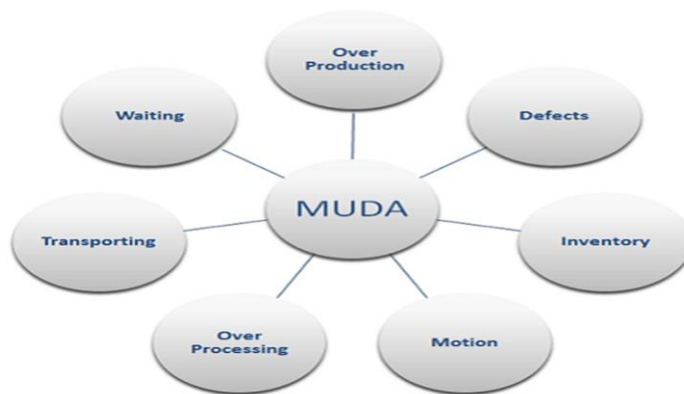


Tour Operation

Level- III

Based on December 2022, Curriculum Version II



Module Title: Prevent and Eliminate Muda

Module code: CST BPP2 M01 1122

Nominal duration: 32 Hour

Prepared By: Ministry of labor and skills

December, 2022

Addis Ababa, Ethiopia

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Acronyms

TTLM -Teaching, Training and Learning Materials

TPM - Total Productive Maintenance

OHS - Occupational Health and Safety

WHS - workplace health and safety

PDCA - plan, do, check, act

PFD- process flow diagram

WHO- World Health Organization

Introduction to the module

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

This module is designed to meet the industry requirement under the bakery and pastry production occupational standard, particularly for the unit of competency: Prevent and Eliminate MUDA.

This module covers the units

- Prepare for work
- MUDA and its problem
- Causes of a problem
- Elimination of MUDA and Assessment effectiveness of the solution, and
- Prevention occurrence of wastes and sustain operation

Learning Objective of the Module

At the end of this session, the trainees will be able to

- Prepare for work
- Identify MUDA and problem
- Analyze causes of a problem
- Eliminate MUDA and Assessing effectiveness of the solution, and
- Prevent occurrence of wastes and sustaining operation

Module Instruction

For effective use this modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Read the identified reference book for Examples and exercise

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Unit one: Prepare for work

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

- OHS requirements and Safety equipment and tools
- Work instructions
- Working manual.
- Appropriate material for work

This unit 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 requirements
- Read and interpret job specifications
- Use OHS requirements
- Select and prepare materials for work which are appropriate to application.
- Identify and check safety equipment and tools for safe and effective operation.

1.1. OHS Requirements and Safety tools

1.1.1. Definitions of 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 equipments 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 health and safety (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.

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

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and safety at work, which is concerned with preventing harm from any incidental hazards, arising in the workplace.

1.3. Safety equipment and tools

1.3.1 Concept of safety

Safety is a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community. It is an essential resource for everyday life, needed by individuals and communities to realize their aspirations.

Attaining an optimum level of safety requires individuals, communities, governments and others to create and maintain the following conditions, whichever setting is considered:

- a climate of social cohesion and peace as well as of equity protecting human rights and freedoms, at the family, local, national or international level;
- the prevention and control of injuries and other consequences or harm caused by accidents;
- the respect of the values and the physical, material and psychological integrity of individuals; and
- The provision of effective preventive, control and rehabilitation measures to ensure the presence of the three previous conditions.

These conditions can be assured by initiatives that focus on the **environment** (physical, social, technological, political, economic and organizational) and on **behavior**.

1.3.2. Safety equipment and tools

Safety equipment and tools that we use in the workshop are dust masks, safety goggle, glove, work wear, first aid safety shoe.

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- I. Dust masks:-** A **dust mask** is a flexible paper pad held over the nose and mouth by elastic or rubber straps for personal comfort against non-toxic nuisance dusts. They are not intended to provide protection from toxic airborne **hazards**.



Fig 1.1 an individual with dust mask

II. Safety goggles

Safety goggles are intended to shield the wearer's eyes from impact hazards such as flying fragments, objects, large chips, and particles. **Goggles** fit the face immediately surrounding the eyes and form a **protective** seal around the eyes. This prevents objects from entering under or around the **goggles**.



Fig 1.2 Safety goggle

III. Glove

Gloves are pieces of clothing which cover your hands and wrists and have individual sections for each finger. You wear gloves to keep your hands warm or dry or to protect them a pair of white cotton gloves.

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Gloves protect and comfort hands against cold or heat, damage by friction, abrasion or chemicals, and disease; or in turn to provide a guard for what a bare hand should not touch.



