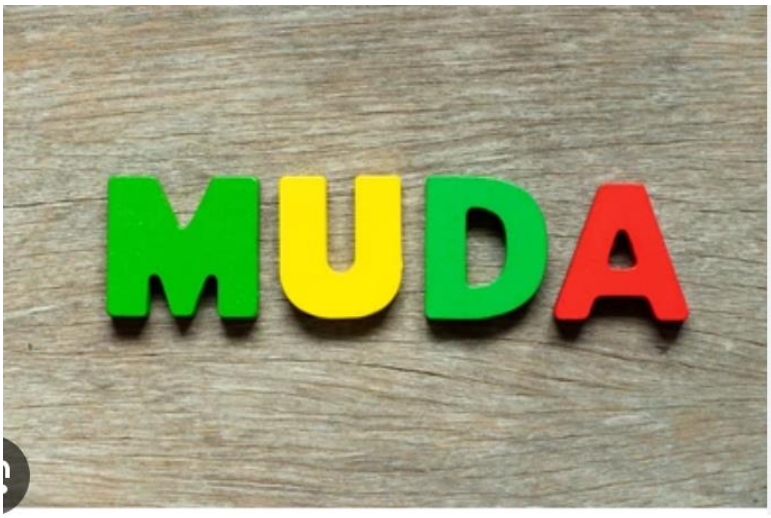
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Ministry of Labor and Skills

Fruit and Vegetable Processing Level II

Based on October 2021, Version 3 Occupational standards



Module Title: Preventing and Eliminating MUDA

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Introduction to the Module

This unit covers the knowledge, skills and attitude required by a worker to prevent and eliminate MUDA/wastes in his/her workplace by applying scientific problem-solving techniques and tools to enhance quality, productivity and other kaizen elements on continual basis It covers responsibility for the day-to-day operation of the work and ensures Kaizen Elements are continuously improved and institutionalized.

LG #40 LO#1- Prepare for work

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Using work instructions to determine job requirements, including method, material and equipment.
- Reading and interpreting job specifications a following working manual
- Observing OHS requirements, including dust and fume collection, breathing apparatus and eye and ear personal protection needs throughout the work
- Selecting appropriate material for work
- Identifying and checking safety equipment and tools for safe and effective operation

This guide will also assist you to attain the learning outcomes stated in the cover page.
Specifically, upon completion of this learning guide, you will be able to:

- Using work instructions to determine job requirements, including method, material and equipment.
- Reading and interpreting job specifications a following working manual
- Observing OHS requirements, including dust and fume collection, breathing apparatus and eye and ear personal protection needs throughout the work
- Selecting appropriate material for work
- Identifying and checking safety equipment and tools for safe and effective operation

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks

Information Sheet1

1.1 Using work instructions to determine job requirements, including method, material and equipment.

Preparing for work involves several key steps, including determining job requirements, identifying the necessary methods, materials, and equipment, and creating work instructions to guide the completion of the job.

To start, it is important to understand the specific requirements of the job at hand. This may involve reviewing project plans, discussing with supervisors or team members, and clarifying any ambiguities or uncertainties. This step helps ensure that the work can be completed efficiently and accurately.

Once the requirements are clear, the next step is to identify the appropriate methods to complete the job. This may involve researching best practices, reviewing technical specifications, and considering any specific constraints or limitations. Selecting the most suitable method helps ensure that the work is conducted safely and effectively.

After determining the methods, the next step is to identify the necessary materials and equipment. This could include tools, machinery, supplies, or any other resources needed to complete the job. It is important to ensure that all necessary materials and equipment are available and in good working condition before starting the work.

With the requirements, methods, materials, and equipment identified, the final step is to create work instructions. These instructions provide a clear and detailed outline of how the job should be completed. They specify the steps to follow, the order of operations, any safety precautions, and any specific techniques or considerations. Work instructions are typically written documents or manuals that can be referenced by the individuals performing the job.

The work instructions should be clear and concise, using language that is easy to understand and follow. They should also be flexible enough to accommodate any unforeseen challenges or changes in circumstances. Work instructions should be reviewed and updated as needed to ensure they are accurate and up to date.

In addition to the steps mentioned above, preparing for work may also involve the following considerations:

Safety: Before starting any job, it is crucial to assess the potential hazards and implement appropriate safety measures. This may include wearing personal protective equipment (PPE), setting up barriers or signage to indicate hazardous areas, and ensuring that all workers are trained on safety protocols.

Scheduling: Depending on the nature of the work, it may be necessary to coordinate schedules with other team members or departments. This ensures that there are no conflicts and that everyone is available and prepared to perform their respective tasks.

Communication: Effective communication is essential when preparing for work. This includes informing all relevant parties about the job requirements, methods, materials, and equipment. It also involves clear communication channels for reporting any issues or concerns that may arise during the work process.

Quality control: Preparing for work may involve establishing quality control measures to ensure that the job is completed to the required standards. This may include inspections, testing, or other checks to verify the quality and accuracy of the work being performed.

Documentation: It is important to maintain proper documentation throughout the preparation process. This includes keeping records of job requirements, method selection, material lists, equipment maintenance and inspection logs, and any changes or deviations from the original plan. Documentation helps ensure accountability, traceability, and the ability to learn from past experiences.

1.2 Reading and interpreting job specifications a following working manual

When job specifications are read and interpreted following a working manual in preparation for work, several steps are typically involved. Here is a detailed description of the process:

- Obtain the job specifications: The first step is to obtain the job specifications, which define the tasks and requirements for a particular job or project. These specifications may be provided in written form, such as a document or digital file, or they could be communicated verbally by a supervisor or project manager.

- Review the job specifications: Next, the job specifications need to be carefully reviewed and understood. This involves reading the document, analyzing each task or requirement, and identifying any important details or special considerations. The reviewer should be familiar with the terminology and industry standards related to the job to ensure a clear understanding.

- Refer to the working manual: Alongside the job specifications, there is typically a working manual that provides guidance and instructions on how to carry out the tasks outlined in the specifications. The working manual may include step-by-step procedures, checklists, diagrams, or other resources that can help in preparing for the work.

- Interpret the specifications: After reviewing the job specifications and the working manual, the next step is to interpret the specifications in light of the guidelines provided in the working manual.

- This may involve clarifying any ambiguous instructions, understanding the proper sequence of tasks, and determining any specific tools or materials required for the job.

- Make necessary preparations: Once the job specifications have been properly interpreted, the necessary preparations can be made. This could involve gathering the required tools and equipment, ensuring the availability of necessary materials, and making any logistical arrangements, such as scheduling manpower or coordinating with other teams or departments.

- Communicate with stakeholders: Throughout the process of reading and interpreting job specifications, it is important to maintain clear communication with relevant stakeholders. This can include supervisors, team members, clients, or customers. By keeping stakeholders informed and seeking clarification when needed, potential misunderstandings or errors can be minimized.

- Document the interpretation: To ensure consistency and effective communication within the team, it is advisable to document the interpretation of the job specifications. This could involve creating an internal document or checklist that outlines the key points, important considerations, and any specific instructions derived from the working manual.

1.3 Observing OHS requirements, including dust and fume collection, breathing apparatus and eye and ear personal protection needs throughout the work

OHS requirements refer to occupational health and safety regulations and guidelines that are established to ensure the safety and well-being of workers in the workplace. These requirements are crucial in preventing workplace accidents, injuries, and illnesses. In the context of preventing and eliminating Muda, a lean manufacturing concept that focuses on reducing waste, OHS requirements play a pivotal role.

One aspect of OHS requirements is the management of dust and fumes in the work environment. Dust and fumes can be hazardous to workers' health if inhaled or if they come into contact with the skin. To address this, dust and fume collection systems are implemented. These systems typically involve the use of extraction hoods, filters, and ventilation systems to capture and remove airborne particles and harmful substances from the air. This helps maintain a clean and safe working environment.

Breathing apparatus is another OHS requirement that may be necessary in certain work environments where there is a risk of exposure to harmful gases, chemicals, or particulates. Breathing apparatus, such as respirators or masks, are worn by workers to protect their respiratory system and prevent inhalation of hazardous substances. The specific type of breathing apparatus required will depend on the nature of the work and the potential threats present.

Eye and ear protection are also important components of OHS requirements. Many work processes involve potential hazards to the eyes and ears, such as flying debris, intense light, loud noises, or chemical splashes. To protect workers from these risks, appropriate personal protective equipment (PPE) is provided. Safety glasses, goggles, or face shields may be used to safeguard the eyes, while earplugs or earmuffs may be utilized to reduce noise levels and protect the ears.

To ensure that these OHS requirements are observed throughout the work, various measures may be implemented. This includes regular inspection and maintenance of dust and fume collection systems, ensuring that they are functioning properly and effectively. Proper training and supervision should also be provided to workers regarding the use of breathing apparatus and the importance of utilizing eye and ear protection.

Furthermore, awareness campaigns and regular reminders about OHS requirements can be implemented to encourage compliance and create a safety-conscious culture. This can involve displaying safety signage, conducting safety briefings, and providing ongoing training on the importance of adhering to OHS regulations.

By actively observing and implementing these OHS requirements, including dust and fume collection, breathing apparatus, and eye and ear personal protection, the risk of workplace accidents, injuries, and illnesses is minimized. This contributes to the elimination of Muda, as a safe and healthy work environment enables employees to perform their tasks more efficiently and effectively, free from the burden of workplace hazards. The definition reads: "The main focus in occupational health is on three different objectives:

I. The maintenance and promotion of workers' health and working capacity;

II. The improvement of working environment and work to become conducive to safety and health and

III. Development of work organizations and working cultures in a direction which supports health and safety at work and in doing so also promotes a positive social climate and smooth operation and may enhance productivity of the undertakings. The concept of working culture is intended in this context to mean a reflection of the essential value systems adopted by the

undertaking concerned. Such a culture is reflected in practice in the managerial systems, personnel policy, principles for participation, training policies and quality management of the undertaking.

Joint ILO/WHO Committee on Occupational Health: those in the field of occupational health come from a wide range of disciplines and professions including medicine, psychology, epidemiology, physiotherapy and rehabilitation, occupational, occupational medicine, human factors and ergonomics, and many others. Professionals advise on a broad range of occupational health matters. These include how to avoid particular pre-existing conditions causing a problem in the occupation, correct posture for the work, frequency of rest breaks, preventative action that can be undertaken, and so forth.

1.4 Selecting appropriate material for work

- Clothing: Choose professional attire that is appropriate for your workplace. This may include items such as a suit, dress, or business casual clothing. Consider the dress code and expectations of your workplace when choosing clothing materials.
- Footwear: Select comfortable and professional shoes or appropriate footwear for your workplace. Look for materials that are durable, breathable, and provide support for standing or walking for extended periods of time.
- Accessories: Pay attention to accessories such as jewelry, belts, ties, scarves, and handbags. Opt for materials such as leather, metal, or good-quality fabrics that convey professionalism and durability.
- Outerwear: Depending on the climate and environment of your workplace, you may need to consider outerwear options such as coats, jackets, or blazers. Look for materials that are suitable for the weather conditions and are both functional and stylish.
- Bags and Briefcases: Choose a bag or briefcase that is appropriate for carrying your work-related items. Consider the material's durability, functionality, and whether it aligns with the overall professional aesthetic you desire.

- Personal Protective Equipment (PPE): For certain industries or jobs, personal protective equipment may be required. It is important to select materials that meet the necessary safety standards and provide adequate protection.

- Grooming and Personal Care: In addition to clothing and accessories, consider the materials used in grooming and personal care products. This includes items such as shaving or grooming tools, skincare products, hair products, and makeup. Choose products with high-quality ingredients that align with your personal preferences and needs.

- Overall, appropriate material selection for preparing for work involves considering the professional requirements, comfort, durability, and functionality of the materials. It is important to strike a balance between professionalism and personal comfort to ensure a successful and confident work experience.

1.5 Identifying and checking safety equipment and tools for safe and effective operation

Safety equipment and tools are essential for ensuring the safety and well-being of individuals while working. Proper identification and checking of these items is crucial to ensure their effectiveness and reliability. Here are some guidelines for identifying and checking safety equipment and tools before starting work:

- Personal Protective Equipment (PPE): PPE includes items like helmets, safety glasses, gloves, earplugs, and safety shoes. Identify the specific PPE required for your work environment and ensure its availability. Check for any damages or wear and tear, such as cracks or tears in gloves or missing parts in helmets. Ensure proper fit and comfort of each item to ensure protection during work.

- Fire extinguishers: Identify the locations of fire extinguishers in your work area. Check for proper labels, pressure gauges within the green range, and inspection tags with a valid expiration date.

- First aid kits: Locate the first aid kits in your workplace. Check for sealed and sterile packages, stocked supplies, and an up-to-date inventory list. Replace any expired or missing items.

- Emergency exits and signage: Identify the emergency exits in your work area and ensure they are easily accessible and unobstructed. Check for proper signage indicating the locations of emergency exits.

- Safety harnesses and lanyards: For jobs that require working at heights, identify the availability of safety harnesses, belts, and lanyards. Check for any signs of wear and tear, such as fraying ropes or damaged connectors. Ensure that they are properly fitted and adjusted to provide maximum safety.

- Power tools and equipment: Before using any power tools or equipment, perform a visual inspection to check for any damages, loose parts, or signs of wear and tear. Ensure that the proper guards, shields, or safety features are in place and functional.

- Lockout/tagout devices: If your work involves electrical or mechanical equipment that needs to be shut down for maintenance or repair, identify the lockout/tagout devices required. Check for the availability of lockout devices, such as locks, tags, and key control systems, and ensure proper training on their usage.

Self-check 1	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below

Test I: True or False

1. Work instructions are created after job requirements, methods, materials, and equipment have been identified.
2. Safety considerations are an important part of preparing for work.
3. Reviewing job specifications involves analyzing each task or requirement and identifying important details.
4. A working manual is typically used alongside job specifications to provide guidance on how to carry out the tasks.
5. Documenting the interpretation of job specifications is recommended to ensure consistency and effective communication within the team.

