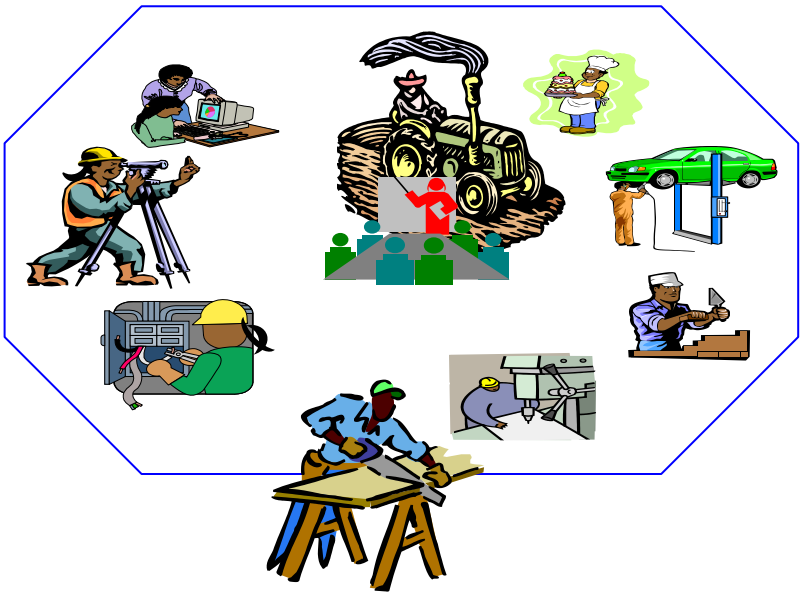
Intermediate Communication and Multimedia Equipment Servicing Level III

Based on May, 2019 Version 1 OS and Dec 2020, V1 Curriculum



Module Title: Preventing and Eliminating MUDA

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Bishoftu, Ethiopia

Table of Contents page

L #1	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 requirement
- Reading and interpreting Job specification
- Observing OHS requirements
- Selecting appropriate material
- Safety equipment and tools

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:

- Use work instructions to determine job requirement
- Read and interpret Job specification
- Observe OHS requirements
- Select appropriate material
- Safety equipment and tools

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
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Information Sheet 1 Using work instructions to determine job requirement

1.1. Work Instruction

- Is used to provide information about the work
- Describe what workers need to be able to do on the job
- Work functions
- Key activities of each work function
- Performance indicators
- Describe what task to be done or work roles in a certain occupation

Work instruction is a description of the specific tasks and activities within the organization. A work instruction in a business will generally outline all of the different jobs needed for the operation of the firm in great detail and is a key element to running a business smoothly.

In other words it is a document containing detailed instructions that specify exactly what steps to follow to carry out an activity. It contains much more detail than a Procedure and is only created if very detailed instructions are needed. For example, describing precisely how a Request for Change record is created in the Change Management software support tool.

1. 2. Procedures vs. Work Instructions

Many people confuse “procedures” with “work instructions”. In fact, most people write work instructions and call them procedures. Knowing the differences of procedures vs work instructions can help you understand the documentation process much better and, therefore, procedure documentation. Procedures describe a process, while a work instruction describes how to perform the conversion itself. Process descriptions include details about the inputs, what conversion takes place (of inputs into outputs), the outputs, and the feedback necessary to ensure consistent results. The PDCA process approach (Plan, Do, Check, Act) is used to capture the relevant information

Questions that need to be answered in a procedure include:

- Where do the inputs come from (suppliers)
- Where do the outputs go (customers)
- Who performs what action when (responsibilities)
- How do you know when you have done it right (effectiveness criteria)
- What feedback should be captured (metrics)
- How do we communicate results (charts, graphs and reports)
- What laws (regulations) or standards apply (e.g., ISO 9001, 8th EU Directive, IFRS, Sarbanes-Oxley)

1.3. Job Requirements

A Job can be defined as:

- A piece of work, especially a specific task done as part of the routine of one's occupation or for an agreed price.
- A post of employment; full-time or part-time position
- Anything a person is expected or obliged to do; duty; responsibility
- An affair, matter, occurrence, or state of affairs.
- The material, project, assignment, etc., being worked upon.
- The process or requirements, details, etc., of working.
- The execution or performance of a task.

The requirements for a job vary according to the nature of the job itself. However, a certain work ethic must be cultivated to succeed in any job and this is fundamental to an individual's sense of himself as a worker, as part of production relations and a fundamental economic being. The basic requirements for a job remain the same no matter what the job is, where it is located or what professional and educational qualifications are required for it. These are as follows:

Discipline: Nothing is possible without discipline. Any job requires a fundamental core of discipline from the worker or the employee and this is a quality which is independent of age, post, stature, job and so on. Discipline is absolutely indispensable and provides the impetus for work that can be strenuous, repetitive, boring and even

unsatisfactory at times.

Enthusiasm: Enthusiasm for work is also a pre-requisite for any job. An innate love for the job, which in modern parlance is known as job satisfaction, is a core requirement for any job. The drive to succeed, to innovate, to do well and to make one's profession into one's livelihood is a critical drive which needs to be present in the employee or cultivated as soon as possible. No job, however perfectly carried out, can evoke the feeling of satisfaction of a job well done without the instinct for success.

Qualifications: This is a more material, tactile need for a job which can be conveyed through degrees and certificates. However education is not limited to what is taught in colleges or vocational training courses. It is the burning desire to learn more, to reach the depths of knowledge about a particular field of interest, to complete the job and learn from it that marks the true enthusiast and the truly learned.

Soft Skills: Soft skills include those skills which ensure that a job is executed well, and the employee can carry himself in the proper manner too. For example, good and smooth communication, computer skills, proficiency in language if needed, presentable appearance, the ability to manage crises are all soft skills which are fundamentally important in any job and which must be cultivated consciously.

Thus, the requirements of a job, though specific to it, cover also a general spectrum. These make for better employees and better individuals.

Self-Check1	Written Test

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Define and elaborate the following terms (2 pts each)

   I. Job Requirements
   II. Procedures
   III. Work Instruction

2. List down elements in job requirements (4 pts)

Note: **Satisfactory rating – 10 and above pts** **Unsatisfactory - below 10pts**

Name: _____ Date: _____

Information Sheet 2Reading and interpreting Job specification

2.1. Job Specification

It is statement of employee/workers characteristics and qualifications required for satisfactory performance of defined duties and tasks comprising a specific job or function. Job specifications should be read and interpreted correctly before starting any job.

2.2 Job profile and job description

Job profile: Every job has a job profile. A job profile usually consists of two parts- job description and person specification. These two in turn will help you to identify the job requirements.

Job Description

- It is a written record of the duties and responsibilities associated with the particular job.
- Job description serves a dual purpose,
- Making it easier to match the right person to the right job, and
- Informing all employees what their jobs entail.

In preparing a job description, the following details must be included:

- A general description of the job
- The duties to be performed
- The job responsibilities
- Specific skills needed
- Education and experience required

2.3. Person Specification

It is used to assess whether someone has the right skills/knowledge and experience for the job. The person specification consists of the essential as well as the desirable qualities of the person who is to perform the job; these include

- Qualifications
- Experience
- Skills and abilities
- Personal qualities/attitudes

Once everything is put down on paper, the employer is ready to start looking for the person who fits the job description as well as the person specification

2.4. Job Analysis

Job analysis is a process in which employers identify and determine the particular job duties and the relative importance of these duties for a given job.

During job analysis, the following leading questions should be asked as a guide by anyone who hires, be it the business owner, the manager or supervisor:

- What work has to be accomplished
- Will additional help be needed to do it
- How many people are needed
- Would part-time help be sufficient
- What are the skills being looked for
- How much experience is required
- How much payment will entail

Self-Check2	Written Test

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1.what is the Job analysis. (5 pts each)

Note: Satisfactory rating – 5 and above pts Unsatisfactory - below 5 pts

You can ask you teacher for the copy of the correct answers

. Score = _____

Rating: _____

Name: _____ Date: _____

Information 3 Observing OHS Requirements

3.1. OHS Requirements

OHS requirements are legislation/regulations/codes of practice and enterprise safety policies and procedures. This may include protective clothing and equipment, use of tooling and equipment, workplace environment and safety, handling of material, use of fire-fighting equipment, enterprise first aid, hazard control and hazardous materials and substances.

Personal protective equipment include those prescribed under legislation/ regulations/codes of practice and workplace policies and practices. Safe operating procedures include the conduct of operational risk assessment and treatments associated with workplace organization. Emergency procedures include emergency shutdown and stopping of equipment, extinguishing fires, enterprise first aid requirements and site evacuation.

Occupational safety and health (OSH) also commonly referred to as occupational health and safety (OHS) or workplace health and safety (WHS) is an area concerned with the safety, health and welfare of people engaged in work or employment. The goals of occupational safety and health programs include fostering a safe and healthy work environment. OSH may also protect co-workers, family members, employers, customers, and many others who might be affected by the workplace environment. In the United States the term occupational health and safety is referred to as occupational health and occupational and non-occupational safety and includes safety for activities outside work.

Occupational safety and health can be important for moral, legal, and financial reasons. In common-law jurisdictions, employers have a common law duty (reflecting an underlying moral obligation) to take reasonable care for the safety of their employees. Statute law may build upon this to impose additional general duties, introduce specific duties and create government bodies with powers to regulate workplace safety issues: details of this will vary from jurisdiction to jurisdiction. Good

OSH practices can also reduce employee injury and illness related costs, including medical care, sick leave and disability benefit costs.

As defined by the World Health Organization (WHO) "occupational health deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards." Health has been defined as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Occupational health is a multidisciplinary field of healthcare concerned with enabling an individual to undertake their occupation, in the way that causes least harm to their health. It contrasts, for example, with the promotion of health and safety at work, which is concerned with preventing harm from any incidental hazards, arising in the workplace.

Since 1950, the International Labor Organization (ILO) and the World Health Organization (WHO) have shared a common definition of occupational health. It was adopted by the Joint ILO/WHO Committee on Occupational Health at its first session in 1950 and revised at its twelfth session in 1995. 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."

"Occupational health should aim at: the promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention amongst workers of departures from health caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an

occupational environment adapted to his physiological and psychological capabilities; and, to summarize, the adaptation of work to man and of each man to his job.

3.1.1. History

Harry Mc Shane, age 16, 1908. Pulled into machinery in a factory in Cincinnati and had his arm ripped off at the shoulder and his leg broken without any compensation. The research and regulation of occupational safety and health are a relatively recent phenomenon. As labor movements arose in response to worker concerns in the wake of the industrial revolution, worker's health entered consideration as a labor-related issue.

In 1833, HM Factory Inspectorate was formed in the United Kingdom with a remit to inspect factories and ensure the prevention of injury to child textile workers. In 1840 a Royal Commission published its findings on the state of conditions for the workers of the mining industry that documented the appallingly dangerous environment that they had to work in and the high frequency of accidents. The commission sparked public outrage which resulted in the Mines Act of 1842. The act set up an inspectorate for mines and collieries which resulted in many prosecutions and safety improvements, and by 1850, inspectors were able to enter and inspect premises at their discretion.

3.2. Workplace hazards

Although work provides many economic and other benefits, a wide array of workplace hazards also present risks to the health and safety of people at work. These include "chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks," and a broad range of psychosocial risk factors.

3.2.1. Physical and mechanical hazards

Physical hazards are a common source of injuries in many industries. They are perhaps unavoidable in certain industries, such as construction and mining, but over time people have developed safety methods and procedures to manage the risks of physical danger in the workplace. Employment of children may pose special problems.

Electronics maintenance

Machines are commonplace in many industries, including manufacturing, mining, electrical and electronics and can be dangerous to workers. Many machines involve moving parts, sharp edges and other hazards with the potential to crush, burn, cut, wound workers if used unsafely. Various safety measures exist to minimize these hazards, including lockout-tag out procedures for machine maintenance and roll over protection systems for vehicles.

Confined spaces also present a work hazard. The National Institute of Occupational Safety and Health defines "confined space" as having limited openings for entry and exit and unfavorable natural ventilation, and which is not intended for continuous employee occupancy. Spaces of this kind can include storage tanks, ship compartments, sewers, and pipelines. Confined spaces can pose a hazard not just to workers, but also to people who try to rescue them. Noise also presents a fairly common workplace hazard: occupational hearing loss is the most common work-related injury in the United States, with 22 million workers exposed to hazardous noise levels at work and an estimated $242 million spent annually on worker's compensation for hearing loss disability hearing loss . Workers near hot surfaces or steam also are at risk for burns.

Self-Check3	Written Test

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided. Use bold letters.

1. What is OHS represents for (2 point)
2. What are the goals of OHS? (2 points)
3. List at least two examples of OHS requirements in your work areas. (1 points)
4. List at least four workplace hazards? (4 points)

Note: Satisfactory rating –10 and above pts Unsatisfactory - below 10 pts

You can ask you teacher for the copy of the correct answers

. Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4 Preparing and selecting tools and equipment for measuring and identification of Muda

4.1. Common tools and equipments used in measuring muda

Tools and equipment are required to identify and measure Waste/Muda in work stations. The following are some tools and equipment used to identify and measure Waste/Muda:

- Tape (any length measuring device)
- Stop watch
- Photo Camera
- Video Camera
- Calculator

4.2. 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.

Self-Check4	Written Test

Calculator – required making arithmetic calculation

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided. Use bold letters.

1. List tools and equipment are required to identify and measure waste/muda in work stations and explain their purpose (10 pts).

Note: Satisfactory rating – 10 and above pts Unsatisfactory - below 10 pts

Note: Satisfactory rating – 6 and above pts Unsatisfactory - below 6 pts

You can ask you teacher for the copy of the correct answers

Score = _____

Rating: _____

Name: _____ Date: _____

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Information Sheet 5 Selecting appropriate material for work

5.1. Introduction

Different safety materials are used when we are working to identify and eliminate muda at the workplace. These materials and safety tools are protecting us from different dangers.

Dust Masks – used for protection against nuisance dusts such as sawdust, chalk, plant related and sanding dusts. These are generally not suitable for toxic substances.

5.2. Glove

Hand Protection shall be worn to protect the operator from contact with hazardous substances. Types of hand protection include:

- Special gloves - wrist or elbow length
- Cotton, rubber
- PVC & leather
- Stainless steel mesh

Figure 5.1: hand protection

5.3. Working cloth

Body & Skin Protection shall be worn when there is remaining risks in the environment. Types of body and skin protection include:

- Protective Clothing
- Sunscreen & insect repellent
- High visibility vests working at or near roadways or near moving traffic or moving plant
- Laboratory coats, heat resistant clothing, waterproof jackets

Figure 5.2 Body and skin protection

5.4. First aid and safety shoes

Foot protection shall be worn wear there is a risk of objects dropping onto feet, or slip hazards present. Types of foot protection include:

- Steel capped boots
- Non slip shoes
- Waterproof boots

Figure 5: 3Foot protection

Self-Check5	Written Test

Instruction I: Matching

Direction I: Match items under column 'A' with items listed under column 'B'. Use the spaces provided in answer sheet to write your answers. Use bold Letters (2 pt each).

A	**B**
1. Safety shoes	**A.** Shall be worn when there is remaining risks in the environment
2. Body & Skin Protection	**B.** Used for protection against nuisance dusts such as sawdust, chalk, plant related and sanding dusts
3. Dust masks/goggles	**C.** Hand Protection shall be worn to protect the operator from contact with hazardous substances
4. Glove	**D.** Shall be worn wear there is a risk of objects dropping onto feet, or slip hazards present
	E. Laboratory coats, heat resistant clothing, waterproof jackets

Note: **Satisfactory rating – 8 and above pts** **Unsatisfactory – below8 pts**

Name: _____ Date: _____

L #2	LO #2**Identify MUDA**

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.
- Causes and effects of MUDA.
- Tools and techniques to draw &analyze current situation.
- Identifying and measuring waste/MUDA.
- Relevant procedures of identifying &measuring MUDA.
- Reporting Identified and measured wastes

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.
- Causes and effects of MUDA.
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Information Sheet 1 Preparing and implementing Plan of MUDA

1.1. The Concept of 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. To understand more about muda/waste at the work place, let us see the three categories of operation.