Fig 1.3 glove

IV. Work wear

Is clothing worn for work, especially work that involves manual labor? Often those employed within trade industries elect to be outfitted in work wear because it is built to provide durability and safety.



Fig 1.4 Work wear

V. First aid and safety shoes

First aid is the first and immediate assistance given to any person suffering from either a minor or serious injury, with care provided to preserve life, prevent the condition from worsening, or to

promote recovery. During this time, a first aid provider may need a safety shoe.



Fig 1.5 safety shoe

1.4. Work instructions

It describes what workers need to be able to do on the job.

- Work functions
- Key activities of each work function
- Performance indicators

It also describes what task to be done or work roles in a certain occupation.

✓ **Work instruction** is a description of the specific tasks and activities within an 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.

1.5 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.

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- 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.

1.6 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)?

1.7 Working manual

1.7.1. Job Specification

A statement of employee/workers characteristics and qualifications required for satisfactory performance of defined duties and tasks comprising a specific job or function.

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Table 1.1. Specification Sample

Technical parameters	Gigabyte 3D Rocket II (GH-PCU23-VE)
Heatsink and fan dimensions (L x W x H)	112mm x 112mm x 160mm 92mm x 92mm x 25mm
Heatsink material	aluminum plates on a copper base and four copper heatpipes 6mm in diameter
Fan rotation speed	~1500-3000rpm
Airflow	no data
Noise level	16.0 ~ 33.5 dBA
Nominal voltage	~12V
Fan MTBF	50,000h
Maximum power consumption	~4.6W
Fan bearings	2 frictionless bearings
Full weight	640g
Supported CPU sockets	Socket 478, LGA 775, Socket AM2/754/939/940
Additional	Additional fan in the lower part of the cooler Gigabyte thermal grease Replaceable fluorescent rings
Price, USD	\$60

1.8. Appropriate materials for work

1.8.1. Best practices for choosing materials

To choose materials, you have to:

- Understand the critical components of your design. The first step in the process of choosing the right material is to understand which structural elements are most important for the mechanical integrity of your product.
- Know your materials.
- Validate your mechanical design

Self-Check-1

Part I: Say true or false (each 1 point)

1. Personal protective equipment includes those prescribed under legislation/ regulations/codes of practice and workplace policies and practices.
2. Occupational safety and health cannot be important for moral, legal, and financial reasons.
3. Effective OHS regulation requires that work unsafe provides clear, accessible advice and guidance.

Part II: Choose

1. Which type of hazard including repetitive movements, improper set up of workstation, poor design of equipment, workstation design, (postural) or workflow, manual handling.
A. Ergonomic C. Physical
B. Psychological D. None
2. Of the following which one is safety equipment?
A. dust mask C. goggle
B. work wear D. all

Part III: short answer

1. Write best practice of selecting appropriate materials. (4 points)
2. List the requirements of job. (3 points)
3. Explain the difference between procedure and work instruction. (4 points)
4. Define job specification? (2 points)
5. What are the goals of OHS? (4 points)
6. List at least four workplace hazards? (4 points)

Unit Two: MUDA and its problem

This unit to provide you the necessary information regarding the following content coverage and topics:

- Plan of MUDA
- Visual Management Board/Kaizen Board
- Tools and techniques to draw and analyse situation of the work place
- Causes and effects of MUDA
- Statistical tools and techniques /Kaizen elements
- Relevant procedures for wastes/MUDA

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:

- Follow Visual Management Board/Kaizen Board.
- Use tools and techniques to draw and analyze, and prepare and implement problem identification.
- Discuss Causes and effects of MUDA.
- Identify and list all possible problems related to kaizen elements using statistical tools and techniques on work place.
- Identify and measure wastes/MUDA based on relevant procedures.
- Report the Identified and measured wastes to relevant personnel.

2.1. Introduction

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.

2.2 Muda Planning

Planning is the most basic and primary function of management. It is the pre decided outline of the activities to be conducted in the organization. Planning is the process of deciding when, what, when where and how to do a certain activity before starting to work.

2.1.1 Types of MUDA

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.

A. 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.



Fig 2.1 over production

B. 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.

C. 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.

D. 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.

E. 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

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

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

2.3. Visual Management Board/Kaizen Board

Kaizen Visual Management Boards are key visual communication tools that help teams and organizations work harder to manage their continuous improvement efforts. They will help you accelerate improvements, and make sure that all your ideas flow and progress from 'to do' to 'done'.

Kaizen Visual Management Boards are key visual communication tools that help teams and organizations work harder to manage their continuous improvement efforts. They will help you accelerate improvements and make sure that all your ideas flow and progress from 'to do' to 'done'. Kaizen Visual management boards are widely used across various sectors including the healthcare and automotive industry, as a way of reducing waste and creating a more streamlined and agile supply chain.