Test II: Choose the best answer

1. Which of the following is NOT a step in preparing for work?

a) Determining job requirements

b) Identifying methods, materials, and equipment

c) Reviewing project plans

d) Creating work instructions

2. What is the purpose of identifying the appropriate methods to complete the job?

a) To ensure the availability of necessary materials and equipment

b) To determine the order of operations for the job

c) To conduct the work safely and effectively

d) To create clear and concise work instructions

3. What should be considered when identifying the necessary materials and equipment?

a) Ensuring all workers are trained on safety protocols

b) Reviewing technical specifications

c) Researching best practices

d) Coordinating schedules with other team members or departments

4. What is the purpose of work instructions?

a) To specify the steps to follow and the order of operations

b) To assess potential hazards and implement safety measures

c) To establish quality control measures

d) To ensure the availability of necessary materials and equipment

5. Which of the following is NOT a consideration in preparing for work?

a) Safety

b) Scheduling

c) Communication

d) Budgeting

Test III: short answer

1. What are the key steps involved in preparing for work?
2. Why is it important to assess potential hazards and implement safety measures before starting any job?

LG #41 LO#2- Identify MUDA and problem

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing and implementing plan of MUDA and problem identification
- Discussing causes and effects of MUDA
- Listing all possible problems related to the process /Kaizen elements using statistical tools and techniques.
- Identifying and listing all possible problems related to kaizen elements on Visual Management Board/Kaizen Board
- Using tools and techniques to draw and analyze current situation of the work place
- Identifying and measuring wastes/MUDA based on relevant procedures.
- Reporting identified and measured wastes are to relevant personnel.

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Prepare and implementing plan of MUDA and problem identification
- Discuss causes and effects of MUDA
- List all possible problems related to the process /Kaizen elements using statistical tools and techniques.
- Identify and listing all possible problems related to kaizen elements on Visual Management Board/Kaizen Board
- Use tools and techniques to draw and analyze current situation of the work place
- Identify and measuring wastes/MUDA based on relevant procedures.
- Report identified and measured wastes are to relevant personnel.

Learning Instructions:
1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3.Read the information written in the information Sheets
4.Accomplish the Self-checks

Information Sheet 2

2.1 Preparing and implementing plan of MUDA and problem identification

Preparing and implementing a plan of MUDA and problem identification is crucial for streamlining operations and improving efficiency. By eliminating wasteful activities and identifying bottlenecks, organizations can optimize their processes and enhance productivity. This strategic approach involves analyzing workflows, engaging stakeholders, and developing targeted solutions to address identified issues. With a focus on lean principles and continuous improvement, a well-executed plan of MUDA and problem identification can drive sustainable growth and competitive advantage in today's dynamic business landscape.

2.1.1 Preparing and implementing plan of MUDA

- **Targets of Customer**

Customer is the one who buys products/services from manufacturers/service providers. So, the customer does not bother how the manufacturer/service provider makes it. Now a days customers have many alternative manufacturers/service providers to buy the same type of product/service from and choose one that fulfills their targets which are listed below:

- ✓ Customer needs better quality
- ✓ On time delivery
- ✓ Reasonable price

- **Targets of Manufacturer/Service provider**

The primary target of Manufacturers/Service providers is to earn profit. So as to meet his/her target, he/she needs to satisfy the targets of customers in such a way by providing better quality product/service on time and at a reasonable price. If he/she is able to do so, he can win customers‟ targets. Then to get higher profit the Manufacturer/Service provider needs to minimize his/her costs by reducing/eliminating wastes and following effective working procedures.



Fig 2.1 **Targets of Manufacturer/Service provider**

- **The concept of Cost**

Cost: - is the amount of money that is expended to accomplish a given task/operation.

Cost can be of Manufacturing or Service Delivering cost= (material + labor + facility +utility + others) cost

Determination of the sales price of the product/Service

Sales price= (manufacturing or service delivery) cost + profit

- **Traditional Thinking of Price Setting**
  - ✓ In traditional thinking of price setting, price is determined by the manufacturer/service provider rather than the market itself.
  - ✓ When there is shortage of supply then the manufacturer raises selling price.

- **Kaizen Thinking of Price Setting**

In modern time, there are a large number of manufacturers/service providers delivering the same type of product/service offering the customers a great deal of options to buy products/services. Price is determined by the interaction between market demand and supply. Manufacturers/service providers, who want to set selling, price above the market price, customers will not be willing to buy their products/services. Manufacturers/Service providers to be competent in the market they should

provide Quality product/service on time and at the market price. Since today's economy is market based, we should focus on minimizing our costs and not maximizing selling price to maximize our profit.

- **Waste/Muda**

  ✓ Waste/Muda is any activity which consumes resources, such as money, time, energy, materials, etc, that does not create value and can be eliminated.

- **Value**
  - ✓ Value is defined by the next customer (Know your Customer's Need).
  - ✓ The next process is your customer. The activity/effect exactly what the next customer needs is value adding activity.

  - ✓ **There are two types of customers: -**
    - Internal customer
    - External customer
    - **Internal customer: -** is the customer within a production line/service delivering sequence that is next to the previous process and makes his/her own process.
    - **External customer: -** is the customer that buys the final out put product/service of the enterprise.

- **The three Categories of Operation**

  A. Net Operation/Value Adding Operation
  B. Non-Value Adding Operation
  C. "Muda""

A. Net Operation/Value Adding Operation

- Part of an operation that adds value to make parts and products or deliver service. Inother words, it is part of the operation that the customer exactly needs / willing to pay for.
- Examples - Milling, Turning, Grinding, Assembling and Welding.
    - Printing/photocopying a document etc.

B. Non-Value Adding Operation

- Part of operation that adds no value but cannot be avoided rather it can be reduced.
- Example Setting up / adjustments, Loading paper to a photo copy machine/printer,et

C. ” Muda’’

- Muda is a Japanese word meaning Wasteful Activity which use resources, time or cost without adding value. In other words, it is anything unnecessary in operation that affects the quality of the product/service, productivity, delivery time and also production cost. Muda can be eliminated immediately. Example: Unnecessary motion/searching for tools, unnecessary transportation of materials, over production, Inventory, Waiting /idle time, making defects.

2.1.2 Identification of Muda

To identify Muda in your warehouse operations, you must observe and analyze your current processes and performance. To do this, utilize various tools and methods such as value stream mapping, gemba walk, key performance indicators (KPIs), root cause analysis, and employee feedback. Value stream mapping is a visual representation of the flow of goods and information from the supplier to the customer, highlighting value-added and non-value-added activities as well as sources of waste and inefficiency. A gemba walk involves a regular visit to the place where the work is done, so that you can identify problems and opportunities for improvement. KPIs are quantitative measures of the effectiveness and efficiency of your warehouse operations. Root cause analysis is a systematic approach to finding the underlying causes of problems or defects. Lastly, employee

feedback is a valuable source of information and ideas from those directly involved in the warehouse operations who can suggest solutions or improvements.

2.2 Discussing causes and effects of MUDA

- **Causes of Muda Overproduction**

✓ Large-lot production
✓ Anticipatory production (producing product in advance of demand)
✓ Inability to achieve short changeover times with the large equipment used in mass production systems
✓ Creating enough stock to replace the number of defective parts produced
✓ Overstaffing or too much equipment
✓ Machines that turn out parts too quickly

- **Effects of Muda of Overproduction**

Companies often have overproduction as a result of large-lot manufacturing methods or mass production. There are several unfortunate effects of over production:

✓ Anticipatory buying of parts and materials
✓ Blocked flow of goods
✓ Increased inventory
✓ No flexibility in planning
✓ Occurrence of defects

- **Causes of Muda of Inventory**

✓ Acceptance of inventory as normal or as a “necessary evil”
✓ Poor equipment lay out
✓ Long changeover times
✓ Shish-kabob or large lot production
✓ Obstructed flow of goods
✓ Anticipatory production

- ✓ Defective parts
- ✓ Upstream process is too fast for the downstream process

- **Effects of Muda of Inventory**

- ✓ Waste of space
- ✓ Needs for inspection, and transportation
- ✓ Expansion of working fund
- ✓ Shelf life may expire
- ✓ It ties up cash
- ✓ Makes FIFO inventory management more difficult

- **Causes of Muda of motion**

- ✓ Isolated operations
- ✓ Low employee morale
- ✓ Poor work layout
- ✓ Lack of training
- ✓ Undeveloped skill

- **Effects of Muda of motion**

- ✓ Increase in manpower and processing
- ✓ Unstable operation
- ✓ Increases production time
- ✓ Can cause injury

- **Causes of Muda of Conveyance/Transportation**

- ✓ Poor layout
- ✓ Shish-skilled workers
- ✓ Sitting to perform operations

- ✓ The need for conveyance systems is assumed

- **Effects of Muda of Conveyance/Transportation**

  - ✓ Waste of space
  - ✓ Production deterioration
  - ✓ Expansion of transportation
  - ✓ facilities
  - ✓ Occurrence of scratches
  - ✓ Increase production time and cost
  - ✓ wastes time and energy

- **Causes of Muda of Waiting/ Idle time**

  - ✓ Obstruction of flow
  - ✓ Poor equipment layout
  - ✓ Trouble at the upstream process
  - ✓ Capacity imbalances
  - ✓ Large Lot-production

- **Effects of Muda of Waiting/ Idle time**

  - ✓ Waste of manpower, time, & machines
  - ✓ Increase in the in-process inventory
  - ✓ Failed delivery dates
  - ✓ Poor workflow continuity

- **Causes of Muda of Defect making**

  - ✓ Emphasis on downstream inspection
  - ✓ No standard for inspection work

- ✓ Omission of standard operations
- ✓ Material handling and conveyance

- **Effects of Muda of Defect making**

  - ✓ Increase in material cost
  - ✓ Productivity deterioration
  - ✓ Increase in personnel & processes for inspection
  - ✓ Increase in defects and claims
  - ✓ Invite reworking costs

- **Causes of Muda of Processing**

  - ✓ Inadequate study of processes
  - ✓ Materials are not studied

- **Effects of Muda of Processing**

  - ✓ Unnecessary processes or operation
  - ✓ Increase in manpower and man-hour
  - ✓ Lower workability
  - ✓ Increase in defects
  - ✓ Can reduce life of components

2.3 Listing all possible problems related to the process /Kaizen elements using statistical tools and techniques

- **The 7 QC tools**

  - ✓ **Stratification**

Stratification also known as a flow chart or run chart is a technique that separates the data gathered from a variety of sources so that patterns can be seen i.e., the path an entity has taken through a defined process. Stratification analysis is a quality assurance tool used to sort data, objects, and

people into separate and distinct groups. Separating your data using stratification can help you determine its meaning, revealing patterns that might not otherwise be visible when it's been lumped together. Whether you're looking at equipment, products, shifts, materials, or even days of the week, stratification analysis lets you make sense of your data before, during, and after its collection.

Stratification is a technique used in combination with other data analysis tools. Stratification is grouping and categorization. When data from a variety of sources or categories have been lumped together, the meaning of the data can be impossible to see. This technique separates the data so that patterns can be seen.

E.g. Data from Machine A & B

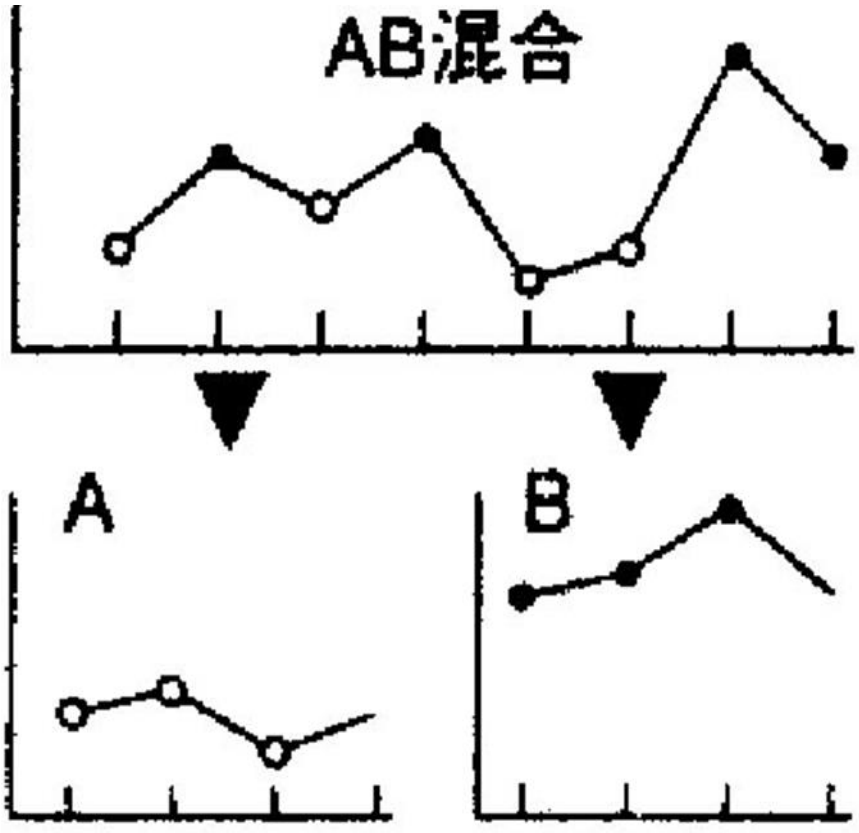


Fig 2.2 Data from Machine

Stratification leads to understanding. For eg, there could be many causes for the variation in a lot.

- a worker related causes,
- different types of machinery,
- the difference in lot material,
- measurement instrument error,
- surrounding environmental conditions, and others

If the worker is suspected to have a great impact on the variations, separating the lots according to each worker & examining the variations according to worker will help pinpoint the cause.

A prerequisite to stratification is the data must be reliably managed, i.e., -- the production date,

- number of units produced,
- the number of lots,
- information about the materials,
- the production machinery name,
- the name of the person-in-charge,
- Quality level and other data must be clearly known.

✓ **Pareto Diagram**

It introduced by an Italian economist, named Vilfredo Pareto, who worked with income and other unequal distributions in 19th century, he noticed that 80% of the wealth was owned by only 20% of the population. Later, Pareto principle was developed by Juran in 1950. A Pareto chart is a special type of histogram that can easily be apply to find and prioritize quality problems, conditions, or their causes of in the organization (Juran and Godfrey, 1998).. On the other hand, it is a type of bar chart that shows the relative importance of variables, prioritized in descending order from left to right side of the chart.

The aim of Pareto chart is to figure out the different kind of “nonconformity” from data figures, maintenance data, repair data; parts scrap rates, or other sources. Also, Pareto chart can generate a mean for investigating concerning quality improvement, and improving efficiency, “material waste, energy conservation, safety issues, cost reductions”, etc., as Figure demonstrated concerning Pareto chart, it can able to improve the production before and after changes (Montgomery, 2009; Kerzner, 2009; Omachonu and Ross, 2004).