Any operation has the following operations.

- Net Operation/Value Adding Operation
- Non-Value Adding Operation
- ”Muda’’

1.1.1 Definition of terms

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.

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.

Net Operation/Value Adding Operation): Part of an operation that adds value to make parts and products or deliver service. In other words, it is part of the operation that the customer exactly needs / willing to pay for.

Examples - Water Sampling, Operating Gates, Controlling Flow, etc.

Non-Value Adding Operation: Part of operation that adds no value but cannot be avoided rather it can be reduced.

Example: Conducting inspection, diverting flow to repair leak in a canal, etc

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 and over processing, etc.

1.2. Planning for MUDA Identification

This is the part of to be done in eliminating muda at the work place. It is the first activity in identification and elimination of Muda. It involves the following two major processes.

Planning for identification of the problem Including:

- Identify the problem to be examined
- Formulate a specific problem statement to clearly define the problem
- Set measurable and attainable goals
- Identify stakeholders and develop necessary communication channels to communicate and gain approval

Planning for analysis of the problem (why?) Including:

- Divide overall system into individual processes - map the process
- Brainstorm potential causes for the problem
- Collect and analyze data to validate the root cause
- Formulate a hypothesis
- Verify or revise the original problem statement

Muda sheet, as seen below, is used most commonly to plan for muda identification for different types of wastes.

Table 2: Sample muda sheet

S.No	Type of waste/muda	Description	Cause of the waste	Problem imposed by the waste	Solution	Responsibility
1	Overproduction					
2	Transportation					
3	Motion					
4	Defect					
5	Inventory					
6	Waiting					
7	Processing					

1.3. Benefits of Eliminating Muda for Customers and Manufacturer/Service Provider

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.

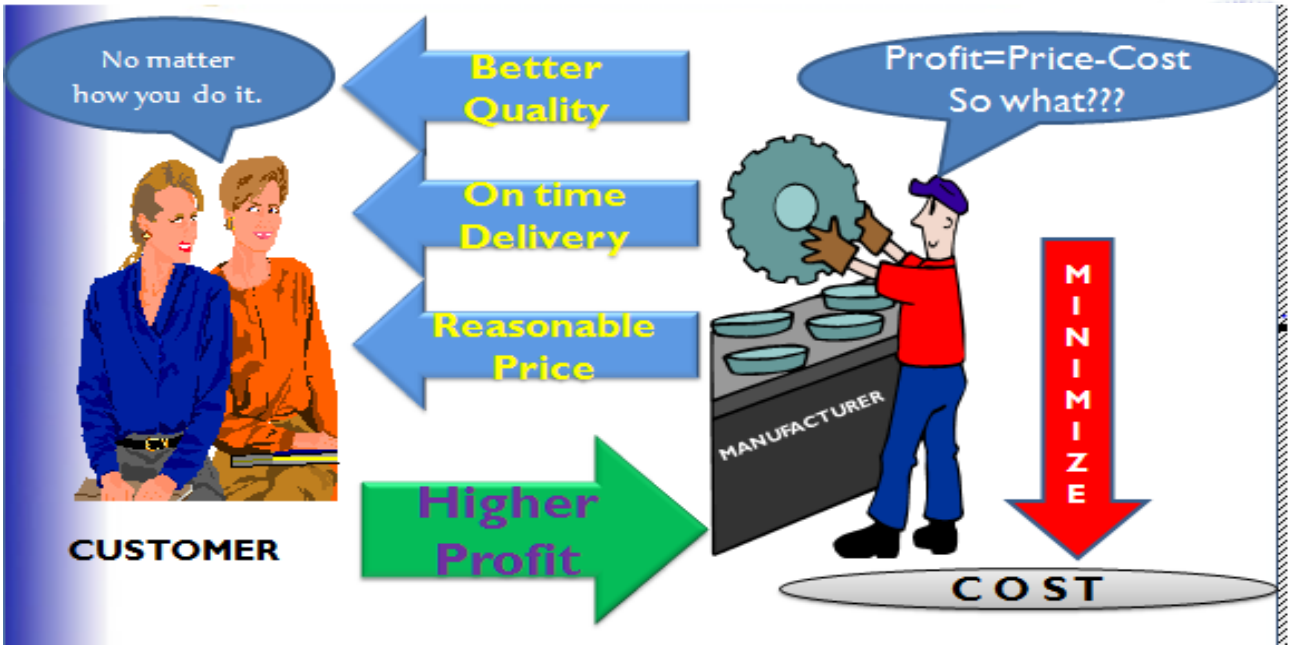

Figure 6: The targets of service providers

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.

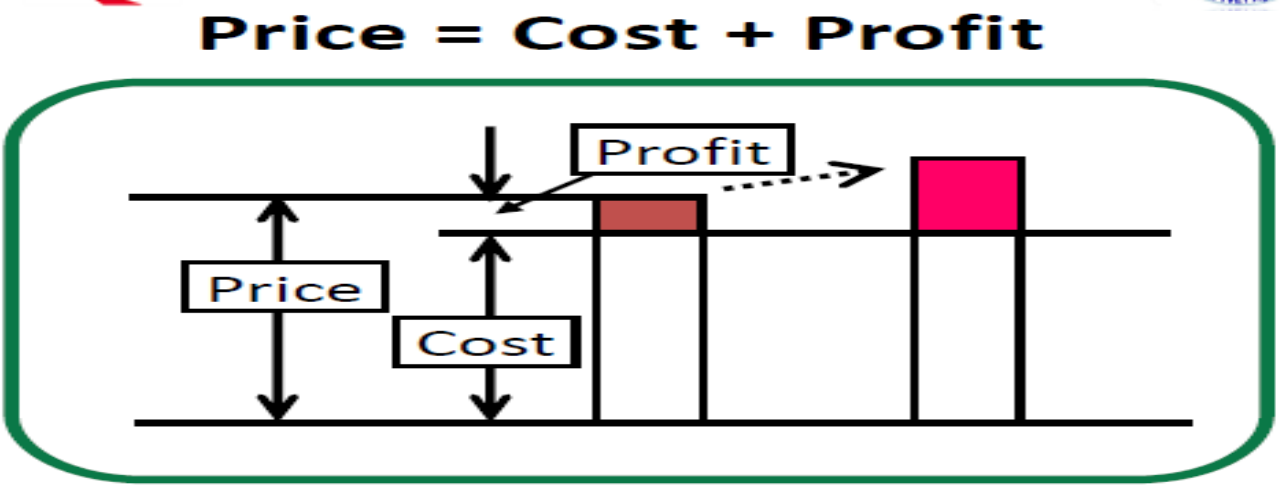

Figure 7: Traditional Thinking of Price Setting

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.

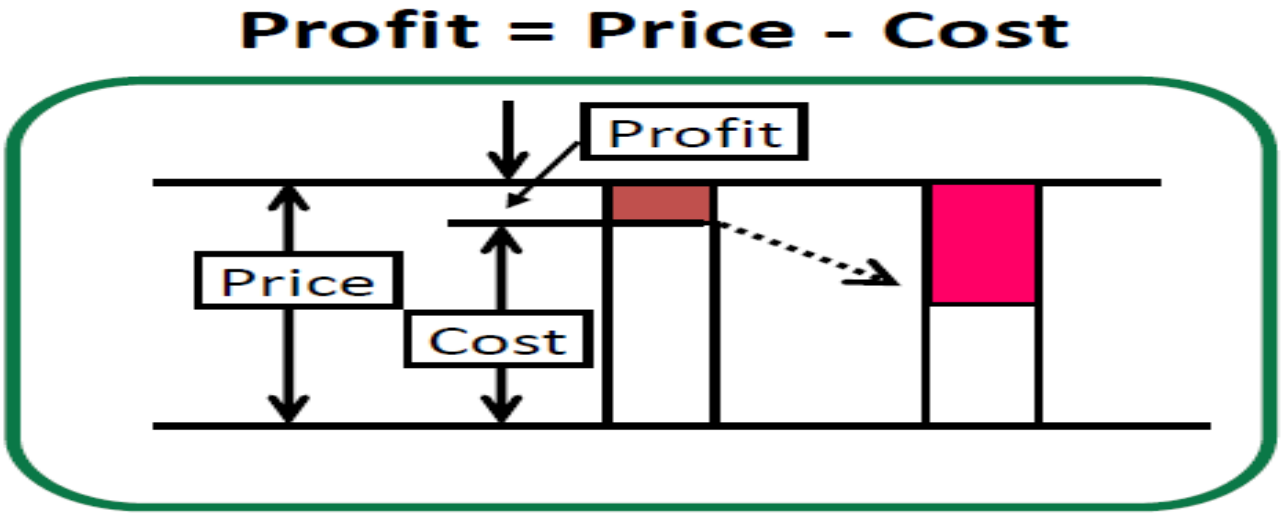

Figure 8: Kaizen Thinking of Price Set

1.4. Methods for Categorizing Types of Wastes/Muda

A number of methods for categorizing types of waste have emerged. We will review some of these models to get a deeper understanding of what waste is and how to find it and eliminate it.

- The three Mus
- The 5M + Q + S
- The flow of goods
- The seven deadly wastes

1.4.1.The Three MUs

In this way of thinking about waste, the goal is to achieve a condition where capacity and load are about equal. In other words, there are just the right amount of workers, materials and machines to make just the right amount of product that is being ordered and deliver it on time to the customer. In Japanese this is expressed with the terms muda,mura and muri.

- Muda (waste) = Capacity exceeds load.
- Mura (inconsistency or variation) = capacity sometimes exceeds the load and the load sometimes exceeds capacity.
- Muri(irrationality/physical or mental overburden) = load exceeds capacity.

By focusing improvement activities on eliminating the non-value added activities throughout the production/service delivering process, and establishing production flow, a balance is naturally achieved between capacity and load.

1.4.2. The 5M + Q + S

Another way of thinking about waste is to focus on the areas where waste may occur: the 5M (man, material, machine, method and management), plus quality and safety. Some of the main forms of waste that you will uncover by focusing on these aspects of production include, walking, waiting, searching, material storage and handling, large machines, conveyers, wasteful production methods, inventory, defective goods, errors, inspection, etc.

1.4.3. The Flow of Goods

A third way of thinking about waste is to focus on the flow of goods in production. If you look

carefully at this you will notice there are really only four things going on: retention conveyance, processing and inspection. Retension means stopping the flow of goods without adding any value to them.

Materials are procured ····▸ Materials are retained in the warehouse Materials are conveyed to processes on the production line ····▸ Materials are retained at the process equipment (WIP) ····▸ Materials are picked up for processing Materials are processed····▸ goods are set down and retained on the other side of the processing machine(WIP) Goods are conveyed to an inspection point Goods are retained until inspection ⟶ Goods are picked up and inspected Goods are set down and retained on the other side of inspection process Inspected goods are conveyed to the finished goods warehouse ⟶ Finished goods are retained prior to shipment ⟶ Finished goods are delivered to the customer

It is called stockpiling, ware housing ,temporary storage, and so on. Retension produces inventory: materials inventory before processing, work-in process inventory, or finished goods inventory.

Inventory occurs for variety of reasons:

- The upstream process moves faster than the downstream process.
- Goods flowing from several lines to one process or goods waiting to go from one process to several different lines tend to pile up.
- There is waiting for machine changeover.
- Materials are purchased and processed for expected end-of-the month rushes.
- Materials are purchased in advance of orders.
- Spare parts are purchased in advance for after-sales service.

Retention adds cost without adding value. It is easy to think that inventory solves production flow problems but in fact it just hides them. When you eliminate retention points the real problems in the production flow must be addressed directly. This is the only path to waste-free production flow, or lean production.

Conveyance refers to transporting goods without adding value. Movement between a

retention point is often called “conveyance” and movement between a retention point and a process is often called “material handling.”

Processing means adding value. We either alter the raw materials or parts or we assemble parts to add value. Improvement of processes includes identifying how a process can best fulfill its purpose or identifying how a process can be done more efficiently. You will ask, Why are we drilling holes? Why are we putting in screws? You may discover many operations that can be replaced by better solutions or even eliminated.

Inspection identifies and eliminates defects from the production flow. It does not add value because it does not eliminate the source of the defect but only its result. Once you change your focus from “finding” defects to “reducing” defects you are on your way to eliminating waste. Ultimately, lean production aims to prevent all defects from occurring.

1.5. The Seven Deadly Wastes

The most well-known category of wastes is the “seven deadly wastes,” which captures the essence of all the ideas discussed above and simplifies them to help you root out waste throughout your production process. You will need strongly motivated people with an instinct for seeing and removing waste. Identifying and eliminating these seven types of waste will forge the path to lean production.

Overproduction: - To produce things more than necessary in terms of type, time, and volume. It is called “the worst kind of Muda” since it hides all the other wastes.

Inventory: - The situation where items such as raw materials, work in process and finished goods are stagnant or which are not having value added to them. Some are located in the warehouses, and others are in-process inventory.

Motion: - These are non-value adding movements or more than necessary movements of workers, equipment, and machines, such as looking for goods, bending, stretching, walking, lifting, reaching etc.

Conveyance/Transportation: - It is unnecessary transportation of parts between processes caused by unnecessary transportation distance, temporary storage, and

relocations or re-piling up. Transportation does not create any value added except for transportation companies. Transportation is usually difficult to be totally eliminated but reducing is possible.

Waiting/ Idle time:- Refers to both human and machine waiting. This includes all kinds of waste of time such as workers or parts waiting:

- For an upstream process to deliver.
- For a machine to finish processing.
- For incoming parts or materials.
- For process that has a long wait time.

Defect making: - This includes defects, inspections for defects in-process, and claims, rescheduling, and resource loss.

Processing: - This consists of processing and operations primarily unnecessary. It is processing beyond the standard required by the customer.

Figure 1:1 The Seven Deadly Wastes

Self-Check1	Written Test

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided.

1. What are the targets of customers?(9 points)
2. What is the target of manufacturer/service provider? (1 points)

You can ask you teacher for the copy of the correct answers.

Note: Satisfactory rating – 10 and above pts Unsatisfactory - below 10 pts

Name: _____ Date: _____

Information Sheet 2 causes and effects of MUDA

2.1. Introduction

The following are some of the general causes and effects of the common seven types of muda in manufacturing and service provider industries such as irrigation and drainage design and constructio9n sectors.

2.2. Causes and Effects of Muda of Overproduction

- Large lot production **(Example:** Production of more irrigation water beyond the crop irrigation water requirement).
- 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

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

2.3. Causes and Effects 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

- 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

2.4. Causes and Effects of Muda of motion

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

Effects

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

2.5. Causes and Effects of Muda of Conveyance/Transportation

- Poor layout
- Shish-skilled workers
- Sitting to perform operations
- The need for conveyance systems is assumed

Effects

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

2.6. Causes and Effects of Muda of Waiting/ Idle time

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

Effects

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

2.7. Causes and Effects of Muda of Defect making

- Emphasis on downstream inspection
- No standard for inspection work
- Omission of standard operations
- Material handling and conveyance

Effects

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

2.8. Causes and Effects of Muda of Processing

- Inadequate study of processes
- Inadequate study of operations
- Incomplete standardization
- Materials are not studied

Effects

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

Self-Check2	Written Test

Instruction I: Matching

Direction I: Match items under column 'A' with items listed under column 'B'. Use the spaces provided in answer sheet to write your answers. Use bold Letters (2 pt each).

A	**B**
1. Muda of Processing	A. Can cause injury
2. Muda of Waiting	B. Poor layout
3. Muda of Transportation	C. Overstaffing or too much equipment
4. Muda of Overproduction	D. Omission of standard operations
5 Muda of motion	E. Trouble at the upstream process
	F. Increase in manpower and man-hour

Note: **Satisfactory rating – 10 and above pts** **Unsatisfactory - below `10 pts**

Name: _____ Date: _____

Information Sheet 3 Tools and techniques to draw &analyze current situation

3.1. tools and techniques to draw and analyze current situation of the work place and to eliminate muda at the work place. The most common tools and techniques used for this purpose are:

- Plant layout and layout improvement
- Process flow
- Do time study by work element
- Measure travel distance
- Take a photo of workplace
- Measure total steps
- Make list of items/products, who produces them and who uses them & those in warehouses, storages etc.
- Focal points to check and find out existing problems
- 5S
- Brainstorming
- Andon
- U-line
- In-lining
- Unification
- Multi-process handling & multi-skilled operators
- A.B. control (Two point control)
- Cell production line
- TPM (Total Productive Maintenance)

3.2. 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. We will describe some of them.