Visual Management Boards are extremely popular in Organizations who are looking to pursue Lean & Continuous Improvement. Implementing Visual Management that works for your business will allow you to reduce visual clutter and establish performance standards for each job and process. Successfully implementing Visual Management will come with a number of benefits including:

- ✓ **Improve Productivity** – Keep your workforce organized and productive whilst reducing downtime.
- ✓ **Impress Clients** – Display to your Visitors that you're invested in continuous improvement.
- ✓ **Reduce Waste** – Make waste reduction a daily concern through visual management.
- ✓ **Promote Values** – Enact your values and make them part of the culture of your working environment

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- ✓ **Raise Awareness** – Ensure all your workforces are complying with your rules & regulations.
- ✓

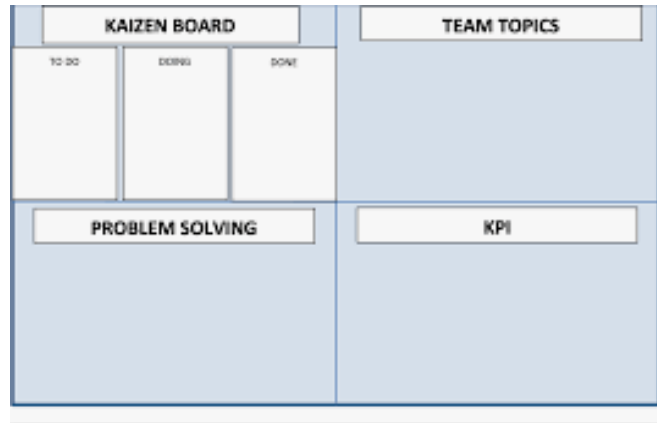


Figure 2.1. Kaizen Board

2.4. Tools to analyze situation of the work place

A **workplace** is a location where someone works for their employer, a place of employment. Such a place can range from a home office to a large office building or factory. For industrialized societies, the workplace is one of the most important social spaces other than the home, constituting "a central concept for several entities: the worker and his/her family, the employing organization, the customers of the organization, and the society as a whole". The development of new communication technologies have led to the development of the virtual workplace, a workplace that is not located in any one physical space.

To identify Muda, the following tools and equipment are used.

- A. Tape/Meter** - is used to measure distances or lengths.
- B. Stop watch** - is used to measure operation/processing or waiting/idling times.
- C. Photo Camera** - may be necessary to take pictures, such as shop layout, for analysis.
- D. Video Camera** - may be necessary to record video of each work element to study and identify wastes, such as motion, processing, waiting, etc.
- E. Calculator** - required making arithmetic calculations.

2.5. Causes and effects of MUDA

Table 2.1 cause and effect of muda

No	Type of muda	Cause	Effect
1.	Over production	<ul style="list-style-type: none"> • Large-lot production • Anticipatory production (producing product in advance of demand) • Inability to achieve short changeover times with the large equipment used in mass production systems • Creating enough stock to replace the number of defective parts produced • Overstaffing or too much equipment • Machines that turn out parts too quickly 	<ul style="list-style-type: none"> • Anticipatory buying of parts and materials • Blocked flow of goods • Increased inventory • No flexibility in planning • Occurrence of defects
2.	Inventory	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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
3.	Motion	<ul style="list-style-type: none"> • Isolated operations • Low employee morale • Poor work layout • Lack of training • Undeveloped skill 	<ul style="list-style-type: none"> • Increase in manpower and processing • Unstable operation • Increases production time • Can cause injury

4.	Transportation	<ul style="list-style-type: none"> Poor layout Shish-skilled workers Sitting to perform operations The need for conveyance systems is assumed 	<ul style="list-style-type: none"> Waste of space Production deterioration Expansion of transportation facilities Occurrence of scratches Increase production time and cost wastes time and energy
5.	Waiting	<ul style="list-style-type: none"> Obstruction of flow Poor equipment layout Trouble at the upstream process Capacity imbalances Large Lot-production 	<ul style="list-style-type: none"> Waste of manpower, time, & machines Increase in the in-process inventory Failed delivery dates Poor workflow continuity
6.	Defect making	<ul style="list-style-type: none"> Emphasis on downstream inspection No standard for inspection work Omission of standard operations Material handling and conveyance 	<ul style="list-style-type: none"> Increase in material cost Productivity deterioration Increase in personnel & processes for inspection Increase in defects and claims Invite reworking costs
7.	Processing	<ul style="list-style-type: none"> Inadequate study of processes Inadequate study of operations Incomplete standardization Materials are not studied 	<ul style="list-style-type: none"> Unnecessary processes or operation Increase in manpower and man-hour Lower workability Increase in defects Can reduce life of components

CHECK SHEET – COMPUTER RELATED PROBLEMS						
S. NO.	Problem	Weekly Status				Total
		1	2	3	4	
1	Network problem					16
2	Server Problem					13
3	Email					18
4	Server Access					17
Total		10	20	13	21	

Figure 2.3. Check sheet

C. Control Charts

Control Charts were developed by Walter A. Shewhart in 1920's. It helps us to understand whether the process is in statistical control.