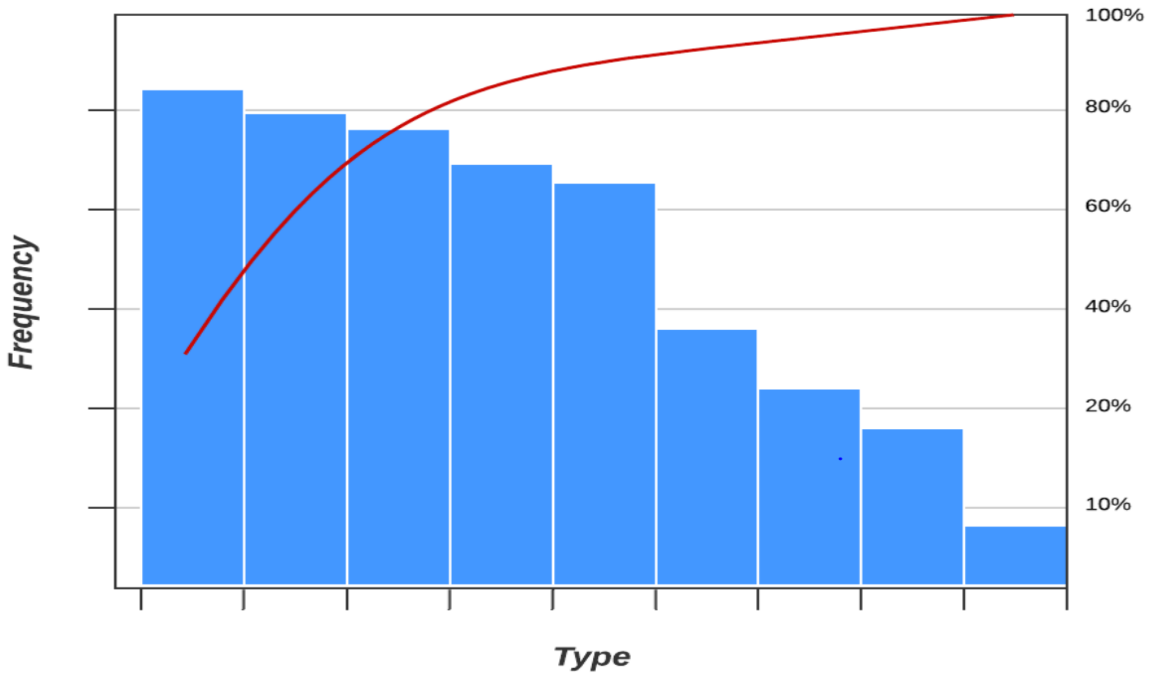


Fig 2.3 pareto chart

- ✓ **Cause and Effect Diagram**

Introduced by Kaoru Ishikawa, the fishbone diagram helps users identify the various factors (or causes) leading to an effect, usually depicted as a problem to be solved. Named for its resemblance to a fishbone, this quality management tool works by defining a quality-related problem on the right-hand side of the diagram, with individual root causes and sub-causes branching off to its left. A fishbone diagram’s causes and sub causes are usually grouped into six main groups, including measurements, materials, personnel, environment, methods, and machines. These categories can help you identify the probable source of your problem while keeping your diagram structured and orderly.

Cause and Effect Diagram also known as Fishbone Diagram helps in identifying the potential causes of an effect or a problem. In addition to sorting ideas in respective categories, it also helps in understanding the areas of opportunity through effective brainstorming. Fishbone training empowers you to identify the potential cause in the problem.

- ✓ **Check Sheet**

Check sheets are simple forms with certain formats that can aid the user to record data in an firm systematically. Data are "collected and tabulated" on the check sheet to record the frequency of specific events during a data collection period. A check sheet is a paper form specially prepared to enable data to be collected and analyzed simply by making check marks or simple symbols. It is used for tallying the occurrences of the defects or causes being addressed and graphing or charting them directly. It is a powerful data recording too. They prepare a "consistent, effective, and economical approach" that can be applied in the auditing of quality assurance for reviewing and to follow the steps in a particular process. Also, they help the user to arrange the data for the utilization later (Montgomery, 2009; Omachonu and Ross, 2004).

The main advantages of check sheets are to be very easily to apply and understand, and it can make a clear picture of the situation and condition of the organization. They are efficient and powerful tools to identify frequently problems, but they don't have effective ability to analyze the quality problem into the workplace. The check sheets are in several, three major types are such as Defect-location check sheets; tally check sheets, and; defect-cause check sheets (Kerzner, 2009). Figure is depicted a tally check sheet that can be used for collecting data during production process.

Ways of recording (collecting) data

- Data is a guide for our actions. From data we learn pertinent facts, and take appropriate actions based on such facts.
- Determine what you are going to do with the data before collecting.
  Eg. In quality control, objectives of collecting data are
  - Controlling and monitoring of the production process,
  - Analysis of the non-conformance or inspection

- Collect data that suites the purpose
- Ensure reliability of measurements
- The origin of the data must be clearly recorded. Data whose origin is not clearly known becomes dead data.
- Data should be gathered in a simple way and in an easy-to-use form.
- A set of standard recording forms should be prepared beforehand to continuously collect data (design a check sheet).

Telephone Interruptions

Reason	Day					
	Mon	Tues	Wed	Thurs	Fri	Total
Wrong number	𝍸	II	I	𝍸	𝍸 II	20
Info request	II	II	II	II	II	10
Boss	𝍸	II	𝍸 II	I	IIII	19
Total	12	6	10	8	13	49

Fig 2.4 standard recording forms

✓ **Control Chart/Graph**

Control charts are used to study how the processes have changed over a period of time. Further, by comparing current data to historical control limits, one could lead to the conclusion about whether the process variation is consistent as in under control or unpredictable as in out of the control due to being affected by special causes of variation.

✓ **Histogram and Scatter Diagram**

Histogram is very useful tool to describe a sense of the frequency distribution of observed values of a variable. It is a type of bar chart that visualizes both attribute and variable data of a product or process, also assists users to show the distribution of data and the amount of variation within a process. It displays the different measures of central tendency (mean, mode, and average). It should be designed properly for those working into the operation process can easily utilize and understand them. Also, a histogram can be applied to investigate and identify the underlying distribution of the variable being explored (Omachonu and Ross, 2004; Forbes and Ahmed, 2011).

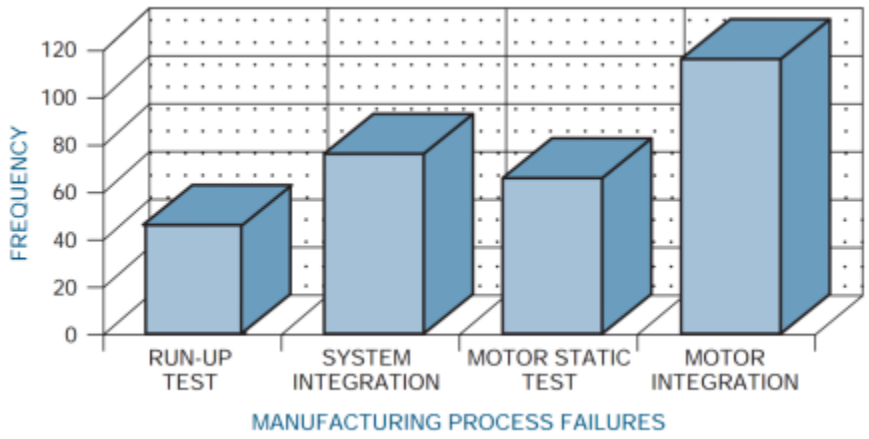


Fig 2.5 Histogram

Scatter diagram is a powerful tool to draw the distribution of information in two dimensions, which helps to detect and analyze a pattern relationships between two quality and compliance variables (as an independent variable and a dependent variable), and understanding if there is a relationship between them, so what kind of the relationship is (Weak or strong and positive or negative). The shape of the scatter diagram often shows the degree and direction of relationship between two variables, and the correlation may reveale the causes of a problem.

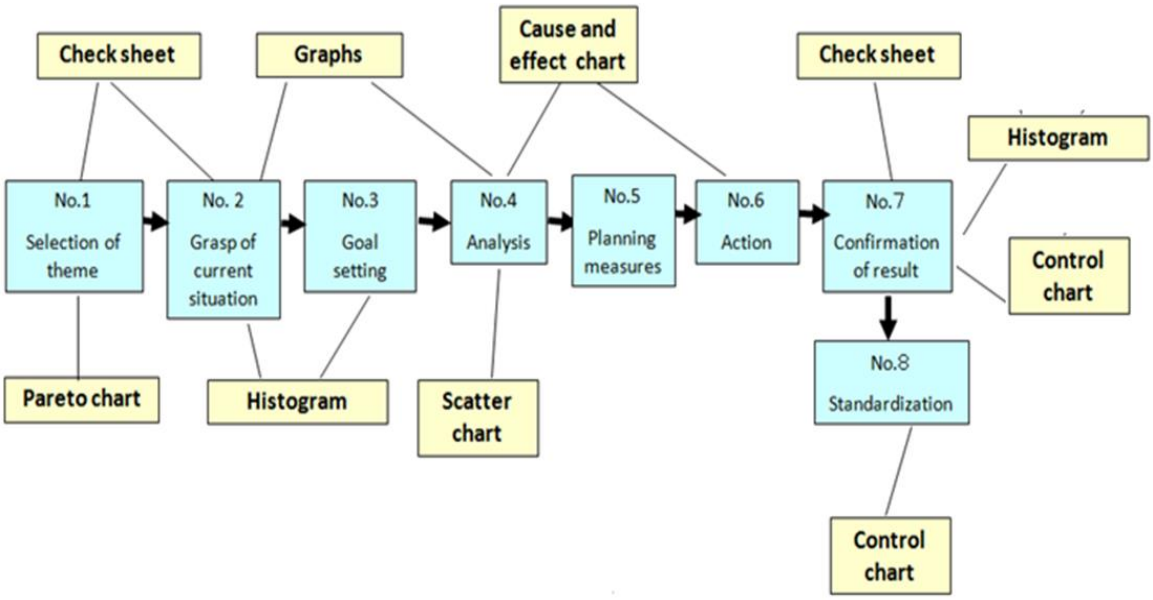


Fig 2.6 Where to use 7-QC tools in the QC Story

- **QC techniques**

  - ✓ **Brain storming**

Brainstorming is a method of generating ideas and sharing knowledge to solve a particular commercial or technical problem, in which participants are encouraged to think without interruption. Brainstorming is a group activity where each participant shares their ideas as soon as they come to mind. This technique provides free environment to present individual ideas, without attracting criticism from any one. Every generated idea is recorded and considered as solution to a problem.

  - ✓ **Why analysis**

The 5 Whys technique involves asking why a problem occurred five times in succession. After each answer, you ask why again, digging into the next layer of the underlying cause. It's important to note that five is just a guideline—you may need to ask even more times.

The process for using the 5 Whys can be broken down into the following steps:

- Create your team: Gathering multiple perspectives is critical to overcoming bias.
- Define the problem: To find the root cause, you first need an accurate problem statement.
- Ask why: Ask at least five times, possibly more.
- Evaluate possible causes: The answer to each why may have multiple potential subcauses, resulting in several possible root causes to evaluate.

  - ✓ **What if analysis**

What-if analysis is a data in tensive simulation whose goal is to inspect the behavior of a complex system, such as the corporate business or a part of it, under some given hypotheses called scenarios. In particular, what-if analysis measures how changes in a set of independent variables impact a set of dependent variables with reference to a given simulation model; such a model is a simplified representation of the business, tuned according to the historical corporate data. In practice, formulating a scenario enables the building of a hypothetical world that the analyst can then query and navigate.

- ✓ **5W1H**

The 5W1H is a questioning approach and a problem-solving method that answers all the basic elements within a problem which are what, who, when, where, why, and how. It aims to view ideas from various perspectives and gain n an in-depth understanding of a specific situation. This method is commonly utilized as a continuous process-improvement technique in an organization.

The 5W1H, also known as the Kipling method—is a set of questions used by Rudyard Kipling to extensively answer existing questions and trigger ideas that could contribute to the resolution of a problem. The concept was eventually incorporated into business practices to eliminate mistakes, increase efficiency, and streamline processes.

The Kipling method is similar to other process improvement methods such as the root cause analysis, the 5S Lean, and the PDCA cycle.

2.4 Identifying and listing all possible problems related to kaizen elements on Visual Management Board/Kaizen Board

Kaizen board is a bulletin board set up at a workplace or in a publicly accessible place in the factory or the company in order to disseminate information about the Kaizen activities at the workplace and the company. Information put up on the board includes various Kaizen-related news and announcements, either company-wide one or particular workplace related. A summary of QC Circle activity result can be posted. It is a means of management -employee communication.

Every working team or KPT has to prepare and use a Kaizen board. This encourages for the teams to work “as independent as possible” and transform their ideas to improvements. As long as every team uses a Kaizen board, it becomes also easy for the management to be informed at any time, just by walking around and checking the information on the board. In general a Kaizen board is important for:

- Continuous Kaizen activity in a company or organization.
- Participation of all employees during Kaizen activity through Suggestion system.

- Employees including management to know about Kaizen performance in their work area or organization.
- Employees and management to know about production plans and performance.

The size of a Kaizen board should be 2 times a flip chart paper. It has four corners or parts depending on the information displayed.

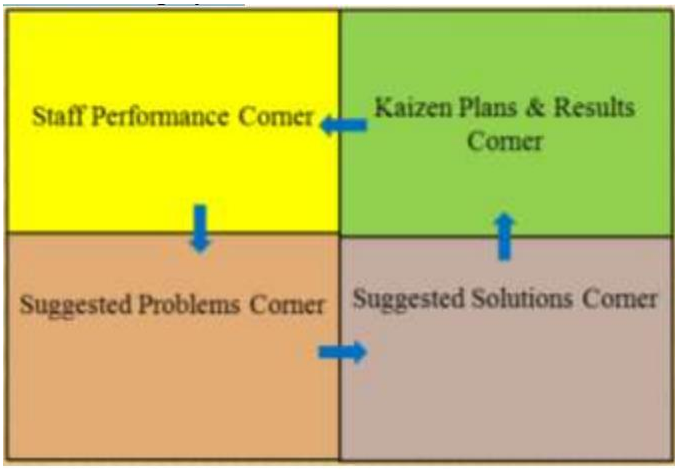


Fig 2.7 kaizen board

- The "staff performance corner" shows the actual performance of the staff and the gabs and training needs. The staff performance can be shown on the Kaizen board using different colors such as red for low performer, blue for average performer, and green for best performer.