A. 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 as indicated below:

Table 3: Symbols used in arrow diagram

Analysis factors	Symbols	Description	Amount of waste
Retention		When the work-in-process flow is stopped (for other than conveyance, processing, or inspection)	Large
Conveyance		When the work-in-process is moved from one place to another	Large
Processing		When the work-in-process is changed physically or chemically for added value	There may be some waste in the process
Inspection		When goods are inspected for conformance to quality and dimensional standards	Large

To create arrow diagram, consider the following.

- Understand the purpose-
- Select the product to be analyzed
- Prepare a factory layout diagram
- Make the arrow diagram

B. 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.

C. 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.

To prepare and use operation analysis table, consider the followings.

- **Fill in the table on the factory floor**
- **Look for detail** – Write everything down that you possibly can.
- **Identify the waste** – Analyze as critically as you can to distinguish work from waste full movement. Everything that is not value-added must be counted as waste.
- **Set an improvement goal** – Review all the data from your observation and decide what would be best to improve and how much improvement you expect.
- **Eliminate waste-** Eliminate waste from everything except the real work operations. Write down the results of your improvement efforts on the "After Improvement" side of the table.

D. The Standard Operation Combination Chart

Standard operations are a critical aspect of lean production. In order to create standard operations, current conditions must be understood and waste must be eliminated from all aspects of the process. A Standard Operation Combination Chart focuses on the relationship of people, goods and machines. By plotting the cycle time of all activities in the process you can discover where the waste is and design the process to create a more efficient combination and reduce overall cycle time.

E. The Workshop Checklist for Major Waste Finding

In the previous portions you have seen detailed checklists for identifying specific instances of each one of the seven deadly wastes. The Workshop Checklist for Major Waste Finding allows you to identify – in a more general way – the seven types of waste in a work area.

Figure 10: Workshop checklist for major wastes findings

Workshop Checklist for Major Wastes Findings											
Workshop Name:										Date:	
S.N	Process Name	1	2	3	4	5	6	7	Waste Magnitude Total	Improvement Ranking	Improvement Ideas and Comments
		Muda of Overproduction	Muda of Inventory	Muda of Motion	Muda of Transportation	Muda of Processing	Muda of Defect Making	Muda of Waiting			

To use the workshop checklist for major waste finding , consider these points.

- Choose several processes or work areas and look for waste.
- Rank the improvements that are needed. Focus improvements on the process with the greatest total when you add up the magnitude columns.

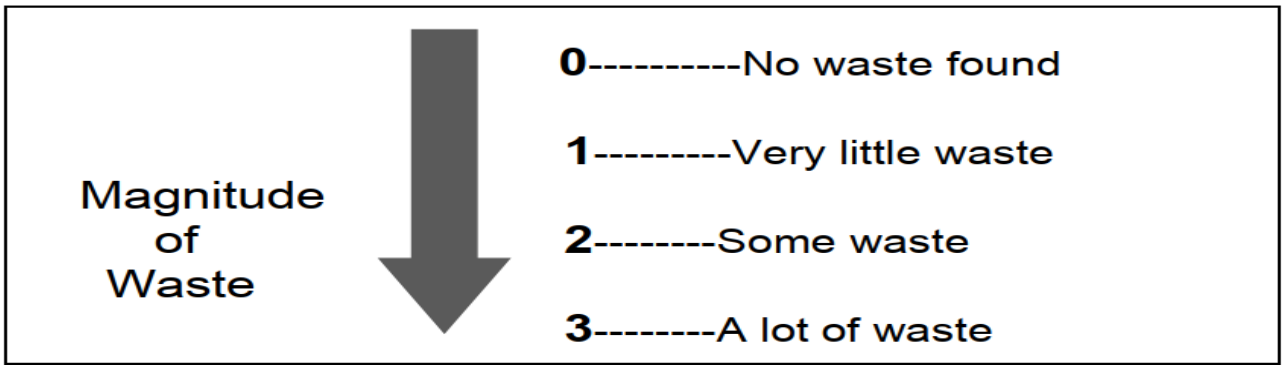

Figure 3:1 Four Level of Magnitude

- Choose the first process to be improved from the workshop checklist.
- Brainstorm improvement ideas and then carry out them

Self-Check3	Written Test

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided.

1. List out at least three ways to make waste visible. (3 points)
2. What are the four factors to be identified in arrow diagram? (4 points)
3. How operation analysis table is prepared and used? (3 Points)
4. List the four analysis factors. (4 Points)

Note: Satisfactory rating – 14 and above pts Unsatisfactory - below 14 pts

Name: _____ Date: _____

Information Sheet 4 Identifying and measuring waste/MUDA.

4.1. Benefits of Waste/Muda Identification

4.2. Muda identification has a number of benefits for both customers and the employees. The following are some of these benefits.

- Cutting the hidden costs of production
- Increased customer satisfaction
- Increased job satisfaction
- Contributing to improvement

Muda at workplaces can be identified by using different kaizen tools and techniques which include:

- Workshop checklist for major waste finding
- Standard operation combination chart
- Operations analysis table
- Summary chart of flow analysis
- Arrow diagram

3.2. Identifying and Measuring Muda

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 procedures used to effective waste identification are:

- Make waste visible
- Be conscious of the waste
- Be accountable for the waste.
- Measure the waste.

Make waste visible: Waste can be made visible in several ways such as:

- Shop layout analysis
- Process flow analysis
- Take photos/video

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 magnitude of 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.

The methods used to measure muda are:

- 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.

Example: How to measure muda

Operation:-To staple two papers using a stapler where the work place is disorganized.

The needed materials and tools for the activity include:

- Two pieces of paper
- Stapler and Staples

Table 4: Measuring muda

No	Activities	Time taken	Category of the operation	Action to be taken to eliminate	How
1	Searching for Stapler	35 Sec	Muda	Eliminate	5S(Set-in-order)
2	Searching for	30 Sec	Muda	Eliminate	5S(Set-in-order)
3	Putting the	8 Sec	Non-Value	Minimize	Load staples
4	Putting the two	3 Sec	Non-Value		
5	**Staple the papers**	**2 Sec**	**Net**		

Lessons from the drill

Total time of operation=78 Sec

- Net Operation (Value adding) =2 Sec (2.6%)
- Non-Value adding operation=11 Sec (14.1%)
- Muda (Unnecessary operation) =65Sec (83.3%)

Self-Check4	Written Test

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided.

1. Discuss the steps to effective waste identification (4 points)
2. What are the benefits of muda identification to the company?(4 points)

Note: Satisfactory rating – 11 and above pts Unsatisfactory - below 11 pts

Name: _____ Date: _____

Information Sheet 5 Relevant procedures of identifying &measuring MUDA

5.1. Common Formats/Checklists for Muda Identification

Muda/wastes identified in workplaces should be reported to the responsible person to take appropriate corrective actions to the problems. The following example formats/check lists (indicated in Table 5 to Table 10 are most commonly used to report the identified muda at any work places (manufacturing or service providing workplaces).

Table 5 : 1Sample inventory waste-finding checklist

Process:				**Date:**	
Description of waste		**Yes**	**No**	**Magnitud e**	**Causes**
1	Lots of inventory on shelves and floors.				
2	Shelf and floor storage takes up lots of				
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				
	Result				

Table 5:2 Motion Waste-finding Checklist

Process:				**Date:**	
Description of waste		**Yes**	**No**	**Magnitude**	**Causes**
1	Walking				
2	Turning around				
3	Leaning sideways				
4	Bending over				
5	Too wide arm movements.				
6	Unnecessary wrist movements.				
7	Wasteful work piece set up/removal.				
8	Non-standardized repetition of operations.				
9	Using different motions each time.				
10	Operations divided into many little				

Total				
Result				

Table 5:3 Waiting/Idle Time Waste-finding Checklist

Process:				**Date:**	
Description of waste		**Yes**	**No**	**Magnitude**	**Causes**
1	Work piece delay from previous				
2	Machine busy status.				
3	Missing item(s).				
4	Lack of balance with previous				
5	Lack of planning				
6	Lack of standard operations.				
7	Worker absence.				
8	Too many workers(more than two).				
Total					
Result					

Table 5: 4Defect Waste-finding Checklist

Process:				**Date:**	
Description of waste		**Yes**	**No**	**Magnitude**	**Causes**
1	Complaints from next process.				
2	Defects within the process.				
3	Human errors.				
4	Defects due to missing part(s).				
5	Defects due to wrong part(s).				
6	Omission(s) in processing.				
7	Defect(s) in processing.				
8	No human automation.				
9	No mistake-proofing.				
10	No inspection within process.				
11	Defects not addressed by				
Total					
Result					

Table 5 :5 Processing Waste-finding Checklist

Process:				**Date:**	
Description of waste		**Yes**	**No**	**Magnitude**	**Causes**
1	Process is not required for product				
2	Process includes unnecessary				
3	Process can be replaced by				
4	Part of process can be eliminated				
Total					
Result					

Note: Rate 0 for Yes and 1 for No

Self-Check5	Written Test

Direction I: Give short Answers

Instructions: Give short and precise answers for the following questions. Write your answers on the spaces provided.

1. Discuss how to report the identification of the seven types of MUDA(7 points).

Note: Satisfactory rating – 7 and above pts Unsatisfactory - below 7 pts

Name: _____ Date: _____

Information Sheet 6 Reporting Identified and measured wastes

Identified and Reports to ensure that the WIRKS is properly maintained, which, in turn, will ensure data integrity, security and accessibility during facility operation and upon closure [6]. This organization should also ensure that change control mechanisms are established to ensure that changes to the WIRKS are properly documented. The identified organization should have a extensive knowledge of the purpose of database fields and an extensive understanding of the nature of the values recorded in those fields. In France, this responsibility has been assigned to the waste management operators at ANDRA facilities.

Reports represent the most common use of data from a WIRKS. Data can either be reported “as-is” (for example, total quantities of contaminants in a package or repository) or processed (for example, radioactive decay algorithms can be used to determine radionuclide inventories at a specified time point. Operational reports could include ad hoc reporting, which typically is not subject to formal specifications and provides quick looks at data for day-to-day, operational needs. In addition, formal operational reports, to report WIRKS data on a periodic basis, are used and typically are subject to formal specifications and quality checks. Descriptions of how data are processed for formal reporting should be maintained (see Section 3.3 for approaches to linking documentation to data sets.

Weak consciousness for inventory/ Identified

Effect

- Lengthened delivery time
- Weak consciousness to control 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
- Bad facility layout
- Big lot production
- Bottle-neck processing stage
- Advanced Production
- Speculative production
- Not leveled Production schedule

Unreliable suppliers

Effect

- Lengthened delivery time
- Weak consciousness to control 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

Self-Check6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Short answers

1.Write Weak consciousness for inventory/ Identified Effect .(12 points)

Note: - Satisfactory rating: 12 and above - Unsatisfactory Rating: below 12

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operation Sheet 1	**Procedures for identifying categories of operation**

Steps

Step 1: Select one operation.

Step 2: Identify and write your customer.

Step 3: Identify/Define what your customer needs.

Step 4: Observe and list out the contents of the operation.

Step 5: Categorize the contents of the operation as Net operation/Value adding operation, Non-value adding operation and Muda.

Step 6: Measure the three categories of the operation (Time).

Step 7: Compare them.

Step 8: Write the action needed to be taken for the three categories of the operation.

Operation Sheet 2	Procedures of Drawing and Analyzing Current Situation of the Work Place Using Tools and Techniques

Activity 1: Draw and analyze current situation of the work place using the arrow diagram

Steps for creating your arrow diagram.

Step 1. Understand the purpose

Step 2. Select the product to be analysed

Step 3. Prepare a factory layout diagram

Step 4. Make the arrow diagram

Activity 2: Draw and analyze current situation of the work place using workshop checklist for major waste finding

Steps

Step 1: Prepare and use a standard workshop check list for major waste findings

Step 2: Choose several processes or work areas and look for waste.

Step 3: Using the checklist find the major forms of waste at each process (Note the magnitude of each waste (Using the figure below)).

Step 4: Rank the improvements that are needed.

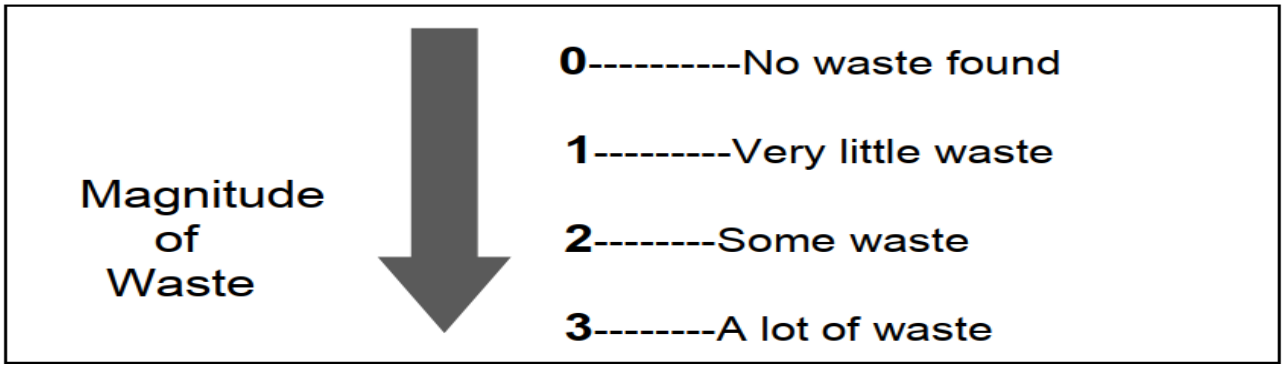

Figure 12: Four Level of Magnitude

Step 5: Choose the first process to be improved from the workshop checklist.

Step 6: Brainstorm improvement ideas and then carry out them.

Operation Sheet 3	Procedure for analyzing the existence of Mura, Muri and Muda

Steps

Step 1: Select a workplace.

Step 2: Write the work load on each machine/worker in process.

Step 3: Recognize the actual capacity of each worker/machine in the process.

Step 4: Compare capacity against work load of workers/machines.

Step 5: Explain the existence of Mura, Muri and Muda on each machine/worker.

Step 6: Write their causes.

LAP Test 1	Practical Demonstration

Name: _____ **Date:** _____

Time started: _____ **Time finished:** _____

Instructions: Given necessary reagents, tools and materials you are required to perform the following tasks within **6 hours.**

Task 1: Identify categories of operation

Task 2: Draw and analyze current situation of the work place using the arrow diagram

Task 3: Draw and analyze current situation of the work place using workshop checklist for major waste finding

Task 4: Analyze the existence of Mura, Muri and Muda.

L #3	LO #3 Eliminate Wastes/Muda

Instruction sheet

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

- Preparing and implementing elimination plan of MUDA
- Necessary attitude to eliminate MUDA
- The ten basic principles to eliminate MUDA
- Tools and techniques to eliminate wastes/MUDA.
- Reducing and eliminating Wastes/MUDA.
- Reporting Improvements.

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 implement elimination plan of MUDA
- Necessary attitude to eliminate MUDA
- The ten basic principles to eliminate MUDA
- Tools and techniques to eliminate wastes/MUDA.
- Reduce and eliminate Wastes/MUDA.
- Report Improvements

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet1 Preparing and Implementing Plan of MUDA

1.1. Planning for Elimination of the 7 Types of Wastes

A plan prepared to eliminate MUDA/waste should identify what the muda is, what is its cause, how it is fixed (methods used to fix or eliminate the MUDA) and when to fix the problem(the time plan). PDCA is used in planning and implementing MUDA elimination processes.

The following sample action plan may be used as an action plan to eliminate any of the seven MUDA in the work place.