- ✓ Used to track the performance of the metric in focus (Y)
- ✓ UCL and LCL are $\pm 3\sigma$ away from the mean
- ✓ When points fall outside control limits, process is not considered in statistical control
- ✓ Concepts of common cause and special cause variation are used
- ✓ Different control charts are used for different types of data

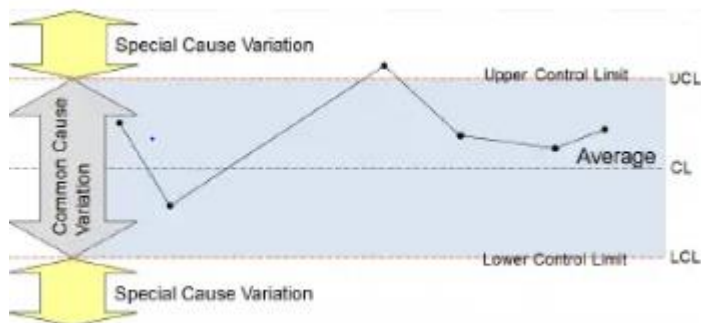


Figure 2.4. Control Charts

2.7. Relevant procedures for MUDA Identification

It is not easy to find waste when you look at the production line or the warehouse or an operation. If you have never been involved in improvement activities you will find it even harder

to discover waste that may be right in front of you. Waste is everywhere, in every operation; it is so common and you are so used to it that it is hard to see.

The steps to effective waste identification are:

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

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

- ✓ Shop layout analysis
- ✓ Process flow analysis
- ✓ Take photos/video
- **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.

B. Be conscious of the waste: -When something is denied as waste, it also cannot be stopped.

C. Be accountable for the waste: -When one refuses to accept responsibility for the waste, then he/she will not eliminate it.

D. 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.

- ✓ 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.

Self-check-2

Part I: say true or false (each 1 point)

1. Tape is one of the tools to identify Muda/ wastes.
2. Planning is the most basic and primary function of management.
3. Overproduction is of the 7 types of Muda.
4. Eliminating Muda decreases job satisfaction.

Part II: Choose (each 1 point)

1. Of the following which one is wastage?
A. overproduction C. motion E. all
B. defects D. over-processing
2. Making waste visible during waste identification is through
A. Shop layout analysis
B. Process flow analysis
C. Take photos/video
D. all
3. Which one of the following is among the eight pillars of TPM?
A. Quality management B. Planned Maintenance
C. Education and Training D. all
4. Of the following one is quality control (QC) tool.
A. cause and effect diagram B. Pareto charts C. scatter diagram D. all E. none

Part III: Short answer

1. What are the seven deadly wastes/Muda? (7 points)
2. Write at least two causes and effects of each type of the seven deadly wastes/Muda. (10)
3. What are the benefits of identifying and eliminating wastes/Muda to a company? (4 points)

4. What are the benefits of identifying and eliminating wastes/Muda to the workers of a company? (4 points)
5. Write down the steps to identify wastes/Muda. (4 points)
6. List out at least three ways to make waste visible. (3 points)
7. What are the four factors to be identified in arrow diagram? (4 points)

Unit Three: Analyze causes of a problem

This unit to provide you the necessary information regarding the following content coverage and topics:

- Listing Possible causes of a problem
- Analyzing Cause relationships using 4M1E
- Finding root cause of the problem
- Solutions for potential complications
- Summaries of the action plan

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:

- Identify and list possible causes of a problem.
- Analyze cause relationships using 4M1E.
- Select the root cause which is most directly related to the problem.
- List all possible ways to eliminate the most critical root cause using creative idea generation.
- Evaluate the solutions for potential complications.
- Prepare detailed summaries of the action plan to implement the suggested solution.

3.1. Finding Possible causes of a problem

Waste of defects can be caused by inefficiencies in manufacturing processes, unclear operating procedures, and poor quality raw materials from suppliers, or staffs who are poorly trained in the use of machinery or tools.

Common causes of Inventory Waste include:

- Overproduction of goods
- Delays in production or 'waste of waiting'
- Inventory defects
- Excessive transportation

3.2. Analyzing Cause relationships using 4M1E

The 4M is a method that allows identifying and group causes that impact to a specific effect. 4M categories (Material, Method, Machine, and Man) are often used in the Cause-Effect Diagram created by Kaoru Ishikawa.