- The "Kaizen plans & results corner" shows the results generated from implementing Kaizen activities. Improvement graphs can be displayed and should be updated regularly at least on weekly basis. If the results are below the planned target, the team has to discuss and find the root cause and implement solution.

- The "suggested problems corner" is the place where every team member's idea or identified problems are posted. The posted problems have to be discussed and solved by the teams and the solutions should be displayed on the next corner i.e. "suggested solutions corner".

- The “suggested solutions corner” displays the solutions suggested for known problems. And the solution ideas have to be implemented and the results achieved have to be shown on the “Kaizen results corner”.

2.5 Using tools and techniques to draw and analyze current situation of the work place

- **Process flow**

Coffee processing refers to the way that a seed is removed from a coffee cherry. Like any other pitted fruit, coffee cherries have a seed, pulp, mucilage around the seed, and a protective skin. There are various methods to remove the seed from the cherry, and these methods affect the seed's flavor as it gets roasted and turned into a coffee bean—this flavor sticks around till the final brew.

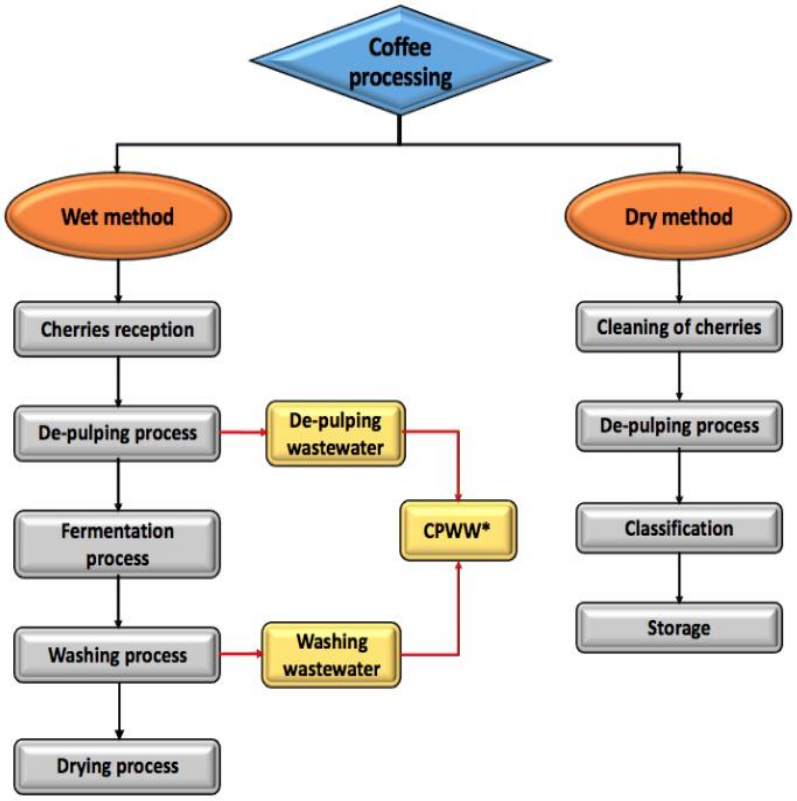


Fig 2.8 Coffee processing

- **5S**

5S is a system to reduce waste and optimize productivity through maintaining an orderly workplace and using visual cues to achieve more consistent operational results. Implementation of this method "cleans up" and organizes the workplace basically in its existing configuration, and it is typically the first lean method which organizations implement.

The 5S pillars, Sort (Seiri), Set in Order (Seiton), Shine (Seiso), Standardize (Seiketsu), and Sustain (Shitsuke), provide a methodology for organizing, cleaning, developing, and sustaining a productive work environment.

- **Layout improvement**

Is to plan the placement of machineries, raw materials, workers, etc. In order to produce raw materials, parts or products economically. When the layout of a shop floor is decided, it is necessary to plan considering production conditions and environmental conditions appropriately. Layout improvement is important technique to avoid" Muda, Mura and Muri" due to placement in production activities.

- **Brainstorming**

Brainstorming can be defined as the methodology used to encourage every individual in the KPT to express freely their opinions or give ideas in an open discussion. Brainstorming can be used to list down all the problems faced by an organization, their causes and the potential effects if a certain suggestion is implemented. To ensure the success of the brainstorming process, it is important for the KPT to follow the following rules:

- ✓ The subject for brainstorming should be clear and accurate. For example, members may brainstorm to identify the causes and reasons why a certain task cannot be completed on schedule.
- ✓ Each member will give only one opinion / idea at each turn regardless of the number of ideas he / she may have.
- ✓ A tension-free atmosphere must be maintained to encourage free expression of ideas.

- ✓ Every idea expressed should be written on the black / white board, flip chart or noted down by a secretary.
- ✓ At the end of the brainstorming session, all the ideas expressed should be evaluated one by one and short-listed.
- ✓ Voting is used to list the ideas according to priority. The prioritization is based on the number of votes received for each idea.

- **Andon**

Is an indicator informing team leaders and supervisors of the current workshop situation with color boards, flash lights, and automated announcement. Types of Andon

- ✓ Calling “Andon” -Used for requesting parts.
- ✓ Warning “Andon” -Used to inform occurrence of irregularities on the lines.
- ✓ Progress “Andon” -Used to identify the progress of operation on the lines with a short Takt Time.

- **U-line**

Is a layout in which the inlet and outlet are positioned in the same direction to avoid walking back for a single operator.

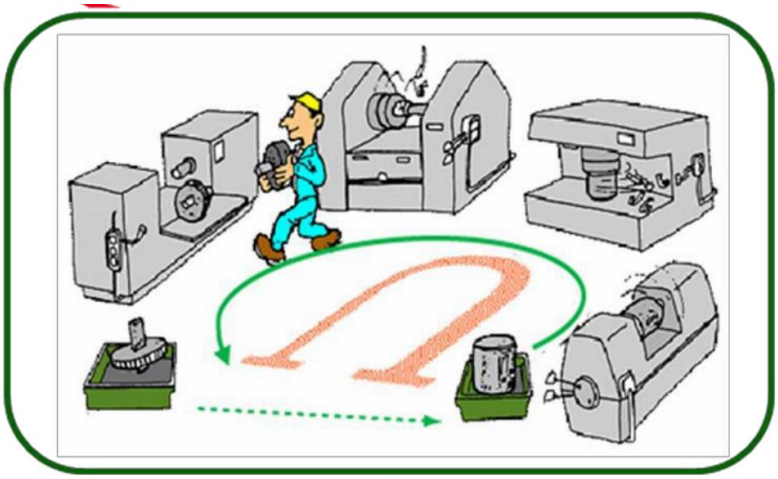


Fig 2.9 u-line layout

- **In-lining**

Is a way to make the production lines simple and effective by integrating the parts processing into the main line in the unit production.

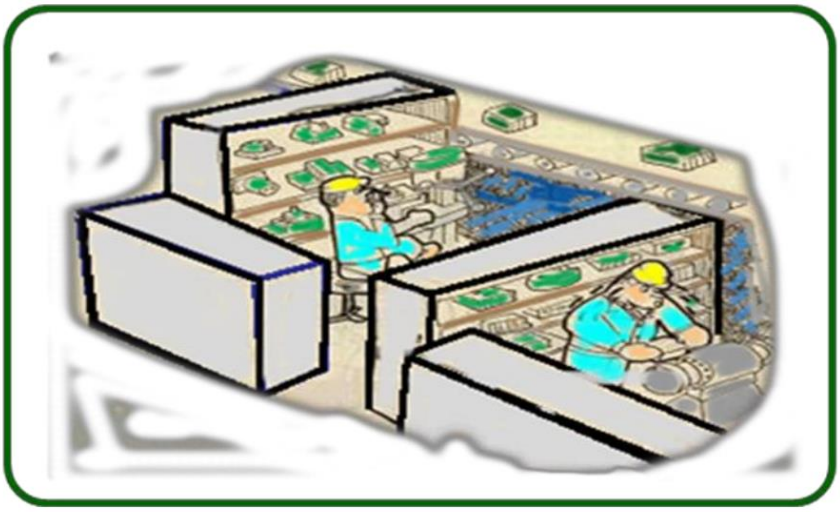


Fig 2.9.1 in lining

- **Unification**

Even if a flowing line cannot be formed, odd operations can be combined together in a place into an operator‟s work

- **Multi-process handling &Multi-skilled operators**
  - ✓ Multi-process handling- means that a single operator manages multiple machines and processes in product processing and assembling. This is the primary factor for constructing lines by a small number of operators.
  - ✓ A multi-skilled Operator- can deal with several machines or processes as described above. The supervisor can make a flexible placement of operators when someone within the same team or section is absent.

- **A.B. control (Two-point control)**

Is a devised automatic control function. It controls the machine movement when they come to start or stop working depending upon the number of work pieces piled up between the preceding process and the following process.

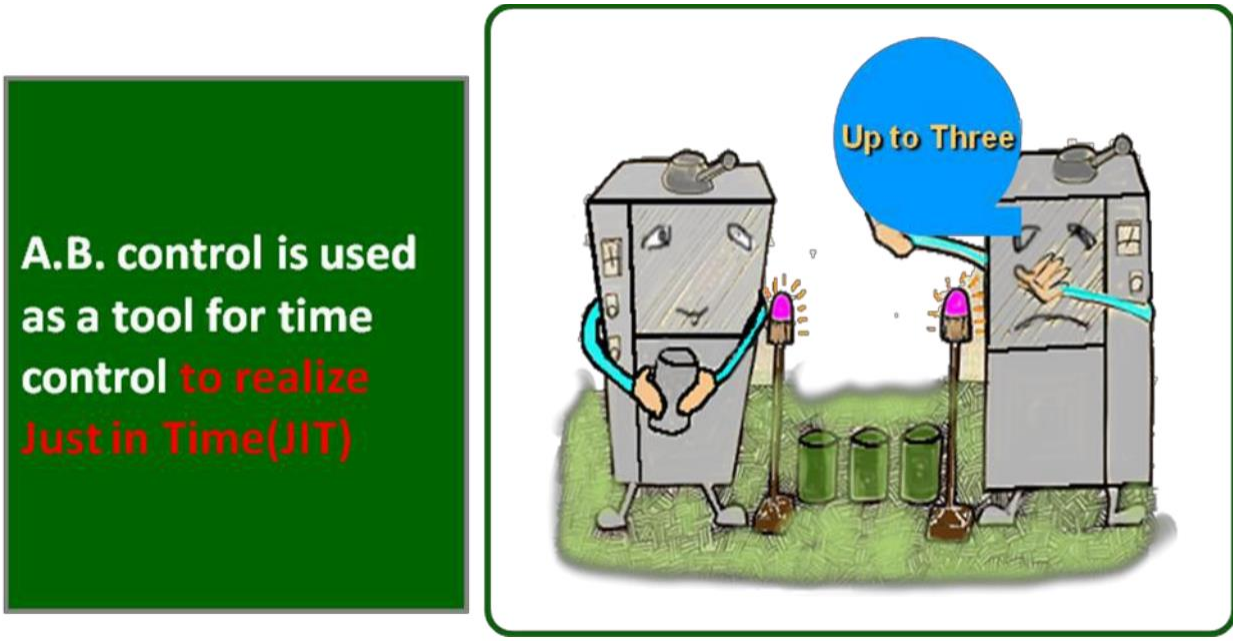


Fig 2.9.2 A.B. control (Two-point control)

- **Cell production line**

This is a production line that a single operator manages all the machining or assembly operations in unit production.

Advantages

- ✓ Quality assurance can be ensured.
- ✓ The production output or efficiency of each operator can be clarified.
- ✓ Operators can obtain a feeling of work achievement.

- **TPM (Total Productive Maintenance)**

Total means All individuals in the organization working together. Productive means Production of goods that meet or exceed customers' expectations. Maintenance means Keeping equipment and plant in good condition at all times. What is Total Productive Maintenance (TPM)?

It can be considered as the medical science of machines. Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction. TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

Types of maintenance

- ✓ **Breakdown maintenance**

This refers to the maintenance strategy, where repair is done after the equipment failure/stoppage or upon occurrence of severe performance decline. This concept has the disadvantage of unplanned stoppages, excessive damage, spare parts problems, high repair costs, excessive waiting and maintenance time and high trouble shooting problems.

- ✓ **Preventive maintenance**

PM comprises of maintenance activities that are undertaken after a specified period of time or amount of machine use. This type of maintenance relies on the estimated probability that the equipment will breakdown or experience deterioration in performance in the specified interval. The preventive work undertaken may include equipment lubrication, cleaning, parts replacement, tightening, and adjustment. The production equipment may also be inspected for signs of deterioration during preventive maintenance work.

It is further divided into periodic maintenance and predictive maintenance. Just like human life is extended by preventive medicine, the equipment service life can be prolonged by doing preventive maintenance.

- Periodic maintenance (Time based maintenance - TBM)

Time based maintenance consists of periodically inspecting, servicing and cleaning equipment and replacing parts to prevent sudden failure and process problems.

- Predictive maintenance

This is a method in which the service life of important part is predicted based on inspection or diagnosis, in order to use the parts to the limit of their service life.

Compared to periodic maintenance, predictive maintenance is condition based maintenance. It manages trend values, by measuring and analyzing data about deterioration and employs a surveillance system, designed to monitor conditions through an on-line system.

✓ **Corrective maintenance**

This is a system in which the concept to prevent equipment failures is further expanded to be applied to the improvement of equipment so that the equipment failure can be eliminated (improving the reliability) and the equipment can be easily maintained (improving equipment maintainability).

- The primary difference between corrective and preventive maintenance is that a problem must exist before corrective actions are taken.

- The purpose of corrective maintenance is improving equipment reliability, maintainability, and safety; design weaknesses (material, shapes); existing equipment undergoes structural reform; to reduce deterioration and failures, and to aim at maintenance-free equipment.

- Maintenance information, obtained from CM, is useful for maintenance prevention for the next equipment and improvement of existing manufacturing facilities. It is important to form setups to provide the feedback of maintenance information.

- ✓ **Maintenance prevention**

It indicates the design of a new equipment. Weakness of current machines are sufficiently studied (on site information leading to failure prevention, easier maintenance and prevents of defects, safety and ease of manufacturing) and are incorporated before commissioning a new equipment.