Table 1: Muda eliminating action

n plan(sample FORMAT)

S.No	Type of MUDA	Description	Its Causes	Methods of Elimination	Deadline for fixing	Responsibility
1	Overproduction					
2	Inventory					
3	Motion					
4	Transportation					
5	Processing					
6	Defect MAKING					
7	Waiting					

Self-Check -1	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. List the common items included in planning for Muda elimination (10 pts).

Note: - Satisfactory rating: 10 and above - Unsatisfactory Rating: below 10

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet **2** Necessary attitude to eliminate MUDA

2.1. Adopting the Necessary Attitude

First you must adopt an attitude that supports your ability to see waste. Waste is hard enough to find when you want to find it; if you don't want to find it, or if your response to find it is denial or resistance, then it will never be possible for you to root out waste and make your work environment stress free.

It is very important that you understand that one purpose of discovering waste is to take the frustration out of your work. Many people will resist seeing the waste in their work. Just don't let it be you. You may hear yourself or others saying things like: "Let's not fix what is not broken." "Can't we live well enough alone?" "This is just another attempt to make us work harder for the same amount of money." "It looks good on paper, but it will never work on the floor." "We tried that twenty years ago. It didn't work then; it won't work now." "That is not my job." and so on.

You know the lines. You have probably said one or two of them at one time or another. We all have. Resistance is normal. Just don't let it keep you from learning to see the waste in your work. In the end, you are the one who suffers most from the results of waste.

2.2. The Ten Basic Principles for Improvement

- Throw out all of your fixed ideas about how to do things.
- Think of how the new method will work-not how it will not.
- Don't accept excuses. Totally deny the status quo.
- Don't seek perfection. A 50 percent implementation rate is fine as long as it is done on the spot.
- Correct mistakes the moment they are found.
- Don't spend a lot of money on improvements.
- Problems give you a chance to use your brain.
- Ask "Why?" at least five times until you find the ultimate cause.
- Ten people's ideas are better than one person'.

- Improvement knows no limit.

2.3. Methods of Eliminating Wastes/Muda.

2.3.1. Waste of overproduction (largest waste)

- Just-in-time production systems create products at the rate they are needed
- Pull systems in production can be used to tailor production to meet demand
- More accurate sales projections can reduce overly-high targets and rebalance production priorities

2.3.2. Waste of time on hand (waiting)

- Process mapping and BPMN techniques allow managers to see an overview of entire flows
- Increased communication with suppliers or deliveries to combat downtime
- Flexible labor force capable of taking on responsibilities across different company areas

2.2.3. Waste of transportation

- Moving aspects of production to be localized, possibly as part of increased vertical integration
- Mapping transport flows in the production process and seeking to streamline and standardize these patterns
- Increased digitization or paperwork reduction to decrease movement in business processes.

2.2.4. Waste of processing itself

- Value stream analysis, also known as information-flow mapping
- Waterfall diagrams help companies measure the cumulative effect of sequential variables
- Streamlining standard operating procedures to reduce overall volume of documentation

2.2.5. Waste of stock at hand

- Tackle waste of overproduction if it is seen to be the underlying cause
- Reassess production targets in order to better meet demand
- Analyze the production rates of slow-moving stock with variable demand

2.2.6. Waste of movement

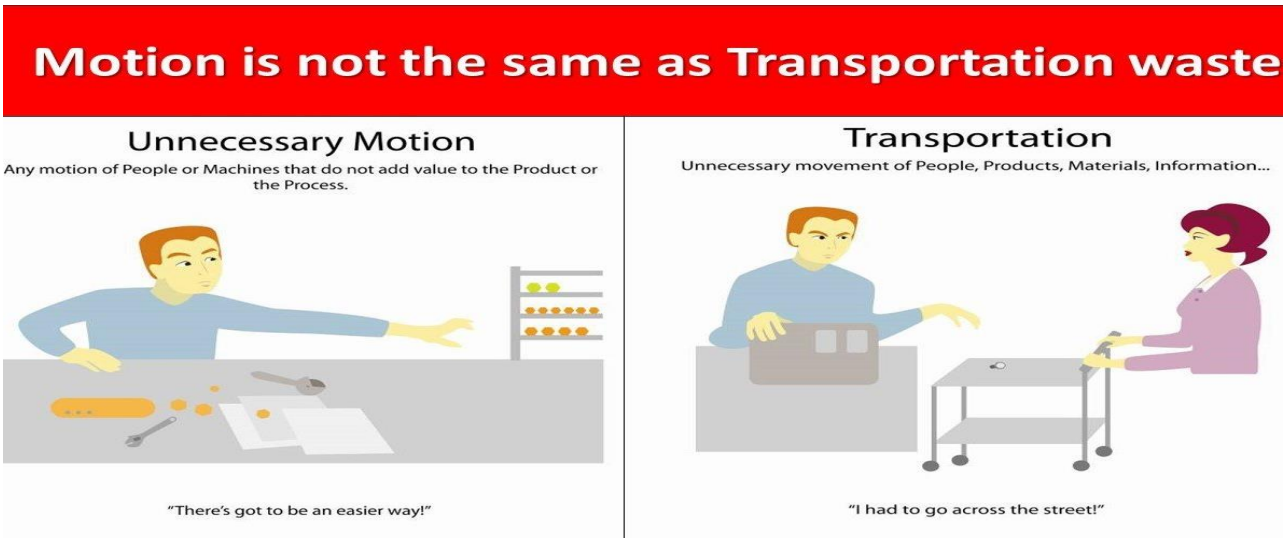

Figure 2:1 Difference between motion and transportation

- Assembly lines can minimize worker movements
- Clear categorization and availability of needed tools or equipment
- Effective training procedures and easily accessible and actionable standard operating procedures

2.2. 7. Waste of making defective products

- Avoid segmenting quality control departmentally; quality control can benefit from a holistic perspective
- Use techniques like the DMAIC process and other Six Sigma methodologies to tackle defects
- Make sure workers are appropriately trained and standardized processes are being adequately followed

Self-Check -2	Written Test

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Write the ten Basic Principles for Improvement muda? 14 pts each).

Note: - Satisfactory rating: 14 and above - Unsatisfactory Rating: below 14

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 3The ten basic principles to eliminate MUDA

10 basic principles to eliminate MUDA

The origin of lean e l e c t r o n i c s can be traced back to Henry Ford's assembly line. If t here's one thingFord did impeccably, it was cutting waste. Yet, it wasn't until the mid1940 s when Toyota Corporationpicked up on the idea of minimal waste and perfected the pro cess. Toyota's lead engineer, TaaichiOhno, designed an operating system solely focused on reducing errors, ordering parts and supplies,shrinking inventory, and above all, elimi nating waste all with the aim of reducing warehousing costs.The following are principles that constitute lean manufacturing. Due to the practicality andapplicability of these conc epts, most companies (even in of ce settings) try to replicate them. To helpyou gain a co mprehensive understanding of lean manufacturing, here are 10 things you should know:

1. Leveled Production

Leveled production is simply smoothing out the quantity or type of production over a peri od of time. InJapanese, it's known as "heijunka." The idea of leveling is to optimize manuf acturing capacity, allowingproduction that meets demands while at the same time avoidi ng inventory accumulation. It helpsmaintain minimum production lead time, manpower, c apital costs, and inventories.

2.Continuous Improvement

Known as "kaizen" in Japanese, continuous improvement goes hand in hand with docum entingprocedures. Managers and employees work together to achieve regular, incremen tal improvementswithin processes, diligently documenting each change to achieve best practices. The ultimate goal ofkaizen is to build a company culture that promotes proacti ve employees who are always looking toimprove inef ciencies. Learn more about kaize n.

3 . Ef Ciency Through A Customer-Firs Tapproach

Finding ef ciency that helps cut waste, a manufacturer has to step into their customer's shoes andlearn about their needs and expectations. This way, the manufacturer can devi

se ways to cut outwastes such as slow transportation, overproduction, and defective pro ducts. Deeply understanding

4. Total Productive Maintenance (Tpm)

TPM is a management philosophy stressing the importance of equipment maintenance i n themanufacturing process. The idea of the program is to eliminate any loses tied to mai ntenance ofequipment, keeping the process awless without any unplanned downtime. Training, safety, and of ceef ciency all have a role in TPM. Employee participation in im provement proposals and maintenance iscritical, as multidisciplinary teams work togeth er to improve machine reliability. Learn more about the7 pillars of TPM.

5 Streamlining Processes

One main idea in lean manufacturing is creating a streamlined process, and this means deliveringproducts on time. This does not only entail the end product, but also includes r aw materials fromvendors. Keeping the sales, production, and engineering departments in uid communication isfundamental for streamlining. They must be in sync to spot buyi ng trends, choose reliable vendors, anddetermine forecasts.

6. Develop Error-Proof Processes

Poka-yoke in Japanese means “mistake-proo ng.” This principle stresses error-proof processes, whichshould be developed to prevent unintended errors. The goal is to immediately reveal any errors so theycan be addressed quickly. By doing this, workers are able to focus their energy on other importantfactors, rather than backtracking to x mistakes. Errorproof processes come in many forms, fromdoublechecking work quality t o inventing mechanisms that activate in the event of an error. Learnmore about poka-yoke.

7. Focus On Quality

Lean manufacturing encourages its adherents to focus on quality as they try to eliminate waste.Companies have to develop a system whereby quality is maintained, whether in t he accountingprocess or the product itself. After all, the goal of lean is to deliver the maxim um customer value in theshortest amount of time with the highest possible quality.

8. One-Piece Flow

This principle is pretty simple. In a production line that has several workstations, onepiec e ow meansthat one item is moved to a work station where any pending work is comple ted before it moves on tothe next station. The idea is to ensure that the product spends a s little time as possible at each stationand travel time from one station to another is mini mal. This process also increases quality assurance, asit is easier to trace product errors back to a single station. Here are 7 advantages to the one-piece owsystem.

9. Mapping The Value System

Value Stream Mapping (VSM) creates a visual representation of all the steps in a proces s. It puts ondisplay every element required, from start to nish. In manufacturing, it's com mon to nd one or twosteps in the process that don't create or add value. Mapping the va lue system involves nding thesesteps and eliminating them completely. Check out this article for a step-by-step guide.

10. Respect For Humanity

To keep things working ef ciently, a company has to have high respect standards for em ployees, andthis means not overworking them, aligning the company's purpose with indiv idual and team goals, andmaintaining high accountability for both failure and success. If an organization wants to implementlean, they need support and participation from every one in the company.These 10 principles of lean manufacturing are all geared to eliminati ng waste and helping a companygain value while delivering quality. Big manufacturers s uch as Toyota have employed these principlefor ages, promoting lean as a global trend. But these practices are not just for huge corporationeven small businesses can adopt th e over-arching mindset of what it means to be lean

Self-Check -3	Written Test

Direction I Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer. (12pts

1. write the 10 basic principles to eliminate MUDA?

Note: - Satisfactory rating: 12 and above - Unsatisfactory Rating: below 12

You can ask your teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet 4Tools and techniques to eliminate wastes/MUDA

4.1 (Five S)

It involves implementing 5S/workplace organization to eliminate Wastes/Muda. Problems cannot be clearly seen when the work place is disorganized. Cleaning and organizing the workplace helps the team to uncover problems. Making problems visible is the first step of improvement.

4.2. 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.

4.3. Brainstorming

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.

Rules of brainstorming process are:

- The subject for brainstorming should be clear and accurate.
- 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.

4.4. Andon

Is an indicator informing team leaders and supervisors of the current workshop situation

with color boards, flash lights, and automated announcement?

4.5. 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.

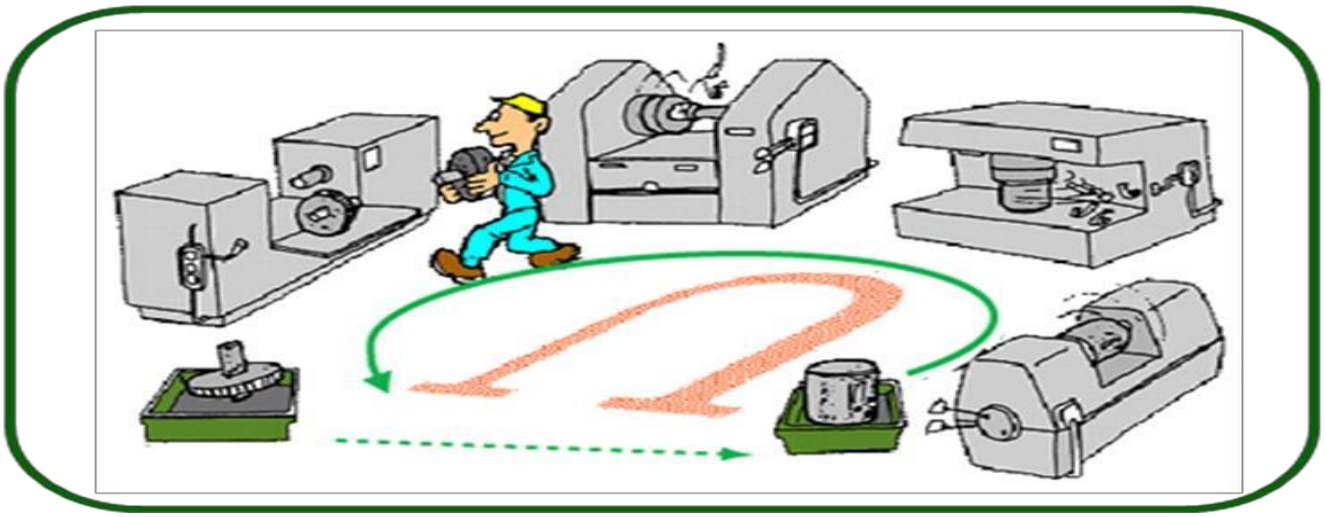

Figure 4.1U-line

4.6. 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.

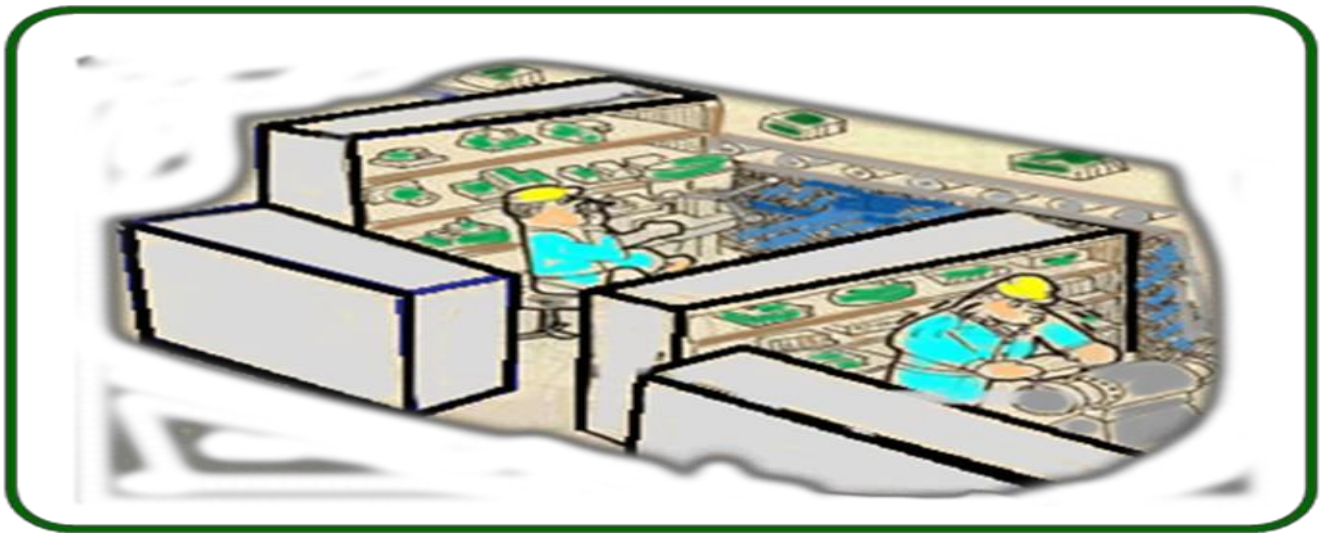

Figure 4.2In-lining

4.7 Unification

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

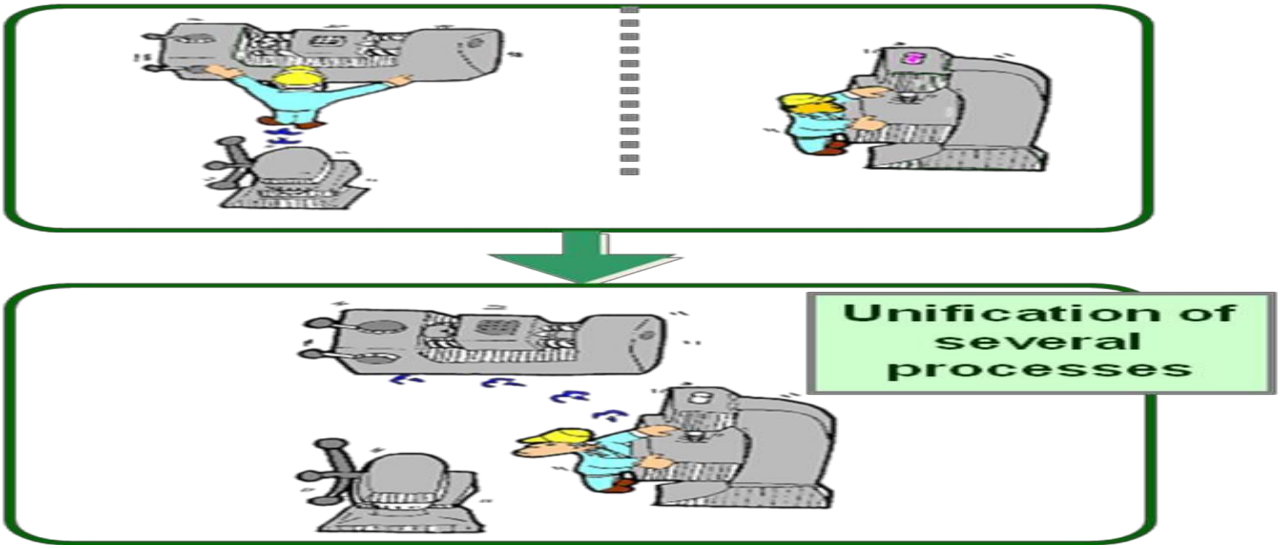

Figure 4.3 Unification

4.8. Multi-process handling and 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.

4.9. 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.