3.3. Finding the root cause of the problem

Root causes are the basic reasons behind the problem or issue you are seeing in the community. Trying to figure out why the problem has developed is an essential part of the "problem solving process" in order to guarantee the right responses and also to help citizens "own" the problems.

3.3.1 "But why" technique

The "But why?" technique is one method used to identify underlying causes of a community issue. These underlying factors are called "root causes." The "But why?" technique examines a problem by asking questions to find out what caused it. Each time an answer is given, a follow-up "But why?" is asked.

For example, if you say that too many people in poor communities have problems with alcoholism, you should ask yourself "but why?" Once you come up with an answer to that

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question, probe the answer with another "but why?" question, until you reach the root of the problem, the root cause.

3.3.2 The need to identify root causes

Identifying genuine solutions to a problem means knowing what the real causes of the problem are. Taking action without identifying what factors contribute to the problem can result in misdirected efforts, and that wastes time and resources. However, by thoroughly studying the cause of the problem, you can build ownership, that is, by experiencing the problem you will understand it better, and be motivated to deal with it.

The "But why?" technique can be used to discover basic or "root" causes either in individuals or broader social systems:

It can be used to find which *individual* factors could provide targets of change for your cause, such as levels of knowledge, awareness, attitudes, and behavior.

Do people need more knowledge about nutrition?

Do children need to learn refusal skills to avoid smoking?

Do teenagers need to learn how to use contraceptives?

It can explore *social* causes. For example, it could help us determine why a certain neighborhood seems to have a higher rate of a specific problem. These social causes divide into three main sub-groups:

Cultural factors, such as customs, beliefs, and values;

Economic factors, such as money, land, and resources;

Political factors, such as decision-making power.

It can uncover multiple solutions for a certain problem and allow the user to see alternatives that he or she might not have seen before. It increases the chances of choosing the right solution, because many aspects of the problem are explored during the "But why?" exercise..

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3.4. Creative idea generation to eliminate most critical root causes

Idea generation is defined as the process of creating, developing and communicating abstract, concrete, or visual concepts. To put it simply, it's the process that requires finding new solutions for practical problems in all fields of life and work.

3.4.1. Elements of creative idea generation

- Focus
- People
- Tools and
- Time

3.4.2. Idea generation methods

Although it may seem like a random set of numbers at first glance, the 5W+H method is a really meaningful way to cope with the creative drought. The technique represents basic questions you need to ask when thinking about a specific topic: Who, what, where, when, why, and how?

1. Social Listening

Idea generation doesn't mean you have to come up with a great suggestion single-handedly. On the contrary, sometimes it's enough to do a little bit of social listening and see what the target audience has to say about a certain topic. You can use social networks like Facebook or Twitter to find precious ideas coming from end-users.

Besides that, you can always organize an opinion poll to directly ask people what they want. For example, a platform such as Survey Monkey allows you to launch a simple survey within minutes, so why not use it as the idea generation tool?

2. Brainstorming

Brainstorming is a well-known method that people all over the world use for decades already. What makes this tactic so popular? Well, it's the fact that no one gets laughed at for proposing a stupid idea. There is no right or wrong here – you just need to say the first thing that comes to

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your mind and that's it. After a quick brainstorming session, you just need to filter through all suggestions and find the ones that have the biggest potential to succeed.



Fig 3.1 Brainstorming

3. Role Playing

Walking in someone else's shoes is everything but easy, but sometimes it's the only way to break the barrier and think of a brilliant idea. The process is simple: you just need to switch places with your colleagues and try to embrace their point of view. It doesn't guarantee immediate results, but it often leads to interesting conclusions and brand new ideas.

4. Use Online Tools

The Internet is filled with interesting tools that can assist you in identifying alternative ideas. You can choose between many different options, but the final decision usually depends on the nature and peculiarities of your business. However, we can definitely recommend a couple of valuable platforms here:

5. Mind Mapping

Mind mapping is another method to get through the creative drought successfully. By definition, a mind map is a diagram for representing tasks, words, concepts, or items linked to and arranged around a central concept or subject using a non-linear graphical layout that allows the user to build an intuitive framework around a central concept.

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Let's say you are writing a screenplay. In this case, you can put the main character in the center of the map and then add links leading to all other elements of your movie – from plot and love relationships to supporting roles.

6. Think in Reverse

The last solution on our list is very amusing. Instead of thinking about how to reach your goal, you can think about how not to achieve it. For example, you can make a plan on how to reduce the number of face book followers instead of increasing it. The so-called negative thinking often leads people to unbelievable conclusions, which in turn brings them a bunch of new ideas.