2.6 Identifying and measuring wastes/MUDA based on relevant procedures.

Some of the benefits of identifying and eliminating waste to the company Benefits to the company include:

- Cutting the hidden costs of production-It is estimated that 80 percent of production activities and associated costs are non-value-added, or waste.When factories begin to focus on identifying and eliminating waste, the impact on the bottom line is astronomical.

- Increased customer satisfaction- Customer satisfaction rises as a direct result of implementing lean production. When waste is eliminated from production, deliveries occur on time and product quality goes up.

Plan and procedure for Waste/Muda Identification

It is not easy to find waste when you look at the production line or the warehouse or an **operation**. If you have never been involved in improvement activities you will find it even **harder** to discover waste that may be right in front of you. Waste is everywhere, in every **operation**; it is so common and you are so used to it that it is hard to see.

The steps to effective waste identification are:

- **Make waste visible**

Waste can be made visible in several ways such as:

- ✓ Shop layout analysis
- ✓ Process flow analysis
- ✓ Take photos/video Etc…

Shop layout analysis and Process flow analysis

There are several tools you can use to analyze current conditions of shop layout and process flow quickly and effectively.

The Arrow Diagram

The Arrow Diagram focuses on the flow of goods to discover waste. (Arrow diagrams have recently been renamed value stream maps.) We include here a simple method for creating an arrow diagram to get a good understanding of your production process and to see where the waste exists in your workplace.

The factors to be identified in your arrow diagram are retention, conveyance, processing and inspection. There are specific symbols you use to indicate each of these aspects of a production process.

The Summary Chart of Flow Analysis

Now that you have done an arrow diagram, write up a Summary Chart of Flow Analysis. Count the symbols you used on the arrow diagram to show totals for the number of retention and conveyance and inspection points. Also note the total amount of goods retained and the total conveyance distance. Keep track of changes after improvements are made using the same chart to compare.

With these tools in hand, brainstorm improvement ideas. In brainstorming, you must let ideas flow freely. One unlikely suggestion may trigger a good idea. Select and further analyze good ideas. The arrow diagram and the flow analysis should not take you too long or keep you away from your observation of the factory floor. Draw the arrow diagram while watching the production of the product on the floor and use it to help you see the waste there. Keep it relevant and keep looking. The whole purpose of using this tool and the others discussed is to help you gain a “sixth sense” for waste. You will start to see the waste at some point as you do this, and when you do you will never be able to not see it again.

The Operations Analysis Table

The Operations Analysis Table focuses on people's actions. As discussed in the previous topic, not everything you do adds value. Operations analysis tables help you identify the waste in your own operations. See the table below. Either have your supervisor fill in the table or do it as a team, filling it in for each other. It is hard to do it for yourself because you can't watch yourself the same way someone else can. Eventually, you will develop an awareness of your own motion and be able to identify, ever more precisely, when you are not adding value. But in the beginning someone else must observe you and fill in the table

- ✓ **Taking photos/Video**

Taking photos and videos and analyzing are also valuable techniques to find waste.

- **Be conscious of the waste**

When something is denied as waste, it also cannot be stopped.

- **Be accountable for the waste**

When one refuses to accept responsibility for the waste, then he/she will not eliminate it.

- **Measure the waste.**

When the waste is not measured, people may think it is small or insignificant and therefore will not be motivated to stop it. What is not measured is not improved. Appreciate its size and magnitude.

- ✓ Do time study by work element
- ✓ Measure Travel distance
- ✓ Measure Total steps
- ✓ Make list of items/products, who produces them and who uses them & those in warehouses, storages etc.

Tools and Equipment for Waste/Muda Identification

- ✓ Tape/Meter
- ✓ Stop watch
- ✓ Photo Camera
- ✓ Video Camera
- ✓ Calculator

Use of Tools and Equipment

Tape/Meter - is used to measure distances or lengths.

Stop watch – is used to measure operation/processing or waiting/idling times.

Photo Camera – may be necessary to take pictures, such as shop layout, for analysis.

Video Camera – may be necessary to record video of each work element to study and identify wastes, such as motion, processing, waiting, etc.

Calculator – required making arithmetic calculations.

2.7 Reporting identified and measured wastes are to relevant personnel

Overproduction Waste-finding Checklist **Process:** **Date:**					
	Description of waste				
1	No production schedule of control boards.	yes	No	magnitude	Causes and/or Improvement plans
2	No leveling of production schedule.				
3	Productions not in synchronize with production schedule.				
4	Items missing				
5	Defective goods produced.				
6	Equipment breakdowns.				
7	Too much manual assistance required.				
8	Machines have too much capacity.				
9	Lots are grouped in to batches.				
10	Using “Push” production.				
11	Caravan style operations.				
12	Not balanced with the next process.				
	Total				

Inventory Waste-finding Checklist

Process: **Date:**

	Description of waste	yes	no	magnitude	Causes and/or Improvement plans
1	Lots of inventory on shelves and floors.				
2	Shelf and floor storage takes up lots of space.				
3	Inventory stacks block walkways.				
4	In-process inventory accumulates within individual operation.				
5	In-process inventory is stacked up between operators.				
6	In-process inventory is stacked up between processes.				
7	Impossible to visually determine quantities of in-process inventory.				
	Total				

Motion Waste-finding Checklist					
Process:				**Date:**	
Description of waste		yes	no	Magnitude	Causes and/or Improvement plans
1	Walking				
2	Turning around				
3	Leaning sideways				
4	Bending over				
5	Too wide arm movements.				
6	Unnecessary wrist movements.				
7	Left or right hand is idle.				
8	Poorly utilized idle time.				
9	Wasteful work piece set up/removal.				
10	Non-standardized repetition of operations.				
11	Worker operates using different motions each time.				
12	Operations divided into too many little segments.				
	Total				

Conveyance/Transportation Waste-finding Checklist **Process:** **Date:**					
Description of waste		yes	no	Magnitude	Causes and/or Improvement plans
1	Pile up during conveyance.				
2	Change of conveyance devices in mid transfer.				
3	Previous and/or next process is on another floor.				
4	Conveyance requires manual assistance.				
5	Conveyance distance is too long.				
	Total				

Waiting/Idle Time Waste-finding Checklist **Process:** **Date:**					
Description of waste		Yes	no	magnitude	Causes and/or Improvement plans
1	Work piece delay from previous process.				
2	Machine busy status.				
3	Missing item(s).				
4	Lack of balance with previous process.				
5	Lack of planning				
6	Lack of standard operations.				
7	Worker absence.				
8	Too many workers (more than two).				
	Total				

Self-check 2	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Part 1. True or false

1. The fishbone diagram is a quality management tool used to identify causes leading to an effect.
2. The fishbone diagram is named after its resemblance to a fishbone.
3. The causes and sub-causes in a fishbone diagram are typically grouped into six main categories.
4. Check sheets are used to record and tally the frequency of specific events during a data collection period.
5. Control charts are used to study how processes have changed over time and determine if they are under control or affected by special causes of variation.

II. Short answer

1. Briefly discus Causes and effects of MUDA.
2. Distinguish the statistical tools and techniques used in all possible problems related to the process /Kaizen elements?
3. What are Visual Management Board/Kaizen Board and elements?
4. Discus Tools and techniques used to draw and analyze current situation of the work place.

LG #42	LO#3- Analyze causes of a problem.

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Listing all possible causes of a problem
- Analyzing cause relationships using 4M1E.
- Identifying causes of the problems
- Selecting the root cause which most directly related to the problem
- Listing all possible ways using creative idea generation to eliminate the most critical root cause.
- Testing and evaluating the suggested solutions carefully for potential complications
- Preparing detailed summaries of the action plan to implement the suggested solution

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Listing all possible causes of a problem
- Analyzing cause relationships using 4M1E.
- Identifying causes of the problems
- Selecting the root cause which most directly related to the problem
- Listing all possible ways using creative idea generation to eliminate the most critical root cause.
- Testing and evaluating the suggested solutions carefully for potential complications
- Preparing detailed summaries of the action plan to implement the suggested solution

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets

6. Do the “LAP test”

Information Sheet 3

3.1 Listing all possible causes of a problem

The causes of Muda problems are:

- waste of overproduction (largest waste)
- Waste of time on hand (waiting)
- Waste of transportation.
- Waste of processing itself.
- Waste of stock at hand.
- Waste of movement.
- Waste of making defective products

3.2 Analyzing cause relationships using 4M1E

Cause and effect analysis concerned Man, Machine, Material, Method and Environment (4M1E) which were applied in this process. These factors were used for further analyzing the relationship between cause and related effect using the cause-and-effect matrix.

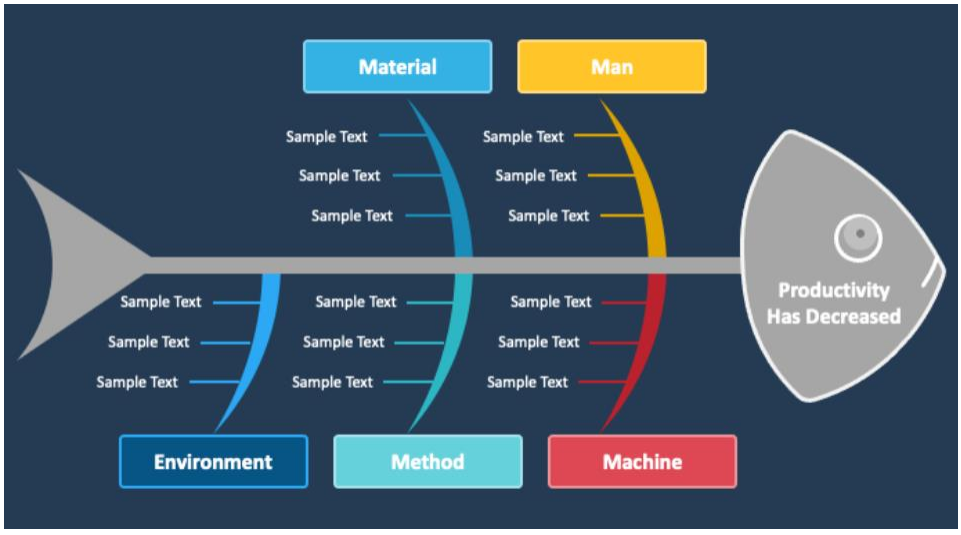


Fig 3.1 Cause and effect analysis

3.3 Identifying causes of the problems

The identification and selection of appropriate options for addressing a problem should be guided by an understanding of its cause. Such insights may also lead to the original framing choice being changed. Often the causes of health systems problems are complex and uncertain and it may be more appropriate to consider underlying factors without attributing causation. The process of clarifying the cause or underlying factors is unlikely to be simple or linear. And although it may be possible to reduce uncertainty about the cause, it may be equally or more important to clarify uncertainty about the cause. Strategies for clarifying the cause of health system problems include using either broader or more specific frameworks, brainstorming, reviewing relevant research evidence, and interviews with key informants.

3.4 Selecting the root cause which most directly related to the problem

Problems can have a single underlying cause. One very effective approach to effective problem solving is Root Cause Analysis (RCA). RCA is one of the most widely used tools/techniques for detecting issues.

The power of Root Cause Analysis lies in its ability to analyze the situation and pinpoint the root of the problems – rather than treating the symptoms. This systematic approach focuses on identifying both, active problems and latent errors, which cause adverse situations and events. It focuses on identifying the main cause of the problem.

The root cause of all problems is ignorance.”

And to be clear, “problem solving” and “improvement” are learning processes. If you didn’t learn, you didn't solve the problem, and you didn't improve anything.

3.5 Listing all possible ways using creative idea generation to eliminate the most critical root cause

- Brainstorming
- Exploring and examining ideas in varied ways
- Elaborating and extrapolating
- Conceptualizing

3.6 Testing and evaluating the suggested solutions carefully for potential complications

Testing and evaluating the suggested solutions carefully for potential complications is an essential step in the problem-solving process. By subjecting the proposed remedies to rigorous examination, organizations can identify any unforeseen risks or negative consequences. Thorough testing allows for the detection and mitigation of potential complications before implementing the solutions, ensuring a smoother transition and minimizing disruptions. This proactive approach helps organizations make informed decisions based on empirical evidence, enabling them to choose the most effective and sustainable course of action.

3.7 Preparing detailed summaries of the action plan to implement the suggested solution

An action plan consists of seven steps: setting objectives, assessing the objectives, identifying action required to meet the objectives, working out how to evaluate the activity, agreeing a timeframe for action, identifying resources (human, financial and technical), finalizing the plan, and evaluating the results.

I. Set objectives

You need to identify clear objectives that will guide your work to achieve the resource centers aims. Objectives need to be achievable - do not be over-ambitious. They need to be measurable (for example, a certain number of activities carried out within a certain period), so that you can know whether you have achieved them.

II. **Assess the objectives**

Assessment helps to determine whether or not the objective is appropriate. It may result in confirming the objective, abandoning it or revising it. Ask yourself:

- Is the objective compatible with the resource center's aims and objectives?
- Are the necessary resources (funds, equipment, staff) available to reach this objective? If not, are they obtainable?
- What problems might arise in working to achieve this objective?
- Example of resources needed to carry out the objective: staff time, relevant materials in the resource center or obtainable from elsewhere, stationery, photocopier, postage.

III. Identify action required to achieve the objective

A series of tasks needs to be identified for the objectives to be achieved. List these as steps.

Ask yourself:

- What tasks are necessary, in what order, to meet the objective

Example:

- ✓ Plan the content of the information pack and decide how to distribute the packs, in consultation with other staff and users.
- ✓ Calculate costs and staff time, and make sure that funds and time are available.
- ✓ Allocate responsibilities.
- ✓ Gather information for the pack (search resource center, contact other organizations).
- ✓ Request permission from publishers to photocopy material.
- ✓ Photocopy material and prepare packs.
- ✓ Distribute packs.

IV. Work out how to evaluate the activity

Plans for finding out how far the activity has achieved its objectives need to be built into the action plan. Ask yourself:

- How will we know whether we have achieved our objectives
- Example:
- Contact five clinics to see whether they have received the packs.
- Include an evaluation form in the pack, asking health workers whether the information has improved their knowledge, how they have used the information, and how future packs could be improved. Assess the feedback from the forms.

Then incorporate plans for evaluation into your action plan.