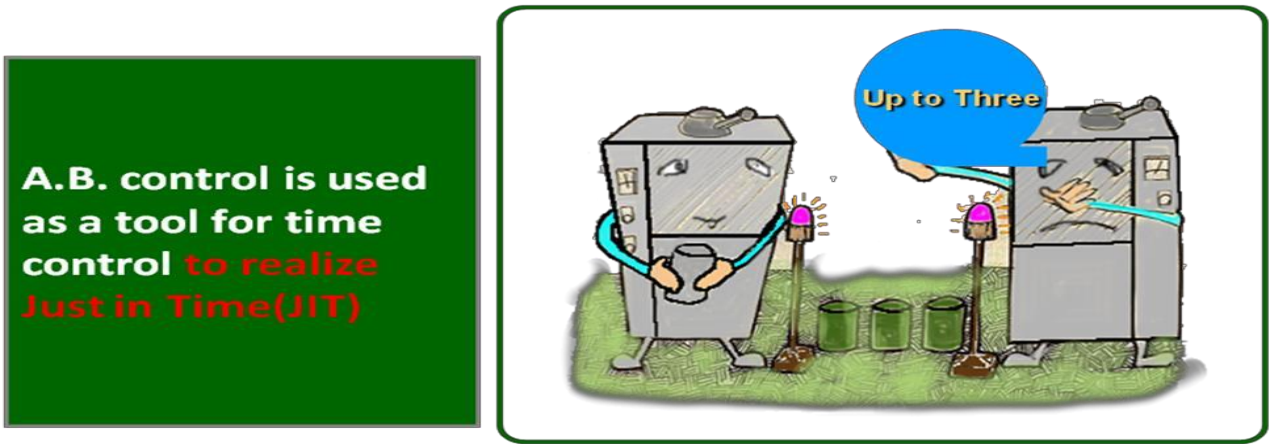

Figure 4.4Unification

4.10. 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.

4.12 Line balancing

Refers to the state where there is a difference in time required for each process of a production line. It is determined that the line balance is good if this difference is small (usually smaller than 15%), but in a bad case the line balance should be improved by leveling out the work time through shortening that of a very time-consuming process and increasing loads of processes consuming less time.

4.13. Build in quality at each process

Quality should be built and guaranteed into each process.

- Do not make Defect
- Do not pass defect
- Work to standard

If machines stop abnormally during operation:

- Worker stops operation, if he/she finds abnormality.
- Don’t send the next process the defects.
- Abnormality will understand simply.
- “Visual control” visually control the states, ANDON,
- Production analysis board, Standardized work chart etc.

4.14. Kanban System

It’s a TOYOTA Production System manufacturing tool. Kanban is not inventory control system rather it is scheduling system. Kanban prevents over production and it is used to give instruction for production and conveyance in every process.

In production it tells us:

- What to produce
- When to produce it
- How much to produce

4.15. Total Productive Maintenance (TPM)

Total means all individuals in the organization working together. Productive means Production of goods that meet or exceed customer’s expectations. Maintenance means keeping equipment and plant in good condition at all times.

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 was introduced to achieve the following objectives. The important ones are listed below.

- Avoid wastage in a quickly changing economic environment.
- Producing goods without reducing product quality.
- Reduce cost.
- Produce a low batch quantity at the earliest possible time.
- Goods send to the customers must be non defective.

4.15.1. 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.

A. 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.

B. 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 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.

4.15.2. The 8 Pillars of TPM

Pillar 1 - 5S: TPM starts with 5S.

Pillar 3 - kaizen: Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. The principle behind is that "a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools.

Pillar 4 - Planned maintenance: It is aimed to have trouble free machines and equipments producing defect free products for total customer satisfaction. With Planned Maintenance we evolve our efforts from a reactive to a proactive method and use trained maintenance staff to help train the operators to better maintain their equipment.

Target:

1. Zero equipment failure and break down.
2. Improve reliability and maintainability by 50 %
3. Reduce maintenance cost by 20 %
4. Ensure availability of spares all the time.

Pillar 5 - Quality maintenance: It is aimed towards customer delight through highest quality through defect free manufacturing. Focus is on eliminating non-conformances in a systematic manner, much like Focused Improvement. We gain understanding of what parts of the equipment affect product quality and begin to eliminate current quality concerns, then move to potential quality concerns. Transition is from reactive to proactive (Quality Control to Quality Assurance).

Target:

1. Achieve and sustain customer complaints at zero
2. Reduce in-process defects by 50 %
3. Reduce cost of quality by 50 %.

Pillar 6 - Training: It is aimed to have multi-skilled revitalized employees whose morale is high and who has eager to come to work and perform all required functions effectively and independently. Education is given to operators to upgrade their skill. It is not sufficient know only "Know-How" by they should also learn "Know-why". By experience they gain, "Know-How" to overcome a problem what to be done. This they do without knowing the root cause of the problem and why they are doing so. Hence it become necessary to train them on knowing "Know-why". The employees should be trained to achieve the four phases of skill.

The different phase of skills is:
Phase 1: Do not know.
Phase 2: Know the theory but cannot do.
Phase 3: Can do but cannot teach
Phase 4: Can do and also teach.

Pillar 7 - Office TPM: Office TPM should be started after activating four other pillars of TPM (JH, KK, QM, and PM). Office TPM must be followed to improve productivity, efficiency in the administrative functions and identify and eliminate losses. This includes analyzing processes and procedures towards increased office automation.

Pillar 8 - Safety, health and environment: In this area focus is on to create a safe workplace and a surrounding area that is not damaged by our process or procedures. pillar will play an active role in each of the other pillars on a regular basis.

Self-Check 4	Written Test

Direction I: Matching item

Direction I: Match items under column 'A' with items listed under column 'B'. Use the space before each question to write your answers. (2 pts each).

A		**B**
1. Kanban System	**A.**	Is an indicator informing team leaders and supervisors of the current workshop situation with color boards, flash lights, and automated announcement.
2. Andon	**B.**	Is a way to make the production lines simple and effective by integrating the parts processing into the main line in the unit production
3. Layout improvement	**C.**	Is a layout in which the inlet and outlet are positioned in the same direction to avoid walking back for a single operator.
4. Unification	**D.**	Is to plan the placement of machineries, raw materials, workers, etc. in order to produce raw materials, parts or products economically.
5. U-line	**E.**	Prevents over production and it is used to give instruction for production and conveyance in every process.
6. Breakdown maintenance	**F.**	odd operations can be combined together in a place into an operator's work.
	G.	Maintenance activities that are undertaken after a specified period of time or amount of machine use.
7. Preventive maintenance	**H.**	Maintenance strategy, where repair is done after the equipment failure/stoppage or upon occurrence of severe performance decline.

Note: Satisfactory rating – 14 and above pts **Unsatisfactory - below 14 pts**

Name: _____ Date: _____

Information Sheet 5 Reducing and Eliminating Wastes/MUDA

5.1. Eliminating waste

You should always start with identifying the value according to the customer. Make that value adding processes flow through your organization at the pull of the customer.

When you go out into the workplace, you should be looking for things that you can do for your people there. You've got no business in the workplace if you're just there to be there. You've got to be looking for changes you can make for the benefit of the people who are working there." Taiichi Ohno**"**

Before one can stop waste, he/she should able to see it, recognize it as waste, identify who is responsible, and finally appreciate its size and magnitude. Waste that is not seen cannot be eliminated. When something is denied as waste, it also cannot be stopped. When one refuses to accept responsibility for the waste, then he will not eliminate it. Finally, when the waste is not measured, people may think it is small or trivial and therefore will not be motivated to stop it. As the saying goes **.**

5.2. Strategies Used for Waste Reduction

Table 4:1 Strategies used for reducing the seven types of Muda

S.No	Type of MUDA	Strategies to reduce
1.	Transportation	• Store materials as close to the point of use as possible • Avoid transportation over long distance • Avoid overproduction
2	Inventory	• Dispose of obsolete material to save space and avoid confusion • Do not produce items ahead of customers delivery
3	Motio n	• Motion economy principal • Effective supervision
4	Waiting	• Time management
5	Over Processing	• Improve work allocation and identify more effective methods • Limit overproduction
6	Overproduction	• Strong production planning and control • Production according to customer schedule • Firm delivery requirements
7	Defects	• Conduct design review; reduce defective materials and train employees • Maintain machines and equipments regularly

Self-Check 5	Written Test

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Differentiate between waste elimination and waste reduction (8 pts)

Note: **Satisfactory rating – 8 and above pts** **Unsatisfactory - below 8 pts**

Name: _____ Date: _____

Information Sheet 6 Reporting Improvements

Reporting A WIRKS could serve as the basis for producing reports that may be required by regulatory or license conditions or that are created to support operations and planning. For example, periodic reports can provide volume and activity totals in storage or disposal facilities Other reports, based on information recorded in a WIRKS, could include lessons learned and could cover experience gained with the operation and monitoring of repositories to provide feedback about how to improve both current and future repository operations, including waste acceptance. Inputs for performance, safety and environmental impact assessments To assess the performance and safety of repositories, which can span very long time periods (e.g., geological scale), computer models may be used. An essential input to these models is a repository's inventory. Prior to operation of a repository, safety assessments may use estimates of the repository's inventory based on WIRKS data for stored waste. As waste is received into an operating repository, a WIRKS is used to record the emplacements, which can be used to provide data for operational and post closure assessments.

For example, it can be used to add up and decay correct the activities of the radionuclide that are in the waste that is actually report is intended to serve Member States planning to develop or implement radioactive waste disposal programmers and to discuss possible ways for compiling and managing information about the inventories in their radioactive waste repositories, which includes low and intermediate level radioactive waste (short lived and long lived) and high level radioactive waste It is not intended to serve as a mechanism to qualify or certify existing WIRKS in Member States. Placed into a repository. Remediation or selective retrieval activities

The objectives of radioactive waste disposal are to remove waste from the human environment and to ensure that it remains isolated from that environment and inaccessible to humans until the radioactivity has decayed away.

This may be impossible to achieve for very long lived radio nuclides. Therefore the intention is to design repositories that ensure that any radioactivity that enters back into the environment in the future does so at levels that result in acceptable risks to humans and the environment.

Self-Check 5	Written Test

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Differentiate between waste radioactive and Reporting (8 pts)

Note: **Satisfactory rating – 8 and above pts** **Unsatisfactory - below 8 pts**

Name: _____ Date: _____

Operation Sheet -1	Techniques of Preparing and Implementing Plan of MUDA Elimination/Improvement

Steps

Step 1: Select and use all the necessary tools and equipments (including PPE)

Step 2: Analyze the documents of the already identified wastes in several processes or work areas

Step 3: Rank the improvements that are needed. Focus on improvements on the process with the greatest total when you add up the magnitude of its wastes.

Step 4: Choose the first process to be improved from the workshop checklist.

Step 5: Set target

- **What?** Decrease/Eliminate the amount of the waste specified.
- **When?** By the End of ----
- **How many?** Minimize the problem from –to –

Step 6: Prepare Activity Plan (see the following sample)

S.N	Type of Muda	Basic Cause of the waste	Magnitude of the waste	Photo/ Video	Description of the effect of the waste(Shortage of space, time, quantity in the units of m^2, peaces or any other unit)	Methods of eliminating the waste	Duration to eliminate the muda	Responsibility
1								
2								
3								
4								

5								
6								
7								

LAP Test 1	Practical Demonstration

Name: _____ **Date:** _____

Time started: _____ **Time finished:** _____

Instructions: Given necessary reagents, tools and materials you are required to perform the following task within **1 hour.**

Task 1: Prepare a plan for elimination/improvement of Muda

L #4	LO #4 **Prevent occurrence of wastes/MUDA.**

Instruction sheet

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

- Preparing and implementing prevention plan of MUDA.
- Discussing and preparing standards for Machines
- Visual and auditory control methods.
- Using 5W and 1H sheet for waste-free workplace
- Doing completion of required operation.
- Updating of standard procedures and practices.
- Ensuring capability of the work team

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 prevention plan of MUDA.
- Discuss and prepare standards for .
- Visual and auditory control methods.
- Use 5W and 1H sheet for waste-free workplace
- Do completion of required operation.
- Update of standard procedures and practices.
- Ensuring capability of the work team

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information Sheet 1 Preparing and Implementing Prevention Plan for MUDA

1.1. Introduction

To prevent muda at work place, a plan for preventing should be prepared and implemented appropriately.

1.2. Planning for MUDA Prevention

Consider the following points when planning for muda prevention at work place.

- When selecting a project think about how you can identify that an area requires improvement. What inputs help you recognize if an area is not conforming to the required standard?
- Achieve this by producing an agreed, clear problem statement, that uses facts, and does not mention any countermeasures.
- Pre-empts countermeasures without understanding the problem based on opinions not facts. States the facts, giving frequency, timescale, and impact.
- Specific actions should be highlighted for completion. The key here is that plans should be time-bound and bought-off by the relevant owner.

The action plan should address the following.

- ✓ Why are we undertaking the project?
- ✓ What are we going to do? What data is required?
- ✓ Who is responsible for each task? Who should be involved?
- ✓ How must it be accomplished? How do we review?
- ✓ Where can we find relevant data and facts?
- ✓ When must a task be complete?

Self-Check -1	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. List down the items the action plan should address(4 pts).
2. What points do you consider whe n planning for muda planning prevention of muda?(4 pts).

Note: Satisfactory rating – 8 and above pts Unsatisfactory - below 8 pts

Answer Sheet-1

Name: _____ Date: _____

Score = _____

Rating: _____

Information Sheet 2 Discussing and preparing standards machines operations

2.1. Standardization

Standardization is defined as an activity that gives rise to solutions for repetitive application to problems in various disciplines. Generally, the activity constitutes the process of establishing (determining, formulating, and issuing) and implementing standards. Thus, standards are the perfect result of a standardization activity and inside the context of quality systems consist of quality documents or documents related to the quality system.