3.5. Preparing Action plan to implement solutions

Action planning is the process in which you plan what will happen in the project or organization in a given period of time, and clarify what resources are needed to make it possible.

In project management, an action plan is a document that lists the action steps needed to achieve project goals and objectives. Therefore, an action plan clarifies what resources you'll need to reach those goals, makes a timeline for the tasks or action items and determines what team members you'll need to do it all. We'll define what project goals, project objectives, action items and action steps are later on in this guide.

An action plan documents the execution of the project plan. That is, it's a detailed list of the work that must be done to complete the project goals, including the action steps that are involved in getting from the start of the project to the finish. An action plan is similar to a project implementation plan and it's very helpful during the project planning and project execution phases.

Not only are you figuring out the action steps and timeline, but you'll also determine who you'll assemble for your project team to work on those tasks.

3.5.2. Writing an Action Plan

When someone prepares an action plan for Muda identification, the following things have to be considered:

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- A. Define your Goals
- B. Define your Objectives
- C. Define Action Steps
- D. Identify and Prioritize Action Items
- E. Define Roles & Responsibilities
- F. Allocate Resources
- G. Set SMART Goals
- H. Set a Timeline for your Action Plan
- I. Use a Project Management Tool

Self-check-3

Part I: Say True or False

1. The 4M is a method that allows identifying and group causes that impact to a specific effect.
2. Idea generation is the process of creating, developing and communicating abstract, concrete, or visual concepts.
3. Setting SMART Goal is necessary for writing an action plan.

Part II: Choose

1. Of the following which one is a common cause of Inventory Waste?
 - A. Overproduction of goods
 - B. Delays in production or 'waste of waiting'
 - C. Inventory defects
 - D. Excessive transportation
 - E. all
2. Waste of defects can be caused by
 - A. inefficiencies in manufacturing processes
 - B. unclear operating procedures
 - C. poor quality raw materials from suppliers
 - D. all
 - E. none
3. Among the following which one is an element of creativity?
 - A. Focus
 - B. People
 - C. Tools
 - D. Time
4. From the following which one is not a method for idea generation?

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A. brainstorming B. mind mapping C. social listening D. all E. none

Part III: short answer

1. What are the elements of creativity? (4 points)
2. How to write an action plan?(4 points)
3. What is creative idea generation mean? (2 points)

Unit Four: Eliminate MUDA and Assess effectiveness of the solution

This unit to provide you the necessary information regarding the following content coverage and topics:

- Basic principles to eliminate MUDA
- Identifying results

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 Plan of MUDA elimination by medium KPT members.
- Adopt necessary attitude and the ten basic principles for improvement to eliminate waste/MUDA.
- Use tools and techniques to eliminate wastes/MUDA.
- Reduce and eliminate Wastes/MUDA.
- Identify tangible and intangible results.
- Compare tangible results using various types of diagrams.
- Report improvements gained by elimination of waste/MUDA.

4.1 Basic principles to eliminate muda

- A. Identify the Key Areas of Waste
- B. Manage Inventory Efficiently
- C. Reduce Packaging Materials Usage
- D. Establish Routine Maintenance Schedules
- E. Leverage Automation for Your Business

4.2 The Ten Basic Principles for Improvement

1. Throw out all of your fixed ideas about how to do things.
2. Think of how the new method will work-not how it will not.
3. Don't accept excuses. Totally deny the status quo.
4. Don't seek perfection. A 50 percent implementation rate is fine as long as it is done on the spot.
5. Correct mistakes the moment they are found.
6. Don't spend a lot of money on improvements.
7. Problems give you a chance to use your brain.
8. Ask "Why?" at least five times until you find the ultimate cause.
9. Ten people's ideas are better than one person'.
10. Improvement knows no limit.

4.2 Characteristics of Good report

- ✓ Suitable Title
- ✓ Simple
- ✓ Promptness
- ✓ Comparability
- ✓ Consistency.
- ✓ Precise and Accurate
- ✓ Relevant Information
- ✓ Presented to Required Person or Group or Department

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Self-check-4

Part I: Say True or False

1. Muda is anything that does not have value or does not add value.
2. A reporting entity is an organization or company, or group of companies that prepares financial reports.
3. Periodic report is one of the types of report.