- Example (showing plans for evaluation in bold italics):
  - ✓ Plan the content of the information pack, including evaluation forms, and decide how to distribute the packs, in consultation with other staff and users.
  - ✓ Calculate costs and staff time, and make sure that funds and time are available.
  - ✓ Allocate responsibilities.
  - ✓ Gather information for the pack (search resource centre, contact other organisations).
  - ✓ Request permission from publishers to photocopy material.
  - ✓ Prepare evaluation forms.
  - ✓ Photocopy material, prepare packs.
  - ✓ Distribute packs.
  - ✓ Contact clinics to see if they have received packs.
  - ✓ Revise plans for distributing packs if they have not reached some clinics.
  - ✓ Assess the feedback from the evaluation forms and use it to plan future work.

V. Agree a time frame

As you identify each task, work out how long it will take and when it needs to be done. This will help you to see whether your action plan is on schedule or whether you need to modify the schedule.

VI. Assess the action plan

Ask yourself:

- How will you know whether the individual tasks have been achieved?
- Have you allowed for possible interruptions?
- Have you tried to do too much or too little?

An action plan must be realistic if it is to work. It is easy to over-estimate what you can do, leading to disappointment and failure. For example:

- Leaflets that you had planned to include in the pack may have run out and need to be reprinted. Can you substitute something else, or will you need to arrange for them to be reprinted before you can finish preparing the packs?
- The member of staff preparing the pack will take annual leave for six weeks during the period in which the pack was planned to be prepared. Can you re-schedule the work, or can someone else do it?

VII. Finalize the action plan

Finalizing the action plan is a crucial stage in the problem-solving process. It involves consolidating all the gathered information, analyzing the proposed solutions, and selecting the most viable course of action. This step requires careful consideration of various factors, such as feasibility, resource allocation, and alignment with organizational goals. The action plan should outline specific tasks, responsibilities, timelines, and milestones to ensure clarity and accountability.

Self-check 3	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Part I.

True/False Questions

1. Cause and effect analysis involves analyzing the relationships between Man, Machine, Material, Method, and Environment.
2. Root Cause Analysis focuses on identifying the symptoms of a problem rather than its underlying causes.
3. Testing and evaluating solutions for potential complications is an optional step in the problem-solving process.
4. Action plans should include detailed summaries to implement suggested solutions.
5. Brainstorming is a creative idea generation technique to eliminate the most critical root cause.

Part II.

Choose the best answer

1. Which of the following is NOT one of the factors analyzed in cause and effect analysis?

a) Man

b) Machine

c) Money

d) Method

2. Root Cause Analysis aims to:

a) Identify and treat symptoms of a problem

b) Focus on latent errors rather than active problems

c) Pinpoint the main cause of a problem

d) Generate creative ideas to eliminate the root cause

3. What is the purpose of testing and evaluating suggested solutions?

a) To identify potential complications

b) To eliminate all possible root causes

c) To finalize the action plan

d) To brainstorm new ideas

3. Which step in the action plan involves setting measurable objectives?

a) Assessing the objectives

b) Identifying required actions

c) Finalizing the plan

d) Evaluating the results

4. Which technique is NOT used for creative idea generation in problem-solving?

a) Brainstorming

b) Exploring and examining ideas in varied ways

c) Elaborating and extrapolating

d) Conceptualizing

III. Short Answer

1. What is the purpose of cause and effect analysis in problem-solving?
2. Explain the concept of Root Cause Analysis and its significance in problem-solving.
3. Provide three strategies for clarifying the cause of health system problems.

LG #43	LO#4 - Eliminate MUDA and Assess effectiveness of the solution

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing and implementing plan of MUDA elimination by medium KPT members.
- Adopting necessary attitude and the ten basic principles for improvement to eliminate waste/MUDA.
- Using tools and techniques to eliminate wastes/MUDA based on the procedures and OHS.
- Reducing and eliminating wastes/MUDA with OHS and organizational *requirements*
- Identifying tangible and intangible results
- Comparing tangible results with targets using various types of diagrams
- Reporting improvements gained by elimination of waste/MUDA to relevant bodies.

This guide will also assist you to attain the learning outcomes stated in the cover page.

Specifically, upon completion of this learning guide, you will be able to:

- Preparing and implementing plan of MUDA elimination by medium KPT members.
- Adopting necessary attitude and the ten basic principles for improvement to eliminate waste/MUDA.
- Using tools and techniques to eliminate wastes/MUDA based on the procedures and OHS.
- Reducing and eliminating wastes/MUDA with OHS and organizational requirements
- Identifying tangible and intangible results
- Comparing tangible results with targets using various types of diagrams
- Reporting improvements gained by elimination of waste/MUDA to relevant bodies.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.

7. Read the information written in the information Sheets 8. Accomplish the Self-checks 9. Perform Operation Sheets 10. Do the “LAP test”

Information Sheet 4

4.1 Preparing and implementing plan of MUDA elimination by medium KPT members.

KPT (Key Performance Team) members involve utilizing various tools and techniques from the field of Industrial Engineering (IE). The medium KPT members, who are part of a cross-functional team, can apply these tools and techniques to identify and eliminate waste effectively. Some of the commonly used tools and techniques include 5S, 4M, 4P, PDCA cycle, and the basics of IE.

5S: 5S is a systematic approach for workplace organization and visual management. It consists of five steps: Sort, Set in Order, Shine, Standardize, and Sustain. By applying 5S, the team can eliminate unnecessary items, arrange essential items in a logical order, maintain cleanliness and tidiness, establish standardized work processes, and sustain the improvements over time. This tool helps create a safe, organized, and efficient work environment, reducing waste and improving productivity.

4M (Machine, Method, Material, and Man): The 4M analysis is a tool used to identify the causes of waste by examining the four key elements that contribute to a process: Machine, Method, Material, and Man. The team analyzes each element to identify potential sources of waste and inefficiency. For example, they evaluate the machine's performance and maintenance, assess the method or process used, examine the quality and availability of materials, and consider the skills and training of the workforce. By addressing issues within these elements, the team can eliminate waste and improve overall process performance.

4P (Policy, Procedures, People, and Plant): The 4P analysis focuses on assessing the organizational aspects that contribute to waste. It involves examining the Policy (organizational policies and guidelines), Procedures (standard operating procedures and workflow), People (skills, training, and motivation of employees), and Plant (physical layout and infrastructure). By identifying inefficiencies, bottlenecks, and gaps in these areas, the

team can develop strategies to eliminate waste and improve the overall effectiveness of the organization.

PDCA Cycle: The PDCA (Plan-Do-Check-Act) cycle is a problem-solving and continuous improvement framework. It involves four steps: Plan (identify the problem and plan for improvement), Do (implement the plan on a small scale), Check (evaluate the results and compare them to the expected outcomes), and Act (standardize the successful changes and continue improvement efforts). The PDCA cycle provides a structured approach for iterative problem-solving and continuous improvement, ensuring that waste elimination efforts are systematically executed and refined over time.

Basics of IE tools and techniques: The medium KPT members should have a fundamental understanding of various IE tools and techniques. These may include process flowcharting, value stream mapping, time and motion studies, bottleneck analysis, root cause analysis, statistical process control (SPC), lean principles, and other relevant tools. These tools and techniques help the team analyze processes, identify waste, determine root causes, measure performance, and implement improvements.

4.2 Adopting necessary attitude and the ten basic principles for improvement to eliminate waste/MUDA

To successfully eliminate waste and drive improvement, adopting the necessary attitude and embracing the ten basic principles is crucial. These principles provide a mindset and approach that can foster a culture of continuous improvement within an organization. While not limited to these, the following are ten basic principles that can guide the improvement process:

- Throw out all of your fixed ideas about how to do things: This principle emphasizes the need to challenge conventional thinking and be open to new ideas and approaches. By letting go of preconceived notions, individuals are more likely to explore innovative solutions and break free from traditional ways of working.

- Think of how the new method will work, not how it won: Instead of fixating on who came up with an idea or solution, this principle focuses on evaluating the effectiveness and applicability of a new method. The emphasis is on achieving positive outcomes rather than clinging to ego or personal interests.

- Don’t accept excuses; totally deny the status quo: This principle encourages individuals to reject complacency and resist the temptation to accept excuses for inefficiencies or waste. By denying the status quo and pushing for improvement, individuals can challenge the existing norms and drive positive change.

- Don’t seek perfection; a 50 percent implementation rate is fine as long as it’s done on the spot: Perfectionism can often hinder progress and delay improvements. This principle emphasizes the importance of taking immediate action and implementing changes even if they are not perfect. Incremental improvements made in a timely manner are valuable and can accumulate over time.

- Correct mistakes the moment they are found: Promptly addressing and rectifying mistakes is vital for continuous improvement. This principle emphasizes the need to acknowledge and learn from errors, treating them as opportunities for growth rather than dwelling on blame or punishment.

- Don’t spend a lot of money on improvements: This principle encourages individuals to focus on finding low-cost or no-cost solutions. It promotes resourcefulness and creativity to identify improvements without excessive financial investments. By seeking simple and cost-effective solutions, organizations can drive sustainable improvement without straining their budgets.

- Problems give you a chance to use your brain: Viewing problems as opportunities rather than obstacles is crucial for improvement. This principle encourages individuals to approach challenges with a problem-solving mindset, leveraging their knowledge, experience, and creativity to identify and implement effective solutions.

- Ask "why?" at least five times until you find the ultimate cause: The "5 Whys" technique is a powerful tool for root cause analysis. This principle emphasizes the importance of digging deep to uncover the underlying causes of a problem by repeatedly asking "why?" This helps address the root cause rather than merely treating symptoms.

- Ten people's ideas are better than one person's: Collaboration and teamwork are essential for driving improvement. This principle emphasizes the value of diverse perspectives and collective intelligence. By involving multiple individuals and encouraging idea sharing, organizations can leverage a wider range of insights and experiences to generate more effective solutions.

- Improvement knows no limits: This principle highlights the limitless nature of improvement. It encourages individuals to continuously seek opportunities for improvement, regardless of the current level of performance. By embracing a mindset of continuous improvement, organizations can strive for excellence and maintain a competitive edge.

4.3 Using tools and techniques to eliminate wastes/MUDA based on the procedures and OHS

When using tools and techniques to eliminate waste (MUDA), it is crucial to adhere to procedures and Occupational Health and Safety (OHS) requirements. These requirements ensure that waste elimination efforts are carried out in a safe and compliant manner. Some key OHS requirements include:

- Compliance with legislation, regulations, codes of practice, and enterprise safety policies and procedures: Organizations must align their waste elimination activities with relevant laws, regulations, and industry standards. This includes procedures specific to the enterprise. Compliance ensures that waste elimination efforts following established codes of practice and the safety policies and are conducted within the legal framework and in accordance with best practices.

- Personal Protective Equipment (PPE): PPE plays a critical role in ensuring the safety of individuals involved in waste elimination activities. OHS requirements specify the types of PPE that should be provided based on the specific hazards present. These requirements may include wearing protective clothing, gloves, safety glasses, respiratory protection, or other necessary equipment. It is essential to adhere to the prescribed PPE and follow workplace policies and practices regarding its use.

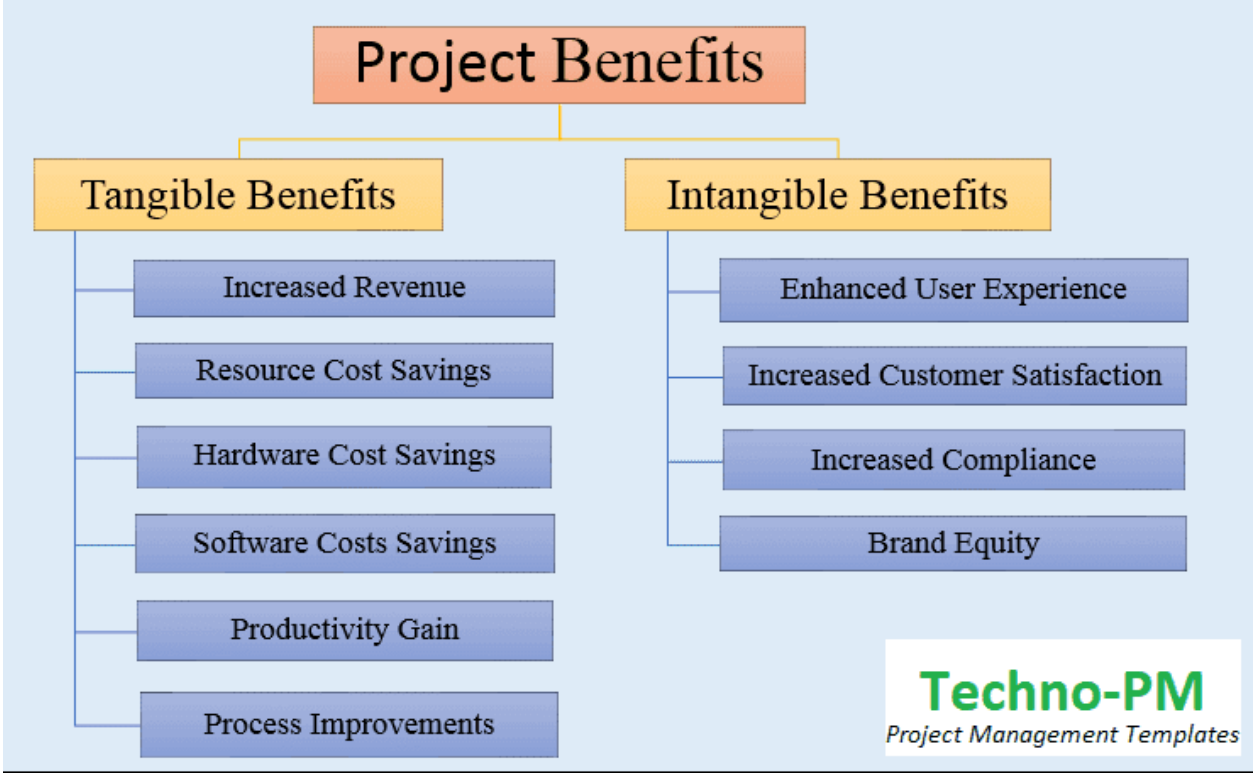
- Safe operating procedures: Safe operating procedures are vital for conducting waste elimination activities in a safe and controlled manner. These procedures should encompass a range of considerations, including operational risk assessment and treatments associated with workplace organization. Risk assessment helps identify potential hazards and their corresponding control measures, ensuring that waste elimination activities are executed with minimal risk to workers and the environment.

- Emergency procedures: Waste elimination activities should be accompanied by effective emergency procedures to handle unforeseen incidents. These procedures may include emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements, and site evacuation protocols. It is essential to document and communicate these procedures to all relevant personnel, ensuring that they are prepared to respond promptly and effectively in case of an emergency.