Procedures that necessitate many decisions should be written along with flow chart. Requirement for document identification and control, accountability and traceability responsibility must be involved with every SOP; this can be obtained by supporting constant format.

2.2. Types of SOPs

Safety and Quality: Since safety and quality are the most critical things to manage in any factory, you might want to focus on general or role-specific, work instructions that have an impact on these two areas. These SOPs ensure that workers follow internal controls and comply with industry and government regulations with regards to safety and quality.

Line Performance: If you are experiencing issues on a specific line, or need to create new lines due to expansion, you might want to focus on your line performance SOPs. These standard operating procedures would outline the most efficient and effective methods for setting up a line, switching between different products on the line, and operating and troubleshooting equipment on the line.

Worker Performance: If, on the other hand, you are experiencing performance gaps between shifts, teams or individual workers, or you need to quickly train new workers, you might want to make work instruction SOPs a priority. SOPs geared towards replacing a retiring worker would focus on the specific role and troubleshooting procedures, while standard work instructions aimed at training many employees due to high turnover, would focus on entry-level workstations.

The processes involved in creating standards and procedures include:

- **Prioritizing the SOP**
- **Creating the SOP**
- **Publishing and Promoting the SOP**
- **Training and Testing Workers on the SOP:** Training and testing workers on the new standard operating procedure are equally important. Just because workers have completed the training doesn't mean that they have fully absorbed and retained the new work instructions.
- **Working at Standard:** Releasing and training workers on a standard operating procedure is just the beginning.

2.3. Workplace Safety Procedures

The most important concept to remember is that you are responsible for your own safety and the safety of others. Most safety practices are common sense. Unfortunately, they can be forgotten or overlooked unless you make safe practices a habit or an instinct.

General Safety: By doing things right, you and your co-workers will commit yourselves to safety on the job and everyone will benefit. Accidents occur in many ways but most often can be traced back to one of two basic factors: ignorance or carelessness. You must always be concerned with your own safety and with the safety of others around you.

The following is a general list of safety precautions you must observe in any work area:
Don't fool around. "Horseplay" is one of the biggest causes of injuries on the job and it may be grounds for dismissal.

- Never work while under the influence of drugs or alcohol, as you are a hazard to yourself and your co-workers.
- Pay particular attention to moving objects, such as equipment, dollies, mixers, and slicers.
- Walk; do not run, in the work areas.
- Stay completely alert on the job.
- Avoid back strain by lifting properly.

Lock-out procedures: All powered machinery or equipment shut down for maintenance or repair must be secured against the possibility of the equipment being accidentally turned on while being worked on. To safeguard the person working on such equipment, lock-out procedures must be posted near the equipment, and the procedures listed must be followed before repairs or maintenance can start.

Locking out a machine usually means the power feeding the machine is disconnected either by pulling a plug, placing a switch in the off position, or turning a circuit breaker to the off position. The disconnected circuit is then secured in the inoperative position by the use of a padlock. The person doing the maintenance or repair keeps the key to this lock until the work on the machine has been completed. The worker then removes the lock and the machine is again operable.

Depending on the situation, the lock might be used to secure the power switch of the machine or it might be used to lock shut the door to a circuit breaker panel where the thrown breaker is located.

If the machine is not wired into its own power circuit but simply plugs into the wall, the lock-out procedure may require that the machine be turned off with its power switch and unplugged from the power receptacle. The plug end of the machine must be kept in plain view of the repair person so no one can inadvertently restore power without the repair person's knowledge.

Example for Procedures for equipment:

- Never use any machine you have not been trained to use.
- Pull plug or throw switch to off position before cleaning or adjusting any machine. Keep fingers, hands, spoons, etc., away from moving parts. Wait until machine stops before moving food.
- Check all switches to see that they are off before plugging into the outlet.

Particular care must be taken when cleaning the slicing machine.

- First pull the plug.
- Turn the gauge to zero in order to cover the edge of the blade
- Do not touch the edge of the blade
- Clean the blade from the centre out.

- Clean the inside edge of the blade with a stick that has a cloth wrapped around one end.

General procedures for machines include:

- Never start a machine until you are sure all parts are in their proper places. If it is a machine that operates with gears, check the gear position.
- You must be aware of the lock-out procedures that are to be followed before repairing or cleaning any machine. Lock-out procedures must be clearly posted by management near each machine.
- When using electrical power equipment, always follow the manufacturer's instructions and recommendations. Do not wear rings, a wristwatch, or a tie when operating electrical power equipment.

Equipment Safety: Extreme care should be taken when operating equipment. Before you attempt to operate any tool or piece of equipment, you must be fully trained by an experienced operator. Make sure that all guards are in place and function properly and that all electrical connections are properly made.

You should observe the following precautions when using equipment:

- Understand the correct operating procedures and safety precautions before operating a piece of equipment.
- Ensure that all guards are in place and functioning before any machine is started.
- Report defective or unsafe equipment to a responsible individual
- Do not distract or interfere with the equipment operator.
- Make sure that the cords to electrically powered tools are in good condition, with no frayed parts or bare wires showing and make sure that the tools are properly grounded.
- Keep edge-cutting tools properly sharpened so that they do the job well and do not have to be forced because of dull edges.
- Use tools only for their intended use and select the right size for the job.
- Report to equipment that is broken or does not function properly to supervisor

Electrical safety: Even though you may normally deal with low voltages and current, the values are never far away from lethal levels. You can receive a shock or burn from any common electrical circuit.

The severity of the electrical shock depends on four factors:

- The amount of current that passes through the body
- The path that the current takes through the body
- The frequency of the current
- The length of time that the current flows within the body.

Normal household current (plugs and light circuits) is generally limited by a circuit breaker to a value of 15 amps. This device has been designed to trip and open a circuit if the 15 amp value is exceeded. It is possible to cause fatal injury with a current flow of only 50 milliamperes (mA). One milliampere (1 mA) is one one-thousandth of an amp.

In order for you to get an electrical shock, you must become part of the electrical circuit. You have to contact a live portion of a circuit while in contact with a lower potential such as a ground. Such an arrangement will complete an electrical circuit through your body to the ground, causing current to flow.

2.4. Clerical procurement

It is a subsection of the finance or accounts payable departments. The function is expected to contribute to the business only in so far as it detects waste and prevents major abuses of institutional procedures.

There is no recognized Head of Procurement or overall procurement manager. Purchasing activity is largely carried out at user/requisitioner level. Where a dedicated buyer exists, requisitions are passed to the buyer to order, frequently detailing the supplier, price and agreed terms.

Procurement is focused on processing the large volumes of paper produced and minimizing transaction speed. Performance is monitored, if at all, on the number of requisitions processed and the delay from requisition to order. Given that the clerical buyer is most often found within the finance function, invoice queries form a large part of the workload.

Procurement procedures and guidelines are limited to finance procedures regarding competitive tendering and the appropriate number of quotations to be obtained. Resources are focused on an arbitrary basis derived from finance policy and procedures related to monetary authorization levels.

Organization of Procurement Support Work Procurement clerk and technician positions are located in a variety of work situations. The work can involve one or more phases of the procurement process, or it can span the entire procurement process from the pre-award phase through the post-award phase. Some positions support agency or activity staff programs, such as contracting policy or small business offices.

Roles of Procurement clerks include:

- preparing, verifying, abstracting, controlling, or closing out procurement documents, files, reports, or records
- updating and maintaining the currency of procurement documents or related information;
- sorting, compiling, typing, and distributing requisitions, contracts, orders, modifications,
- tracking the status of requisitions, contracts, and orders using automated or manual files and through contacts with vendors, supply technicians, inventory managers, etc.;
- attending bid openings and abstracting bid information;
- maintaining bidder mailing lists by adding or deleting vendor information in the system;
- assembling contract file information and entering purchase order or contract data into a management information system;
- reviewing reports and researching errors or conflicting information in procurement documentation;
- assembling and preparing procurement management reports by gathering and consolidating pertinent information;
- monitoring contractor performance and recommending modifications to the contract;
- investigating customer or vendor complaints of errors in shipment, payment, and/or contract documentation;
- developing manual or assist in development of automated procurement procedures;
- reviewing purchase order or contract files for inclusion of specific documents

2.5. Factors affecting equipment effectiveness

- Equipment failure (breakdown)
- Setup and adjustment downtime
- Idling and minor stoppages
- Reduced speed
- Process defects
- Reduced yield

Cycle Time and Set-Up Reduction: The amount of time that elapses between the completions of two parts completed on the same line. Cycle time may also be defined as the amount of time it takes for a single operation to complete a single part. Both working definitions are based on shop floor observation. The general term “Cycle Time” should be specified as “Observed Cycle Time”. It is important to note that with all variations of “Cycle Time” definitions, the starting and ending point of each cycle must be exactly the same point to ensure a complete cycle.

Shorter runs produce customer orders with less lead time. However, equipment breakdowns, idling and minor stoppages will make it very difficult to reduce cycle times. Hence, cycle time reductions result in shorter and more frequent production runs. Suddenly, set-ups and adjustments become crucial in reducing cycle times. Past OEE (Overall Equipment Efficiency) studies show that set-up and adjustments can consume up to 50% of total production time.

Figure 18: The Equipment Losses (you can and must measure)

Equipment Availability	Set up and adjustments including: • Changeovers • Programming • Test runs	Equipment Failures: • Sporadic breakdowns. • Chronic breakdowns.
Equipment Efficiency	Idling and Minor Stoppages • Jams and other short stoppages. • No parts, no operator.	Reduced Speed • Equipment worn out. • Lack of accuracy.

Quality	Process defects - Scrap - Rework
Others	Equipment warm up etc. No parts, no operator.

Availability: Loading time = Total available time per day (or month) – Planned downtime

Planned downtime: amount of downtime officially scheduled in the production plan.

OEE (Overall Equipment Efficiency) : OEE = A x PE x Q

Possibly there are three ways that failure may occur.

1. A - Availability of the machine. Availability is proportion of time machine is actually available out of time it should be available. (the equipment can stop working completely known as a total failure),

$$\text{Availability (\%)} = \frac{\text{total time available} - \text{downtime}}{\text{total time available}} * 100\%$$

2. The equipment can work slower than it is capable of known as the partial failure (throughput rate/Performance), and

$$\text{Performance (\%)} = \frac{\text{number of units manufactured}}{\text{possible number of manufacturable units}} * 100\%$$

3. The equipment or product can lose quality known as quality failure (Quality).

$$\text{Quality (\%)} = \frac{\text{number of units produced} - \text{number of defects}}{\text{number of units produced}} * 100\%$$

OEE Exercise

Calculate Availability, Performance, Quality and OEE based on the following information.

Item	Data
Shift Length	8 hrs = 480 min
Short Breaks	2@15 min = 30 min
Meal Breaks	1@30min=30min
Down Time	47min
Ideal Run Time	60 pieces per min
Total Pieces	19,271 pieces

Reject Pieces	423 pieces

a. **Availability = Operating time / Planned production time**

= 373 minutes / 420 minutes

= **0.8881 = 88.81%**

b. Performance = (Total pieces /Operating time) / Ideal Run Time

= (19,271 pieces/373 minutes)/60 pieces per minute

= **0.8611 = 86.11%**

c. Quality = Good Pieces / Total Pieces

= 18,848 / 19,271 pieces

= **0.9780 = 97.80 %**

d. OEE = Availability X Performance X Quality

= 0.8881 X 0.8611 X 0.9780

= **0.7479 = 74.79%**

Self-Check -2	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. List down factors affecting equipment effectiveness (4 pts).
2. What are the major roles of Procurement clerks? (4 pts.).
3. Explain machine workplace safety procedures (4 pts).
4. Discuss SOP of a machine (4pts).

Name: _____Date: _____

Score = _____

Rating: _____

Information Sheet 3 Visual and auditory control methods.

3.1. Methods for waste prevention

We have discussed how you discover waste and what to do to remove it; but it doesn't end there. Unfortunately, problems always crop up, and we prevent them from becoming sources of waste we will be right back where we started in no time at all. That is one reason why one of the very first things mentioned about discovering waste adopting the right attitude. If everyone is paying attention to keeping waste from taking hold, then you have a good chance of sustaining production flow.

There are four important methods you can use for maintaining a waste-free production environment:

- Standardization
- Visual controls
- Auditory controls
- 5W and 1H Sheet

3.1.1. Standardization

The primary purpose of standardization is to create and sustain a waste-free process. Standardization means establishing standard procedures for every operation so that anyone can understand and use them – and everyone does. There are many aspects to standardization. Standards must be created, documented, well-communicated, adhered to, and regularly re assessed.

Standards are required for:

- Machines
- Operations
- Defining normal and abnormal conditions

- Clerical procedures
- Procurement

3.1.2. Visual and Auditory Controls

One way waste enters into operations is when standards are not improved to meet changing conditions. Even standardization fails to sustain waste-free production if not systematically updated to take advantage of new materials, new technology, and worker improvement ideas. If the slightest defect occurs, the standard must be reconsidered.

The factory is a living thing and must constantly be adjusted to stay responsive to changes in the environment. Responsiveness must be systematic so that problems are addressed without losing the solid foundation of the waste-removing methods already established. The best way to do this is through visual and auditory controls.

Red-tagging – You probably did this at the beginning of your improvement activities when you implemented 5S. If not, do it now: put a red tag on everything in the factory that is not necessary to the current operations of the production process. After everyone has had time to notice red-tagged items and claim any that are needed in their area, remove the remaining red-tagged items from the environment.

Management can decide what to do with them: they can be sold, thrown out, or moved to a location where they are needed. Always keep the production floor free of any thing that is not directly part of the production process.

Signboards- The purpose of workstations and the names of the workers who operate them should be displayed at every processing point. Signboards can also identify equipment and processes so that everyone knows what things are and what they are used for. Standard quantities should be included on supply bins or carts. The products produced on each line or in each cell can be displayed, and so on.

Outlining- Boarders around tools and equipment, big and small, help people find and return things. Outlining can also create patterns of work-flow by using the floor to indicate where and where not to place things, where to walk, safety zones and danger zones. Outlining to indicate goods to be processed or parts that have been processed becomes

a signal to material handlers for replenishing or for delivery to the next process.

Andons- Different colored lights can report the status and needs of a system and signal when defects or abnormal conditions occur so that problems can be solved immediately.

Kanban- These little signs accompany work-in-process. They are the flexible production instructions or work orders that trigger materials supply and production in a pull system, the hallmark of lean manufacturing.

Pitch and Inspection Buzzers- These indicate when operations get out of sync with demand or when defects are around. They keep awareness focused on solving problems and keep waste from taking root.

Self-Check -3	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Enumerate visual and auditory controls (4 pts).
2. What are the four important methods you can use for maintaining a waste-free production environment? (4 pts).
3. Define standardization (42pts).

Note: Satisfactory rating – 10 and above pts Unsatisfactory - below 10 pts

Name: _____Date: _____

Score = _____

Rating: _____

Information Sheet 4 Using 5W and 1H sheet for waste-free workplace

4.1. The 5W and 1H Sheet

The 5W and 1H (five “whys” and one “how”) is a powerful method and one that never stops being wasteful in sustaining a waste-free production environment. The 5W and 1H sheet is a tool that will help you systematically apply this method.

Figure 19: shows one sheet filled out.(Use the side columns when multiple questions or answers arise at any step of solving a single problem).