Part II: Choose

1. Of the following which one is the way to reduce wastes?
 - A. manage inventory efficiency
 - B. reduce packaging material usage
 - C. leverage automation
 - D. all
 - E. none
2. Which one is **not** Characteristics of Good or Essential Report?
 - A. Suitable Title
 - B. Simple
 - C. Promptness
 - D. all
 - E. none
3. How can you Eliminating Inventory Wastes?
 - A. by Production leveling.
 - B. By Pull production using kanban
 - C. By regulating the flow of production
 - D. By quick changeover operations
 - E. all

Part III: Short Answer

1. List down the type of report? (4 points)
2. Write at least two methods how to eliminate each of the seven deadly wastes. (5 points)
3. What are the characteristics of essential report? (5 points)

Unit Five: Prevent occurrence of wastes and sustain operation

This unit to provide you the necessary information regarding the following content coverage and topics:

- Plan of MUDA prevention
- Standards required for machines
- Preventing occurrences of MUDA
- Creating waste-free workplace
- Building 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:

- Prepare and implement Plan of MUDA prevention.
- Discuss and prepare Standards required for machines.
- Prevent occurrences of wastes/MUDA using visual and auditory control methods.
- Create waste-free workplace using 5W and 1H sheet.
- Do the completion of required operation.
- Facilitate the updating of standard procedures and practices.
- Ensure the capability of the work team on the new SOPs.

5.1. Plan of MUDA 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.

A. Standardization

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

B. 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.

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c. 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. 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.

d. 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.

E. Outlining- Borders 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.

5.2. Standards required for machines

5.2.1. Total Productive Maintenance (TPM)

It can be Total Productive Maintenance (TPM) is a maintenance program which involves a newly defined concept for maintaining plants and equipment. The goal of the TPM program is to markedly increase production while, at the same time, increasing employee morale and job satisfaction.

TPM brings maintenance into focus as a necessary and vitally important part of the business. It is no longer regarded as a non-profit activity. Down time for maintenance is scheduled as a part of the manufacturing day and, in some cases, as an integral part of the manufacturing process. The goal is to hold emergency and unscheduled maintenance to a minimum.

Why TPM?

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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 sent to the customers must be non-defective.

TPM Targets

- Productivity
- Obtain Minimum 80% OPE (Overall Plant Efficiency)
- Obtain Minimum 90% OEE (Overall Equipment Effectiveness)
- Run the machines even during lunch. (Lunch is for operators and not for machines!)
- Quality - Operate in a manner, so that there are no customer complaints
- .Cost - Reduce the manufacturing cost by 30%.
- Delivery time - Achieve 100% success in delivering the goods as required by the customer.
- Safety - Maintain accident free environment.
- Moral - Increase the suggestions by 3 times. Develop Multi-skilled and flexible workers.

The 8 Pillars of TPM

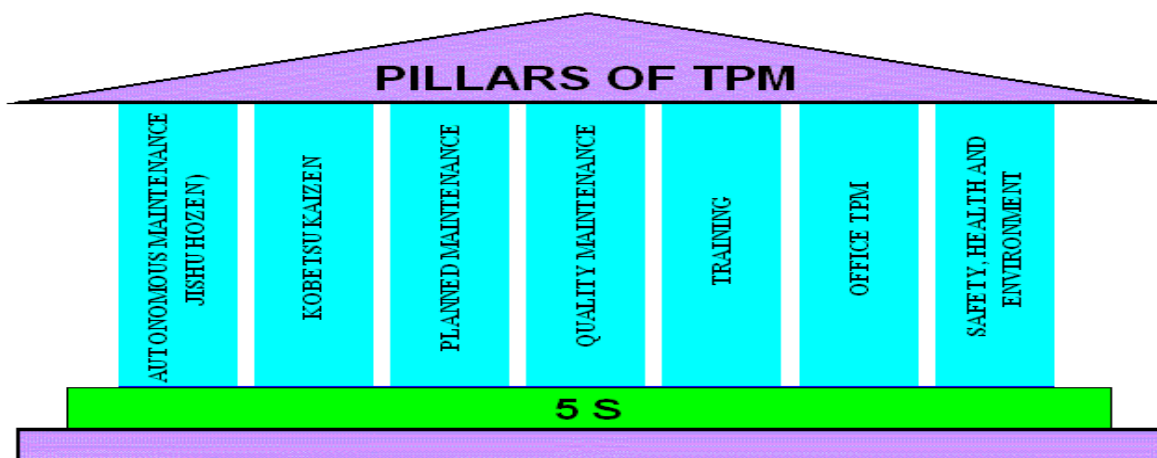


Figure 5.3. Pillars of TPM

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Factors affecting equipment effectiveness

Factors affecting equipment effectiveness are:

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

5.3. Creating waste-free workplace

A. 5W and 1H

➤ What

Considering what the problem is and what should be done about it are ways of using this "W." Another way is to find what is good about certain processes and build on those good attributes.

➤ Why

Finding out why something happens is the focus of this "W." Explanations are required to establish why something occurred. It could be a good or bad thing but there is a need to know why; if it's good, it can be used again, and if it's bad, it can be changed or nixed altogether.