By integrating these OHS requirements into the waste elimination process, organizations prioritize the well-being and safety of their employees while striving for improved efficiency. It is important to regularly review and update OHS procedures to reflect any changes in legislation or regulations and to address emerging risks. Additionally, fostering a culture of safety awareness and providing adequate training on OHS requirements will help ensure that waste elimination activities are conducted in a manner that minimizes risks and maximizes positive outcomes.

4.4 Identifying tangible and intangible results

- Tangible assets are physical items owned by a company, such as a building, land, or computer equipment. Tangible assets are the main type of asset that companies use to produce their products and services.
- Intangible asset are don't physically exist, yet they have a monetary value because they represent potential revenue. A type of intangible asset is a copyright to a song. The record company that owns the copyright would get paid a royalty each time the song is played.



4.5 Comparing tangible results with targets using various types of diagrams

- Line graph: A line graph is useful for showing trends and changes over time. It consists of a series of data points connected by lines. Line graphs are commonly used to compare actual results with target values or to track progress over a specific period. The x-axis represents time or intervals, while the y-axis represents the measured values. Line graphs allow for easy identification of deviations from the target and provide a visual representation of the performance trend.

- Bar graph: A bar graph is ideal for comparing different categories or groups. It consists of rectangular bars that represent the values of each category. Bar graphs are often used to compare actual results with targets across different time periods, departments, or products/services. The length or height of each bar represents the value being measured. By comparing the heights of the bars, it is easy to identify variations from the targets and compare performance across different categories.

- Pie chart: A pie chart is a circular graph divided into slices to represent different categories or proportions. Each slice represents a portion of the whole, with the size of the slice corresponding to the percentage or proportion it represents. Pie charts are useful for comparing the contribution or distribution of different elements within a whole. They can be used to compare actual results with target percentages or to visualize the relative importance of various categories.

- Scatter diagrams: Scatter diagrams are used to analyze the relationship between two variables. They consist of plotted points on a graph, with one variable represented on the x-axis and the other on the y-axis. Scatter diagrams help identify patterns, correlations, or trends between the variables being compared. By comparing the plotted points with a line representing the target relationship, it becomes easier to assess the degree of deviation and identify areas for improvement.

- Affinity diagrams: Affinity diagrams are a visual tool used to organize and categorize large amounts of data or ideas. They are particularly useful when analyzing qualitative data or brainstorming sessions. Affinity diagrams help identify common themes, patterns, or relationships among data points or ideas. By grouping related items together, they provide a visual representation of the key factors influencing the performance and help in identifying areas for improvement.

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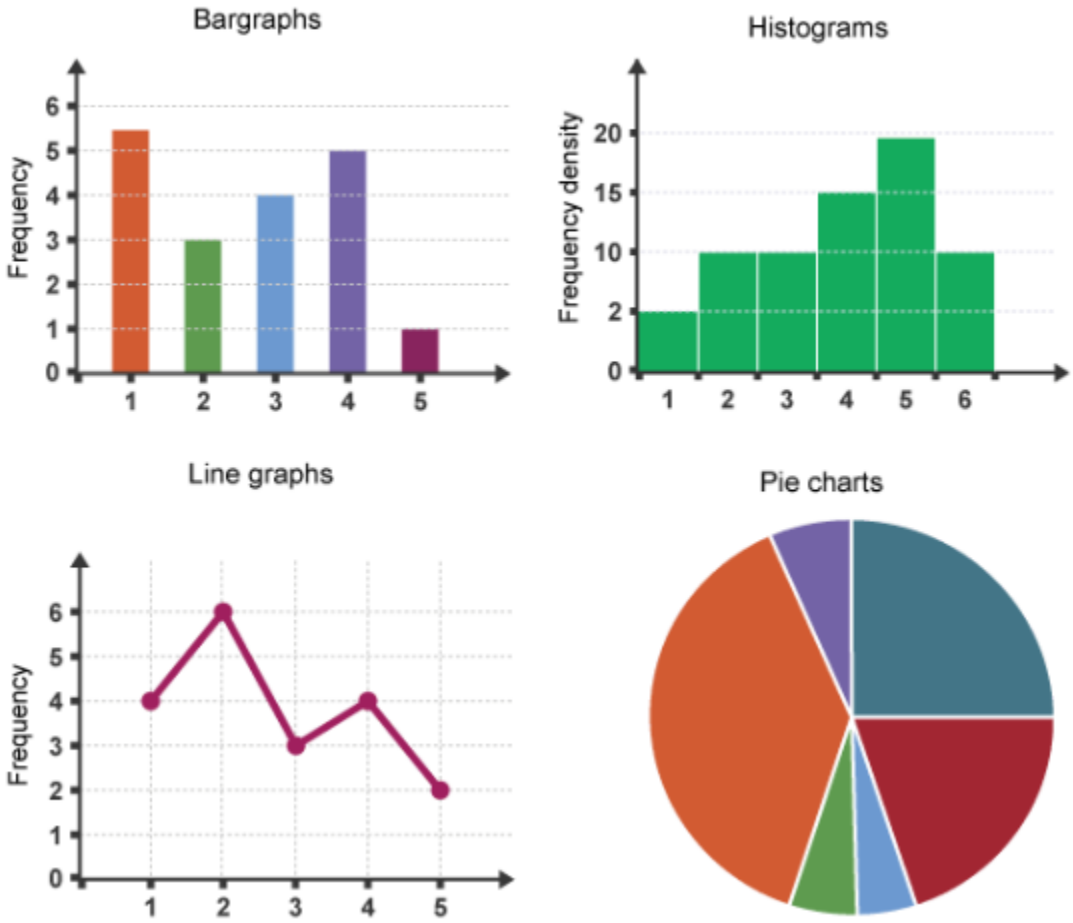


Fig 4.2… various types of diagrams

4.6 Reporting improvements gained by elimination of waste/MUDA to relevant bodies.

Reporting the improvements gained through the elimination of waste (MUDA) to relevant bodies is an important step in showcasing the effectiveness and impact of waste reduction efforts. It allows organizations to communicate their achievements, share best practices, and maintain transparency with stakeholders. Here are some key aspects to consider when reporting improvements gained by the elimination of waste:

- Identify relevant bodies: Determine the appropriate stakeholders or bodies to whom the improvements should be reported. This may include internal departments, senior management, shareholders, regulatory agencies, industry associations, or customers. Consider the specific requirements and expectations of each group to tailor the reporting accordingly.

- Define key performance indicators (KPIs): Establish meaningful KPIs that align with the objectives of waste elimination. These KPIs should be measurable, relevant, and specific to the organization's goals. Examples of KPIs may include cost savings, productivity gains, and reduction in cycle time, improved quality, increased customer satisfaction, or environmental impact indicators. Measuring and tracking these KPIs provide tangible evidence of the improvements achieved.

- Gather and analyze data: Collect the necessary data to support the reported improvements. This may involve analyzing operational records, financial data, customer feedback, or other relevant sources. Ensure that the data is accurate, reliable, and representative of the impact of waste elimination efforts. Analyze the data to identify trends, patterns, and significant findings that demonstrate the positive outcomes of waste reduction.

- Prepare a comprehensive report: Develop a report that presents the improvements gained through the elimination of waste in a clear, concise, and informative manner. The report should include an executive summary, an overview of the waste elimination initiatives undertaken, a description of the methodology used to measure improvements, and a detailed

analysis of the results achieved. Present the findings using graphs, charts, tables, or other visual aids to enhance clarity and understanding.

- Share success stories and best practices: Highlight specific case studies or success stories that illustrate the positive impact of waste elimination. Describe the challenges faced, the strategies implemented, and the outcomes achieved. Share best practices and lessons learned to inspire others and promote knowledge sharing within the organization and with relevant bodies.

- Communicate effectively: Tailor the reporting style and format to suit the needs and preferences of the target audience. Use language that is clear, concise, and easily understandable. Present the information in a logical and organized manner, focusing on the key messages and highlights. Include recommendations for further improvement and future initiatives to sustain the gains made through waste elimination.

- Seek feedback and continuous improvement: Encourage feedback from relevant bodies to gain insights, suggestions, and validation of the reported improvements. Actively listen to stakeholders' perspectives and address any concerns or inquiries. Use the feedback received to drive continuous improvement in waste elimination efforts and refine reporting processes for future assessments.

Self-check 4	Written test

Name…… ID…… Date…….

Directions: Answer all the questions listed below.

Part I

True or False

1. The 5S approach consists of six steps.
2. The PDCA cycle is a problem-solving framework that involves three steps.
3. The 4M analysis focuses on evaluating the organizational aspects that contribute to waste.
4. The 4P analysis examines the Policy, Procedures, People, and Planet.

Part II

Choose the best answer

1. Which step of the 5S approach involves establishing standardized work processes?

a) Sort

b) Set in Order

c) Shine

d) Standardize

2. Which key elements are examined in the 4M analysis?

a) Machine, Management, Material, and Method

b) Manpower, Methodology, Material, and Maintenance

c) Machine, Method, Material, and Man

d) Management, Methodology, Material, and Manpower

3. What does the PDCA cycle stand for?

a) Plan-Do-Check-Act

b) Process-Develop-Control-Analyze

c) Plan-Design-Coordinate-Assess

d) Process-Deploy-Check-Adjust

4. Which principle encourages individuals to seek low-cost or no-cost solutions?

a) Throw out all of your fixed ideas about how to do things

b) Don't seek perfection; a 50 percent implementation rate is fine as long as it's done on the spot

c) Don't spend a lot of money on improvements

d) Problems give you a chance to use your brain

Part III

Short Answer:

1. What are the five steps of the 5S approach?
2. Explain the concept of the PDCA cycle.

LG #44	LO#5- Prevent occurrence of wastes and sustain operation

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Preparing and implementing plan of MUDA prevention
- Discussing and preparing standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement
- Preventing Occurrences of wastes/MUDA by using visual and auditory control methods
- Creating waste-free workplace using 5W and 1H sheet
- Doing the completion of required operation with standard procedures and practices
- Facilitating the updating of standard procedures and practices
- Ensuring and training the capability of the work team that aligns with the requirements of the procedure on the new *Standard Operating Procedures (SOPs)*

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Applying decorating materials.
- Doing decorating with in customer requirements.
- Meting finished product and applying typical decorating techniques.
- Identifying, rectifying or reporting unacceptable product.
- Assembling product with quality requirements.
- Conducting work with workplace information.
- Maintaining workplace records.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.

11. Read the information written in the information Sheets

12. Accomplish the Self-checks 13. Perform Operation Sheets 14. Do the “LAP test”

Information Sheet 5

5.1 Preparing and implementing plan of MUDA prevention

The plan of MUDA prevention involves a systematic approach to identify, analyze, and eliminate waste from various processes within an organization. This plan typically consists of several key steps:

- Understanding the current state: Before developing a plan for MUDA prevention, it is essential to have a comprehensive understanding of the organization's current state. This includes identifying the processes, activities, and areas where waste is prevalent. It may involve conducting process audits, analyzing data, and engaging with employees at various levels to gather insights.
- Setting goals and objectives: Once the current state is understood, the next step is to establish clear goals and objectives for waste elimination. These goals should be specific, measurable, achievable, relevant, and time-bound (SMART). They should align with the organization's overall objectives and reflect the desired outcomes of MUDA prevention efforts.
- Identifying types of waste: Waste can take various forms, and it is important to categorize and identify the specific types of waste present in the organization. Common types of waste include overproduction, waiting time, unnecessary transportation, excess inventory, defects, motion waste, and underutilized talent. By identifying these types of waste, organizations can prioritize their efforts and focus on the areas with the highest impact.
- Conducting root cause analysis: To effectively prevent MUDA, it is necessary to identify the root causes behind the waste. This involves conducting a thorough analysis of the processes and activities to determine the underlying factors contributing to waste. Techniques such as the 5 Whys, cause-and-effect diagrams, and data analysis can be used to identify the root causes and develop targeted solutions.

- Developing action plans: Based on the identified types of waste and root causes, action plans are developed to address each specific issue. These action plans outline the steps, responsibilities, and timelines for implementing waste prevention measures. The plans may include process redesign, standardization of work procedures, improvement in material flow, implementation of visual management systems, and training programs to enhance employee skills and knowledge.
- Implementation and monitoring: Once the action plans are developed, they are put into practice. Implementation involves engaging employees, providing necessary resources, and executing the planned activities. It is important to establish clear communication channels, monitor progress, and track the effectiveness of the implemented measures. Regular review and feedback loops ensure that adjustments can be made if needed to achieve the desired outcomes.
- Continuous improvement: MUDA prevention is an ongoing process, and continuous improvement is essential for sustained success. Organizations should foster a culture of continuous improvement, encouraging employees to identify and report waste, propose ideas for improvement, and participate in problem-solving initiatives. Through regular monitoring, feedback, and refinement of the MUDA prevention plan, organizations can continuously enhance their operations and drive further waste reduction.

5.2. Discussing and preparing standards required for machines, operations, defining normal and abnormal conditions, clerical procedures and procurement

When it comes to machines, having clear standards is crucial for their effective and safe utilization. By defining standards for machine operations, maintenance, and safety protocols, organizations can ensure that equipment is used optimally and in compliance with established guidelines. These standards aid in preventing accidents, reducing downtime, and maximizing machine performance. Regular maintenance schedules, operating procedures, and safety protocols are established based on these standards, ensuring smooth operations and minimizing disruptions.

Standardizing operations is also a critical aspect of achieving efficiency and quality. By defining best practices, work methods, and process flows, organizations can eliminate variations, reduce errors, and improve productivity. Standard operating procedures (SOPs) provide a consistent framework for performing tasks, ensuring that each step is carried out in a standardized and efficient manner. This leads to increased efficiency, reduced waste, and improved overall performance. Clear guidelines on quality checkpoints and performance metrics enable organizations to monitor and measure their operations against the established standards, facilitating timely corrective actions and continuous improvement.

Defining normal and abnormal conditions is another important part of establishing standards. By clearly outlining what is considered normal and abnormal, organizations can quickly identify deviations from the expected performance or quality levels. This enables prompt detection of issues, allowing for timely interventions and preventing the occurrence of defects or errors. Having standardized criteria for normal and abnormal conditions facilitates effective monitoring, troubleshooting, and decision-making. It ensures that deviations from the norm are identified and addressed promptly, minimizing the impact on productivity and customer satisfaction.

