through departmental barriers. To anticipate potential production and use issues with the good or service, people in research, design, sales, and production must work together.

The Project Leader should decide who is needed, when he is needed, and what responsibilities each team member is allocated before the project gets underway. It is advisable to approach the Sponsor directly and present specific recommendations. The Sponsor is thereafter in charge of seeing to it that the agreed-upon resources are made available to the core team. Making the team members aware of the project's responsibility transitions from marketing and sales to research and development to production and quality control is crucial during the kick-off meeting.

Finally, based on the overall performance, it is determined that this article attempts to compile all the data pertaining to the garment factory AMAN Graphics & Design Ltd. and analyze LEAN implementation concepts that can satisfy current global customer demand and modern textile trends.

Reference

[1]Book- Design for Six Sigma + LeanToolset by Stephan Lunau, Christian Staudter, Jens-Peter Mollenhauer, Renata Meran, Olin Roenpage, Clemens Hugo, Alexis Hamalides

[2] Dr. Harindra De Silva Consultant ESOne

[3] http:// ESONE.BIZ

[4] Book-SIX SIG For Everyone by George Eckes

[5] Kasun Dilendra –Consultant ,MAS,Shrilanka

[6] Http:// Amanknittings.com