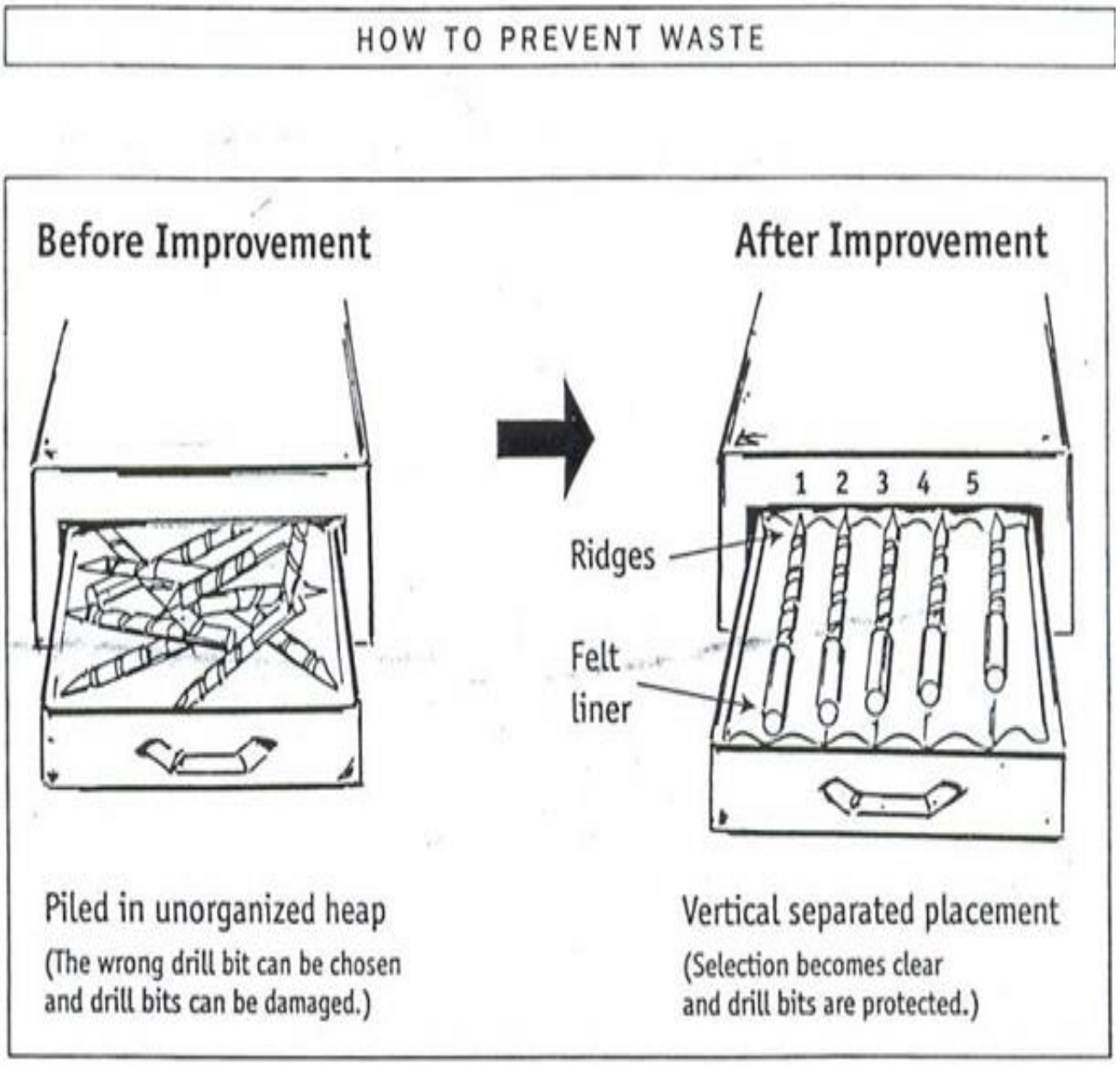

Figure 4.1 How to prevent waste

Figure 4.1 shows an example of an improvement idea that resulted from the use of the 5W1H Sheet in figure 21.

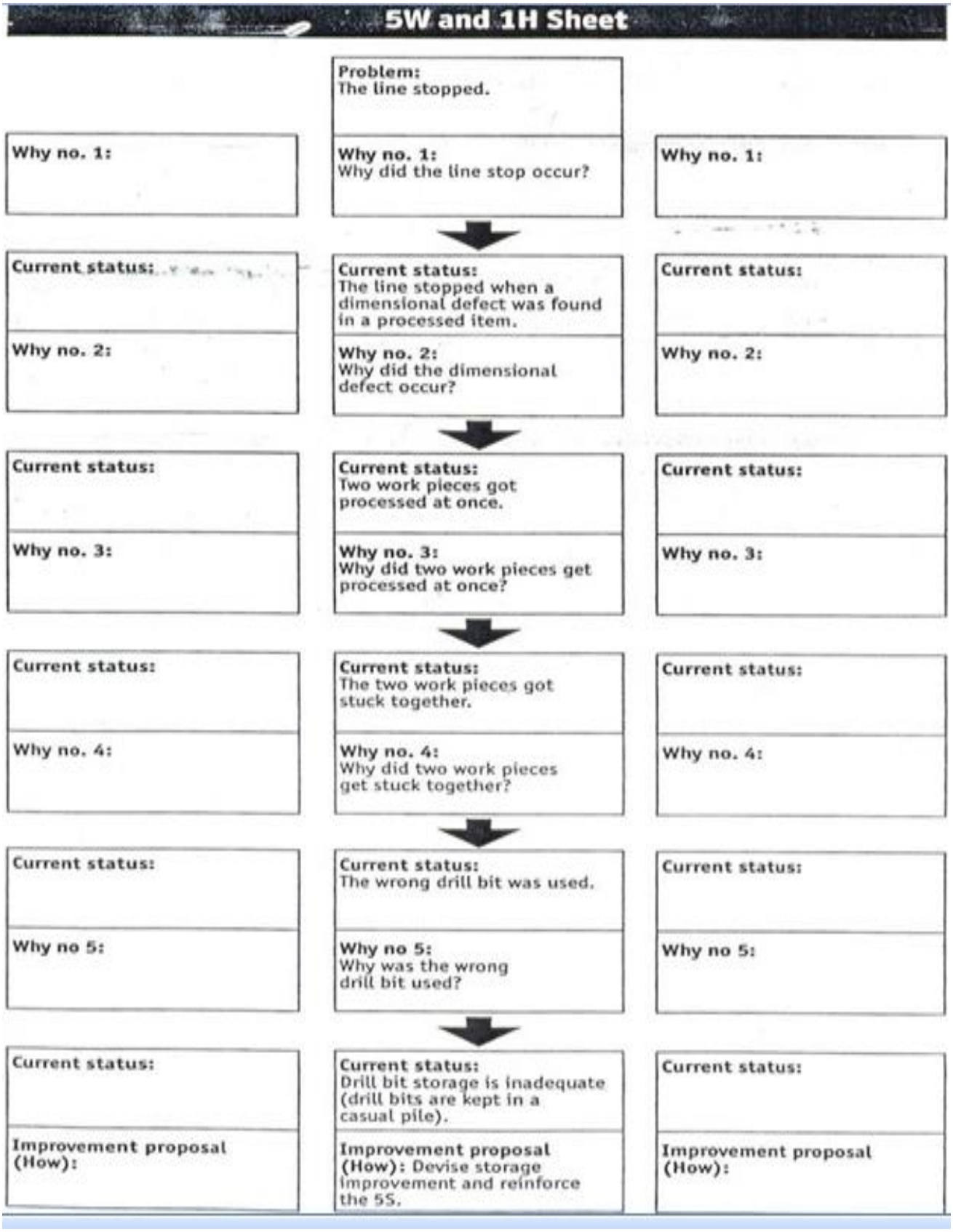

Figure 21.5W and 1H Sheet

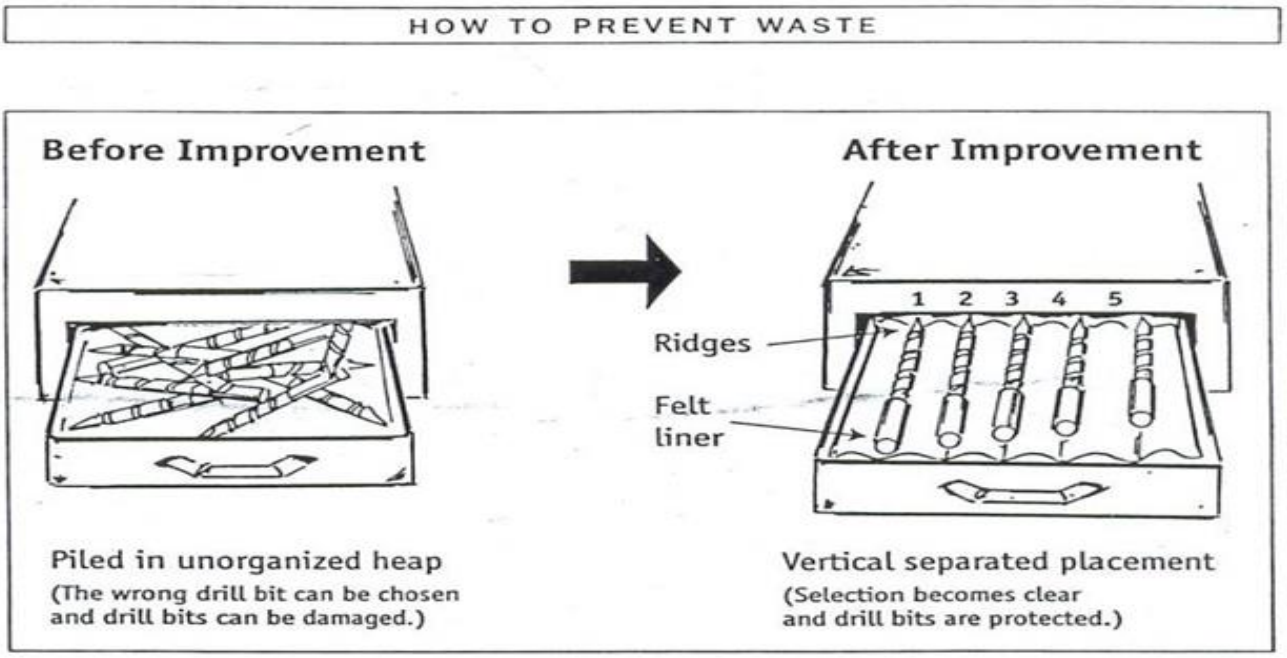

Figure 4.2 Improved waste in drill bit storage

4.2. Five Key Concepts for Asking "Why" and "How"

Following these principles suggested by Hiroyuki Hirano when you are asking the 5"whys" and 1"how":

1. Look with the eyes of a child- All improvement begins with the first why. Never cease looking and never cease asking that first why. As you practice this, the result will follow.

2. Remember three essentials for fact finding- (1) Go to where the problem occurred.(2) See the problem first-hand. (3) Confirm the facts based on your own observations.

3. Be a walker and an observer- Supervisors and managers must continually work through the factory to see that standards are being followed and to practice seeing waste. Operators need to continually examine their own operations to stay alert for new problems and new ideas for solving them that may come to mind as they do their jobs.

4. Break down fixed thinking- If you ask "why" and "how" often enough you will eventually run out of "known" answers. At this point you may reach internal mental resistance to the discovery of what you don't know. Get in the habit of asking why and how beyond this point of fixed thinking. That is when you will make the big discoveries about waste and how to solve it.

5. Do it now- Don't wait. Put your ideas into practice immediately!

Self-Check -4	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. How does 5W and 1H sheet maintains a waste free environment? (2 Points)
2. Write the five key concepts for asking “why” and “how”(5 pts).
3. Define and elaborate 5W and 1H sheet(1pt)

Note: Satisfactory rating – 8 and above pts ***Unsatisfactory - below 8 pts***

Name: _____Date: _____

Score = _____

Rating: _____

Information Sheet 5 Doing completion of required operation

5. 1. Use of Standard Operating Procedures

Standard operating procedures (SOPs) are step-by-step instructions that act as guidelines for employee work processes. Whether written up in numbered steps or formatted as flow charts, effective SOPs are complete, clearly written, and based on input from the workers who do the job. When employees follow the SOP for a particular job, they produce a product that is consistent and predictable.

The following are some benefits of standard procedures and practices in completion of operation.

- Readiness for Future Growth
- Standard Operating Procedures Simplify Performance Management
- Control the Quality and Consistency of Your Product
- Protect Yourself from Knowledge Loss
- Save on Training Costs
- Greater efficiency
- Consistency
- Easier for employees

5.2. Completing Operation of Eliminating Muda

The end of muda elimination is evaluating the effects of the implemented muda elimination tools and techniques and reporting the result using different standard sheets at the work place. This step is used to compare and contrast the condition of the workplace after and before kaizen/implementation of muda elimination techniques.

The following two tables (Table 12 and Table 13) are used for this purpose

5.2.1. Kaizen Effect Evaluation Sheet

Name of the Process:_____

Work place:_____

Problem Solving Title:_____

Table 12: Part one –Quantitative Results

S.No	Improvement Indicators	Before Kaizen	Target	After Kaizen	Improvement (%)	Remar
1	**Muda Elimination Indicators**					
	1.1. Tools & Equipment					
	1.2 . Parts Saving					
	1.3 . Raw Material saving					
	1.4. Transportation					
	1.5 . Motion in Meter					
	1.6 . Transaction Time					
	1.7. Excess Stock					
	1.8. Expired Stock					
2	**Productivity indicators**					
	2.1. Lead time					
	2.2. Machine down time					
	2.3 . Frequency of equipment failure					
	2.4. Production volume					
	2.5. Labor saving					
	2.6. labour productivity					
	2.7. Delivery time					
3	**Quality Indicators**					
	3.1. Defect rate					
	3.2. Raw material damage in %					

	3.3. Number of customer complaints					
4	**Other Indicators**					
	4.1. Number of new inventions					
	4.2. Minimized cost of Production					

Describe the Qualitative results and change that are achieved by Muda and Elimination/Reduction based on the indicators listed below .

Table 13: Part Two –Qualitative Results

S.No	Improvement Indicators	Description of the Result
1	Muda Elimination capacity of workers	
2	New inventions and Improvements	
3	Motivation of workers	
4	Awareness about Safety	
5	Corporate culture of kaizen	
6	Team work	
7	Transaction Time	

Name of Worker: _____ **Signature:** _____ **Date:** _____	**Name of Leader:** _____ **Signature:** _____ **Date:** _____

Self-Check -5	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. List down importance and benefits of standard operating procedures (10 pts).

Note: **Satisfactory rating – 10 and above pts** **Unsatisfactory - below 10 pts**

Name: _____ Date: _____

Information Sheet 6 Updating of standard procedures and practices

6.1. Checking the existing SOPs

Here are some questions to ask as you consider whether your existing SOPs are in use throughout your organization and are still working as you intended them to.

Staff awareness:

- Where are the SOPs kept? Is the "centralized" copy really still available?
- Does everyone have a copy? Does new staff get a copy right away? Is there someone responsible for assuring this?
- Do all of the staff know—more than vaguely—what you are talking about when you ask about policies?

Usefulness of current SOPS:

- Do you hear consistent grumbling from staff regarding any particular procedures
- Is the manual truly comprehensive? Have you noticed any gaps
- Are the SOPs still realistic? Efficient? Effective? Is there now a better way
- When did you last really read them

Integration with your operations:

- Are staffs still involved in conversations that arise about needed updates
- Are you open to changes and improvements, even though you worked so hard to get what you have now

- Is your training still linked to procedures, and successful at helping staff understand what it is they need to accomplish

6.2. Needs for Change

The following are the kinds of changes needed most of the time For example:

- If awareness is the issue, you may need to produce and distribute the procedures and ask supervisors to remind staff about them.
- If the information is out of date, you can use the process outlined in Part I to identify and make necessary changes to the SOPs.
- If there's a lack of acceptance of the SOPs, do some digging to find out why:
- Is the use of the SOPs included in job descriptions, employment policies, performance objectives, and training?
- Are the SOPs too cumbersome to use? Are they unnecessarily complicated or too far removed from day-to-day reality?
- Do your supervisors believe in their value and insist on their use? If not, why?
- Do line staff resist following the SOPs? If so, why?

Identifying where the gaps between the procedures and their acceptance occur means that you can focus on a response that addresses the real issues and involves the right people.

6.3. Ways of Making Changes

Designate only one person to actually enter changes in the master document. This person could be your director of operations, manager, and executive director—based on what's best for your agency.

Here is a suggested process for identifying and implementing changes to your SOPs:

- Include SOPs on the agenda of regular department staff meetings if there are any suggestions for change, deletions, or additions that need to be discussed.
- After discussion with the entire department, the department supervisor advises the director of operations of his/her team's suggestions or needed clarification.