In addition to operations, standards are also necessary for clerical procedures and procurement. Standardizing clerical procedures, such as documentation, record-keeping, and information management, ensures consistency, accuracy, and compliance with regulatory requirements. It streamlines administrative processes, reduces errors, and enhances communication and collaboration within the organization. Similarly, procurement standards help in defining guidelines for supplier selection, evaluation, and contract management. These standards contribute to ensuring the quality, reliability, and cost-effectiveness of purchased goods and services.

5.3. Preventing Occurrences of wastes/MUDA by using visual and auditory control methods

Preventing occurrences of waste, or MUDA, is a crucial aspect of lean management and continuous improvement. Visual and auditory control methods are effective tools used to enhance workplace organization, communication, and waste reduction. These methods utilize visual cues and auditory signals to provide clear instructions, warnings, and reminders, helping employees to identify abnormalities, maintain standards, and take appropriate actions. Here are some commonly used visual and auditory control methods:

- Red Tagging: Red tagging involves the use of red tags or labels to mark items that are not necessary or are causing waste. The red tags indicate that these items should be removed or reviewed for potential elimination or improvement. Red tagging helps identify and eliminate excess inventory, unused equipment, or obsolete materials, reducing storage space requirements and avoiding unnecessary costs.

- Sign boards: Sign boards are visual displays that provide information, instructions, and warnings to employees. They can be used to indicate safety precautions, work procedures, or specific instructions related to waste reduction. Sign boards improve communication, ensure consistency in processes, and serve as a constant reminder of best practices.

- Outlining: This visual control method helps employees quickly identify where items should be stored, reducing search time and the risk of misplaced items. It also facilitates standardization and ensures that everything has a designated place, promoting organization and waste reduction.

- Add-ons: Add-ons are visual indicators added to existing equipment or processes to enhance safety, efficiency, or waste reduction. These can include additional features or modifications such as mirrors, lights, or sensors that provide visual feedback or warnings. For example, adding a mirror to a blind spot on a machine can improve visibility and prevent accidents.

- Kanban: Kanban is a visual control method used in lean manufacturing to manage inventory and production flow. It involves the use of cards or visual signals to indicate when and how much to produce or replenish. Kanban systems help prevent overproduction, reduce inventory levels, and ensure a smooth flow of materials based on actual customer demand.

5.4. Creating waste-free workplace using 5W and 1H sheet

Creating a waste-free workplace is a fundamental objective for organizations striving for operational excellence and efficiency. The 5W and 1H sheet is a powerful tool used to analyze and understand the various aspects of a process or problem.

- Who: This question focuses on identifying the individuals or teams involved in the process. Understanding the roles and responsibilities of each person helps in assigning ownership and accountability for waste reduction initiatives. By involving all stakeholders, organizations can foster a culture of continuous improvement and teamwork.

- What: This question aims to define the specific activities, tasks, or processes being analyzed. It involves breaking down the process into its constituent parts and identifying areas where waste is generated. By examining each step, organizations can identify non-value-added activities, such as overproduction, waiting, or defects, and develop strategies to eliminate or minimize them.

- Where: This question addresses the physical locations or areas where the process occurs. Identifying the physical layout and flow of materials or information helps in optimizing the workspace and reducing waste related to transportation, motion, or excess inventory. By reorganizing work areas and streamlining material flow, organizations can minimize unnecessary movement and improve efficiency.

- When: This question focuses on the timing or sequence of events within the process. Understanding the timing of activities helps in identifying bottlenecks, delays, or idle time that result in waste. By analyzing the process timeline, organizations can implement

strategies such as balancing workloads, reducing setup times, or implementing just-in-time principles to eliminate waste caused by waiting or excessive lead times.

- Why: This question delves into the underlying reasons or root causes of waste. It involves analyzing the factors contributing to waste generation, such as poor communication, inadequate training, or inefficient equipment. By identifying the root causes, organizations can implement targeted improvements, such as training programs, process standardization, or equipment upgrades, to address the underlying issues and prevent waste from reoccurring.

- How: This question focuses on the methods or procedures used to execute the process. It involves evaluating the current practices and identifying opportunities for improvement. By applying lean principles, organizations can identify and eliminate waste through methods such as value stream mapping, 5S (Sort, Set in Order, Shine, Standardize, Sustain), or mistake-proofing (poka-yoke). These methodologies help streamline processes, reduce errors, and enhance overall efficiency.

Using the 5W and 1H sheet allows organizations to systematically analyze their processes and understand the sources of waste. It provides a structured approach to identify and eliminate waste by addressing each element comprehensively. By involving cross-functional teams and continuously analyzing processes using the 5W and 1H sheet, organizations can create a waste-free workplace, improve productivity, and deliver value to their customers.

5.5. Doing the completion of required operation with standard procedures and practices

Completing required operations with standard procedures and practices, particularly through the use of Standard Operating Procedures (SOPs), is crucial for organizations to ensure consistent, efficient, and high-quality work. SOPs are detailed documents that provide step-by-step instructions and guidelines for carrying out specific operations or tasks. Let's explore each of the elements mentioned:

- Customer Demands: SOPs should take into consideration the demands and expectations of the customer. This includes understanding customer requirements, specifications, and any specific instructions or preferences they may have. By aligning the standard procedures with customer demands, organizations can ensure that the final output meets or exceeds customer expectations. For example, customer demands may include specific product features, quality levels, or delivery timelines.

- The Most Efficient Work Routine (Steps): SOPs outline the most efficient and effective work routine or sequence of steps required to complete the operation. This involves breaking down the process into clear and logical steps, ensuring that tasks are performed in the proper order. The SOPs may provide detailed instructions, including specific actions, tools or equipment to be used, and any safety precautions to be followed. By defining the most efficient work routine, organizations can streamline their operations and minimize unnecessary steps or activities.

- Cycle Times Required to Complete Work Elements: SOPs may specify the cycle times required to complete work elements within the operation. Cycle time refers to the time required to complete one unit or iteration of the process. By defining the cycle times, organizations can set realistic expectations, plan resources, and monitor performance against targets. This helps in maintaining productivity and ensuring timely completion of operations. For example, cycle times may be defined for specific tasks or stages within a manufacturing process or for service delivery.

- All Process Quality Checks Required to Minimize Defects/Errors: SOPs often include instructions for process quality checks to minimize defects or errors. These quality checks may include inspections, tests, or verification steps at various stages of the operation. By incorporating quality control measures within the SOPs, organizations can identify and rectify any deviations from the desired quality standards, ensuring that the final output meets the required quality levels. Quality checks may involve measurements, visual inspections, or other validation methods to ensure adherence to quality standards.

- The Exact Amount of Work in Process Required: SOPs may specify the exact amount of work in process (WIP) required for the operation. WIP refers to the inventory or unfinished work at various stages of the process. By defining the appropriate WIP levels, organizations can optimize resource utilization, minimize bottlenecks, and reduce excess inventory. This helps maintain a smooth workflow and improve overall efficiency. The defined WIP levels ensure that the operation progresses smoothly without overburdening the system or causing delays.

5.6. Facilitating the updating of standard procedures and practices

Facilitating the updating of standard procedures and practices is essential for organizations to adapt to changing circumstances, improve efficiency, and ensure that their operations remain effective. Here are some key aspects of facilitating the updating of standard procedures and practices:

- Documentation Management: One of the primary steps in updating standard procedures and practices is to have a robust documentation management system in place. This includes having a central repository where all SOPs are stored, accessible, and regularly reviewed. It is important to have a clear version control mechanism to track revisions and ensure that the most up-to-date SOPs are readily available to employees.
- Continuous Improvement Culture: Creating a culture of continuous improvement is crucial for facilitating the updating of standard procedures and practices. Encouraging employees to provide feedback, suggestions, and insights on existing processes helps identify areas for improvement. This can be done through regular meetings, surveys, or suggestion boxes. By valuing employee input and involving them in the updating process, organizations can harness their collective knowledge and experience.
- Regular Review and Evaluation: Standard procedures and practices should be periodically reviewed and evaluated to identify areas that need updating. This can be done through scheduled audits, internal assessments, or external benchmarking against industry best

practices. By regularly examining the effectiveness of existing procedures, organizations can identify gaps, inefficiencies, or opportunities for improvement.

- Cross-functional Collaboration: Involving employees from different departments or teams in the updating process can provide valuable insights and diverse perspectives. Cross-functional collaboration allows for a comprehensive evaluation of existing procedures and practices. It also fosters a sense of ownership and commitment to the updated procedures, as employees feel involved in the decision-making process.
- Training and Communication: When updating standard procedures and practices, it is important to provide adequate training and clear communication to all relevant stakeholders. Employees need to understand the updated procedures, the rationale behind the changes, and any specific training requirements. This ensures a smooth transition and helps employees align their actions with the updated practices.
- Change Management: Implementing updates to standard procedures and practices may require change management strategies to ensure successful adoption. Change management involves planning, communicating, and addressing any potential resistance or challenges that may arise during the updating process. By proactively managing the change, organizations can minimize disruptions and facilitate a smooth transition to the updated procedures.
- Performance Monitoring and Feedback: After updating standard procedures and practices, it is crucial to monitor their performance and gather feedback from employees and other stakeholders. This helps identify any unforeseen issues, assess the effectiveness of the updates, and make further improvements if necessary. Performance monitoring can include metrics such as process cycle times, quality indicators, customer feedback, or employee satisfaction surveys.
- Continuous Training and Development: Updating standard procedures and practices should be an ongoing process. Organizations should invest in continuous training and development programs to ensure that employees are equipped with the necessary skills and knowledge to implement the updated procedures effectively. This can include providing regular refresher training, conducting workshops, or providing access to resources and tools that support the updated practices.

5.7. Ensuring and training the capability of the work team that aligns with the requirements of the procedure on the new Standard Operating Procedures (SOPs)

Ensuring and training the capability of the work team to align with the requirements of new Standard Operating Procedures (SOPs) is crucial for successful implementation and adherence to the updated procedures. Here's a breakdown of the key aspects involved:

- Assessing Training Needs: Conduct a thorough assessment of the training needs of the work team to identify any gaps in knowledge or skills that need to be addressed. This can involve evaluating the current capabilities of team members, conducting skills assessments, or gathering feedback from employees and supervisors.

- Designing Training Programs: Develop comprehensive training programs that align with the requirements of the updated SOPs. This includes determining the training content, methodologies, and delivery formats. The training programs should be designed to effectively communicate the changes in the procedures, provide clear instructions, and equip team members with the necessary knowledge and skills to implement the updated SOPs correctly.

- Interactive Training Methods: Utilize interactive training methods to engage the work team and facilitate effective learning. This can include hands-on exercises, simulations, role-playing, group discussions, or case studies. Interactive training methods encourage active participation, enhance understanding, and help team members apply the knowledge gained to real-life scenarios.

- Practical Application: Allow ample opportunities for the work team to practice and apply the updated SOPs in a controlled environment. This can involve conducting practical exercises, simulations, or on-the-job training. Encourage team members to ask questions, seek clarification, and provide feedback during the training process.

- Ongoing Support and Guidance: Provide ongoing support and guidance to the work team as they implement the new SOPs. This can include assigning mentors or experienced employees to assist with the transition, conducting regular check-ins or progress reviews, and addressing any challenges or concerns that arise. Encourage open communication and create a supportive environment where team members feel comfortable seeking assistance when needed.

- Monitoring and Feedback: Continuously monitor the performance of the work team in implementing the updated SOPs. Provide constructive feedback on their adherence to the procedures and offer guidance for improvement. Regularly assess the effectiveness of the training programs and make necessary adjustments based on feedback and observations.

- Reinforcement and Refresher Training: Schedule periodic reinforcement and refresher training sessions to reinforce the knowledge and skills acquired during the initial training. This helps to ensure that team members maintain a high level of capability and continue to adhere to the updated SOPs over time.

- Documentation and Access: Document the training activities conducted, including training materials, attendance records, and any assessments or evaluations. Ensure that the training materials and updated SOPs are easily accessible to the work team for reference purposes. This helps to reinforce learning and allows team members to review the procedures as needed.

- Continuous Improvement: Foster a culture of continuous improvement by encouraging the work team to provide feedback on the effectiveness of the training programs and the updated SOPs. Actively seek input from team members on any challenges they face in implementing the procedures and use their insights to make necessary improvements.

Self-check 5	Written test

Name…… ID…… Date…….
Directions: Answer all the questions listed below.

Part I

True or False:

1. The plan of MUDA prevention involves a random approach to eliminate waste from various processes within an organization.
2. Setting goals and objectives for waste elimination should be specific, measurable, achievable, relevant, and time-bound (SMART).
3. Identifying types of waste is not necessary when developing a plan for MUDA prevention.
4. Conducting root cause analysis involves identifying the underlying factors contributing to waste.
5. Continuous improvement is not necessary for sustained success in MUDA prevention.

Part II

Choose the correct answer

1. What techniques can be used to identify the root causes of waste?

a) Process audits

b) Cause-and-effect diagrams

c) Data analysis

d) All of the above

2. Which of the following is not a benefit of standardizing operations?

a) Reduced waste

b) Increased efficiency

c) Improved overall performance

d) Increased variations

3. What are the benefits of defining normal and abnormal conditions?

a) Prompt detection of issues

b) Timely interventions

c) Prevention of defects or errors

d) All of the above

4. What is the purpose of standardizing clerical procedures?

a) Streamlining administrative processes

b) Enhancing communication and collaboration

c) Reducing errors

d) All of the above

Part III

Short Answer:

1. Why is it important to understand the current state before developing a plan for MUDA prevention?
2. What are some examples of waste types that organizations can prioritize in their MUDA prevention efforts?

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The experts who developed the learning guide

No	Name	Qualification	Educational Level	Region (College)	Phone number	E-mail
1	**Mulugeta Alemu**	**Horticulture**	**A**	**Nefas Silk Polytechnic College , Addis Ababa**	**09 25322650**	**mulugetaalex44@gmail.com**
2	Gadisa Berhanu	Food Science & Technology	B	Negele Arsi Tvet College ,Oromia	0923450658	gadisabe08gmail.com
3	Kiros Mezgebo	Food Science	A	FTVI	0921310111	kirosmez@gmail.com
4	Habl legese	Food Technology & Process Engineering	B	Nefas silk polytechnic	0911403703	Habyeleggese88@gmail,com-[
5	Alemayoh Araya	Food science	B	Kolfe Industrial College	0987127971	alemayohmr@gmail.com
6	Tolina Kebede	Food Science & Technology	A	Oromia	0917241112	tolinakebede2009@gmail.com