- The director of operations evaluates the requested change and if necessary discusses it with the executive director or leader.
- If the Director of Operations and the ED agree to make the change, that section of the master SOP manual (both electronic and physical copy) is updated with the new wording and instruction.
- A memo then goes out to the entire staff with a summary of the update, and the page and section number that was updated. Each staff person also receives a printed copy of the new revised section for the staff member to update their own manual.

6.4. Updating SOPs

Development of SOPs and keeping them up to date and used must be a priority of an agency. Agencies who are most successful with following SOPs have made it someone's main task to:

- keep the SOPs current,
- ensure training is taking place based on the SOPs, and
- Prevent SOPs from falling to the bottom of the priority list.

Many agencies are understaffed, and yours may be one of them. If you are thinking you can't devote staff time to SOPs, think again about all of the aspects of your operation that will run more smoothly, more safely, and more reliably when everyone follows a good set of SOPs. SOPs are the core of your entire operation, and therefore critical to the internal and external success of your program.

SOPs should be reviewed by all staff, department supervisors and the director at least once each year, and suggestions from staff should always be considered for changes of process. The consequences of not having SOPs in good working order are far more serious than the inconvenience of keeping them updated.

Organizations need to develop a comprehensive system to ensure that all policies, procedures and training programs are continually reviewed and updated, in practice as

well as in writing. Making such a review part of supervisor job descriptions, and making time for it on the calendar help ensure that your organization keeps the information current and functional.

SOP Advocate: Is a staff person who takes charge of SOPs in your organization. Select a staff who:

- is organized,
- does not "have an agenda,"
- likes people, and
- Understands the importance of this project and document.

When you find this individual, see where you can make some changes so this person has the time and energy to take on your SOPs.

Self-Check -6	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. Why changes are needed in standards and practices at work places?(4 pts)
2. List the characters of a staff person you may choose as SOPs advocate(1 points).
3. Suggest the processes used for identifying and implementing changes to your SOPs(5 pts)

Note: **Satisfactory rating – 10 and above pts** **Unsatisfactory - below 10 pts**

Name: _____ Date: _____

Information Sheet 7 Ensuring capability of the work team

7.1. Teams

A team is a group of people working toward a common purpose. A team is a group of people who work together toward a common goal. Teams have defined membership (which can be either large or small) and a set of activities to take part in. People on a team collaborate on sets of related tasks that are required to achieve an objective. Each member is responsible for contributing to the team, but the group as a whole is responsible for the team's success.

Organizations typically have many teams, and an individual is frequently a member of more than one team. Some teams are permanent and are responsible for ongoing activities. For instance, a team of nurses in a maternity ward provides medical services to new mothers. While patients come and go, the tasks involved in providing care remain stable. In other cases a team is formed for a temporary purpose: these are called **project teams** and have a defined beginning and end point linked to achieving a particular one-time goal.

7.2. The Purpose of Teams

Organizations form teams to accomplish tasks that are too large or complex for an individual to complete. Teams are also effective for work that requires different types of skills and expertise. For example, the development of new products involves understanding customer needs as well as how to design and build a product that will

meet these needs. Accordingly, a new product-development team would include people with customer knowledge as well as designers and engineers.

So, teams are used for the following purposes.

- In a business setting most work is accomplished by teams of individuals. Because of this, it is important for employees to have the skills necessary to work effectively with others.
- Organizations use many kinds of teams, some of which are permanent and some of which are temporary.
- Teams are used to accomplish tasks that are too large or complex to be done by an individual or that require a diverse set of skills and expertise.

7.3. Teamwork

- Teamwork involves a set of interdependent activities performed by individuals who collaborate toward a common goal.
- Teamwork involves shared responsibility and collaboration toward a common outcome.
- Teamwork processes can be divided into three categories: the transition process, action processes, and interpersonal processes.
- Five characteristics of effective teamwork are shared values, mutual trust, inspiring vision, skills, and rewards.

Teamwork involves a set of tasks and activities performed by individuals who collaborate with each other to achieve a common objective. That objective can be creating a product, delivering a service, writing a report, or making a decision. Teamwork differs from individual work in that it involves shared responsibility for a final outcome.

Figure 7.1 Teamwork (Human skill involves the ability to work effectively as a member of a group and to build cooperative effort in a team).

7.4. Teamwork Processes

While the substance of the tasks involved in teamwork may vary from team to team, there are three processes that are common to how teamwork gets done: the transition process, action processes, and interpersonal processes. During each of these processes, specific sets of activities occur.

These processes include:

- The transition process is the phase during which a team is formed. Activities include:
  - ✓ Mission analysis: establishing an understanding of the overall objective
  - ✓ Goal specification: identifying and prioritizing the tasks and activities needed to achieve the mission

- ✓ Strategy formulation: developing a course of action to reach the goals and achieve the mission

- Action processes comprise the phase during which a team performs its work. Activities include:
  - ✓ Monitoring milestones and goals: tracking progress toward completion of tasks and activities
  - ✓ Monitoring systems: tracking the use of resources such as people, technology, and information
  - ✓ Coordination: organizing and managing the flow of team activities and tasks
  - ✓ Team monitoring and support: assisting individuals with their tasks by, for example, providing feedback and coaching.
- Interpersonal processes include activities that occur during both the transition and action processes including:
  - ✓ Conflict management: establishing conditions to avoid disagreement and resolving conflict when it occurs
  - ✓ Motivation and confidence building: generating the willingness and ability of individuals to work together to achieve the mission
  - ✓ Affect management: helping team members to regulate their emotions as they work together.

7.5. Characteristics of Effective Teamwork

An effective team accomplishes its goals in a way that meets the standards set by those who evaluate its performance. For instance, a team may have a goal of delivering a new product within six months on a budget of $100,000. Even if the team finishes the project on time, it can be considered effective only if it stayed within its expected budget.

Effective teamwork requires certain conditions to be in place that will increase the likelihood that each member's contributions—and the effort of the group as a whole—will lead to success.

Effective teams share five characteristics include:

Shared values: a common set of beliefs and principles about how and why the team members will work together

Mutual trust: confidence between team members that each puts the best interest of the team ahead of individual priorities

Inspiring vision: a clear direction that motivates commitment to a collective effort

Skill/talent: the combined abilities and expertise to accomplish the required tasks and work productively with others

Rewards: recognition of achievement toward objectives and reinforcement of behavior that supports the team's work

Effective teamwork requires that people work as a cohesive unit. These five characteristics can help individuals collaborate with others by focusing their efforts in a common direction and achieving an outcome that can only be reached by working together.

7.6. Elements of Effective Teamwork in the Workplace

Elements of successful teamwork include:

- Communication: Effective communication is the most important part of teamwork and involves consistently updating each person and never assuming that everyone has the same information.
- Delegation: Teams that work well together understand the strengths and weaknesses of each team member.
- Efficiency
- Ideas
- Support

The following methods are used to align individual goals with organizational goals for mutual success includes:

- Clear company goals.

- Communicate the company strategy and vision relentlessly.
- Employees set their own goals within the company framework.
- Avoid incentives; focus on attaining goals
- Hire only the cultural fit.

Ways of building organizational capabilities are:

- Establish a programme of change to build organisational capability;
- Identify a senior champion and initiate top down implementation;
- Excite management buy-in;
- Incentivize value-focused behaviors through recognition and reward;
- Focus on identifying the areas of greatest need to maximize effectiveness; and

Self-Check -7	**Written Test**

Direction I: Short Answer Item

Instruction: Give short and precise answers to the following questions and write your answers in the spaces provided on answer sheet 1.

1. List elements of successful teamwork (7 pts).

Note: **Satisfactory rating – 7 and above pts** **Unsatisfactory - below 7 pts**

Name: _____ Date: _____

Operation Sheet -1	Techniques of Preparing and Implementing a Plan for Elimination/Reduction of Muda

Use the following steps

Step 1: Analyze the documents of the already identified wastes in several processes or work areas

Step 2: Rank the improvements that are needed. Focus on improvements on the process with the greatest total when you add up the magnitude of its wastes.

Step 3: Choose the first process to be improved from the workshop checklist.

- Using the more detailed waste-finding checklists provided, find more specific instances of waste.
- Observe the types and magnitude of the detailed waste.

Step 4: Set target

- **What?** Decrease/Eliminate the amount of the waste specified.
- **When?** By the End of ----
- **How many?** Minimize the problem from –to –

Step 5: Prepare Activity Plan(see the following sample)

	Why?	What?	Where?	Who?	When?	How?
	Objectives	**Items to be implemented**	**Location**	**Person(s) charge**	**Time/Duration**	**Method**
P						
D						
C						

Note 2: P=Plan; D= Do and C= Check

Operation Sheet -2	Techniques of Planning New Procedure for Preventing Muda

Steps:

Step 1: Prepare any resources, including tools and equipments, used for planning

Step 2: Select work area or process for which you are going to prepare a plan for muda prevention (Use work area or process for which you have implemented improvement idea and confirmed the results previously).

Step 3: Establish a new standard procedure for the area/working process.

Step 4: Document the new standard procedure.

Step 5: Train the workers the new standard procedure.

Step 6: Prepare action plan to implement and follow up the standard procedure(refer the following sample action plan).

No.	What	When	Where	Who	How	Why	Counter point	Follow up
1		Always		Operator				Team Leader
2		At the time of purchasing		Leader				
3		Always		Leader				
		Once every 6 months		Leader and maintenance head				
		Every 6 months		Leader & members				
		When necessary		Leader & trainers				
		Once a year		Leader				
4		When necessary		Operators				

Figure 24: Sample action plan

Step 7: Follow up the workers to correctly apply the standard procedure according to the action plan.

Step 8: Improve the standard procedure when conditions change.

LAP Test 1	Practical Demonstration

Name: _____ **Date:** _____

Time started: _____ **Time finished:** _____

Instructions: Given necessary reagents, tools and materials you are required to perform the following tasks within **2 hours.**

Task 1: Plan new procedure for Preventing Muda

Task 2: Prepare and implement a plan for elimination/reduction of Muda

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The trainers who developed the TTLM

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Unit of Competence: :- Preventing and Eliminating MUDA **Self-check**

LO 1

Self-check 1: key answer

1.Procedures describe a process, while a work instruction describes how to perform the conversion itself

2.A piece of work, especially a specific task done as part of the routine of one's occupation or for an agreed price

3. a description of the specific tasks and activities within the organization.

2 Discipline:

Enthusiasm:

Soft Skills:

Qualifications

Self-check 2: key answer

1 is a process in which employers identify and determine the particular job duties and the relative importance of these duties for a given job

Self-check 3: key answer

legislation/regulations/codes of practice and enterprise safety policies and procedures.

Physical hazards are a common source of injuries in many industries
History

Workplace hazards

Physical and mechanical hazards

Electronics maintenance

Self-check 4: key answer

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.

Self-check 5: key answer

1. D
2. A
3.B
4.C

LO 2

Self-check 1: key answer

1 is the customer within a production line/service delivering sequence that is next to the previous process and makes his/her own process.

2.Customer is the one who buys products/services from manufacturers/service providers.

The primary target of Manufacturers/ Service providers is to earn profit

Self-check 2: key answer

1.F

2.E

3.C

4.B

5.A

Self-check 3: key answer

- Equipment failure (breakdown)
- Setup and adjustment downtime
- Idling and minor stoppages
- Reduced speed
- Process defects

- Reduced yield
- Never use any machine you have not been trained to use.
- Pull plug or throw switch to off position before cleaning or adjusting any machine. Keep fingers, hands, spoons, etc., away from moving parts. Wait until machine stops before moving food.
- Check all switches to see that they are off before plugging into the outlet
- **Prioritizing the SOP**
- **Creating the SOP**
- **Publishing and Promoting the SOP**
- **Training and Testing Workers on the SOP**

Self-check 4: key answer

- **1**Make waste visible
- Be conscious of the waste
- Be accountable for the waste.
- Measure the waste.
- Cutting the hidden costs of production
- Increased customer satisfaction
- Increased job satisfaction
- Contributing to improvement

Self-check 5: key answer

Waste that is not seen cannot be eliminated

- Store materials as close to the point of use as possible
- Avoid transportation over long distance
- Avoid overproduction

Self-check 6: key answer

- Lengthened delivery time
- Weak consciousness to control inventory

- Waste of space
- Needs for inspection, and transportation
- Expansion of working fund

LO 3

Self-check 1: key answer

it is fixed (methods used to fix or eliminate the MUDA) and when to fix the problem(the time plan

Self-check 2: key answer

- 1 Throw out all of your fixed ideas about how to do things.
- Think of how the new method will work-not how it will not.
- Don't accept excuses. Totally deny the status quo.
- Don't seek perfection. A 50 percent implementation rate is fine as long as it is done on the spot.
- Correct mistakes the moment they are found.

Self-check 3: key answer

- Leveled Production
- Continuous Improvement
- Ef Ciency Through A Customer-Firs Tapproach
- Develop Error-Proof Processes
- Focus On Quality
- One-Piece Flow
- Mapping The Value System
- Respect For Humanity

Self-check 4: key answer

1. **E**
2. **B**
3. **A**
4. **D**
5. **F**
6. **C**
7. **H**
8. **G**

Self-check 5: key answer

- Store materials as close to the point of use as possible
- Avoid transportation over long distance
- Avoid overproduction
- Dispose of obsolete material to save space and avoid confusion
- Do not produce items ahead of customers delivery requirement
- Do not manufacture products in excess

Waste that is not seen cannot be eliminated

Self-check 6: key answer

may be required by regulatory or license conditions or that are created to support operations and planning

remove waste from the human environment and to ensure that it remains isolated from that environment and inaccessible to humans until the radioactivity has decayed away.

LO 4

Self-check 1: key answer

- ✓ Why are we undertaking the project?
- ✓ What are we going to do? What data is required?
- ✓ Who is responsible for each task? Who should be involved?
- ✓ How must it be accomplished? How do we review?
- ✓ Where can we find relevant data and facts?
- ✓ When must a task be complete?

Self-check 2: key answer

- Equipment failure (breakdown)
- Setup and adjustment downtime
- Idling and minor stoppages
- Reduced speed
- Process defects
- Reduced yield
- Never use any machine you have not been trained to use.
- Pull plug or throw switch to off position before cleaning or adjusting any machine. Keep fingers, hands, spoons, etc., away from moving parts. Wait until machine stops before moving food.
- Check all switches to see that they are off before plugging into the outlet
- **Prioritizing the SOP**
- **Creating the SOP**
- **Publishing and Promoting the SOP**
- **Training and Testing Workers on the SOP**

Self-check 3: key answer

One way waste enters into operations is when standards are not improved to meet changing conditions.

- Standardization
- Visual controls
- Auditory controls
- 5W and 1H Sheet

1important methods you can use for maintaining a waste-free production environment:

standardization is to create and sustain a waste-free process. Standardization means establishing standard procedures for every operation so that anyone can understand and use them – and everyone does

Self-check 4: key answer

1is a powerful method and one that never stops being wasteful in sustaining a waste-free production environment. The 5W and

1H sheet is a tool that will help you systematically apply this method

Look with the eyes of a child- All improvement begins with the first why. Never cease looking and never cease asking that first why. As you practice this, the result will follow.

2. Remember three essentials for fact finding- (1) Go to where the problem occurred.(2) See the problem first-hand. (3) Confirm the facts based on your own observations.

Self-check 5: key answer

1.step-by-step instructions that act as guidelines for employee work processes

Self-check 6: key answer

- Where are the SOPs kept? Is the "centralized" copy really still available?
- Does everyone have a copy? Does new staff get a copy right away? Is there someone responsible for assuring this?

- Do all of the staff know—more than vaguely—what you are talking about when you ask about policies?
- If the information is out of date, you can use the process outlined in Part I to identify and make necessary changes to the SOPs.
- If there's a lack of acceptance of the SOPs, do some digging to find out why:
- Is the use of the SOPs included in job descriptions, employment policies, performance objectives, and training

Self-check 7: key answer

- Communication: Effective communication is the most important part of teamwork and involves consistently updating each person and never assuming that everyone has the same information.
- Delegation: Teams that work well together understand the strengths and weaknesses of each team member.
- Efficiency
- Ideas
- Support