➤ When

When did it happen or when will it happen? Establishing time frames is an important part of business. If there is something wrong with timing, then this step addresses the situation.

➤ Where

Where will it or did it take place? Was it a good location, and if it was not, has a lesson been learned so that location will not be used again? It could be that the location is not a

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good one for a particular project but perfect for another; this can all be established during the improvement process.

➤ **Who**

Who was involved, and finding out if they were the right people for the job, is another part of the process. Changing personnel and making sure the right people are in the right roles, teams and departments is a vital part of the Kaizen program.

5.4 Benefits of Addressing Waste

- ✓ **Save Money** -
- ✓ **Knowledge is power** - By understanding the amount and types of wastes your organization produces, you're better positioned to find ways to reduce hauling costs and negotiate for waste and recycling services that actually fit your needs.
- ✓ **Streamline reporting and information sharing** - Tracking your waste management activities in one platform and using a standard set of metrics, makes it easier to share and report information with stakeholders.
- ✓ **Enhance sustainability** - Managing waste, water, and energy more efficiently are core components of sustainability. Improving your organization's sustainability can boost your corporate image, attract quality tenants to your properties and positively engage employees.
- ✓ **Reduce greenhouse gas emissions** - Waste prevention and recycling offer significant potential for reducing greenhouse gas emissions.
- ✓ **Conserve resources** - Reuse and recycling conserves natural resources including trees, metals and water.

5.5. Standard Work in Practice

Standard work ensures a safe working environment (reduces Muri), facilitates efficient use of both man and machine (reduces Muda), and makes sure everybody performs a task the same way (reduces Mura). It is also used to preserve knowledge and skills, forms the basis for continuous improvement, is the communication tool for all improvements as

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well as the documentation of improvements, it is used as training material and is used as a reference for employees.

To implement standard work in every department, I describe 6 steps:

- ✓ Create a SIPOC,
- ✓ Create process maps
- ✓ Evaluate availability of standard operating procedures (sop's)
- ✓ Update current sop's to single-page documents when possible
- ✓ Create missing sop's
- ✓ Build an easy accessible sop-database.

The following sheets show how we are implementing each of these 6 steps in our organization:

The First step in systematically define Standard Work is the SIPOC.

1. This tool is used to define the most important sub-processes of a department or workstation. The boundaries of each process are defined which define for what process-steps standard work will be defined. Next to the boundaries of the process, the supplier and customer for each sub-process are defined. The customer requirements, which can also be another workstation in de factory, will be used to define quality remarks in the job descriptions later on.
2. The second step is to map the sub-processes each in a Process map. With only 6 symbols, each sub-process can be visualized in combination with a time-study. The time-study will include process- and waiting-times, which will help you identifying wastes at kaizen activities.
3. All sub-process-steps which are described in Process maps need to have a Standard Operating Procedure. The process maps can help analyzing what sop's are there already.
4. Update Current Sop's to single-page-documents as much as possible. It is not uncommon that operating procedures are documents of enormous size, which results in them not being used by operators because of the amount of text. By reducing the

size of the SOP's to one page as often as possible, including graphical examples, people will have the tendency to use them more often.

5. Create The Missing Sop's. All process-steps defined in the Process maps in step 2 need to be documented in Standard Operating Procedures. The best way to document the current way of working is involving operators who perform the task in documenting it.
6. Finally, all operating procedures should easily be accessible, and should therefore be put in a database. Finding the right SOP can be facilitated by building a Tree-structure of SOPs and a PowerPoint presentation to click through the tree to find the SOP you're looking for. Next to the official digital database, it can be necessary to place some of the procedures on the shop-floor in hardcopy. Standard Work is the basis for all improvements and therefore the basis of every Lean implementation. When current working methods are not standardized, variation (Mura) might exist in the process. When employees all agree on the current way of performing a task, collectively finding improvements will be easier.

5.6. Building capability of the work team

5.6.1. Teamwork approach

Kaizen concept and strategy and its embraced tools emphasize and revolve around. Team work activities. So it is worthwhile to present from bibliography types of teamwork with their characteristics that used in specific circumstances and can be adjusted or modified to any company to promote kaizen activities.

5.6.2. Team works principles

One of the most compelling reasons for the movement toward implementing empowered work teams is the fact that teams work. The basic rationale is that the use of teams allows an organization to take advantage of the diverse, backgrounds, and interests of team

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members. The team effort and cooperation often result in a motivated and entrepreneurial workforce.

According to Laureau and Orsburn et al (30), a work team is a group of employees that is responsible for activities on a "whole" work process that delivers a product or service to internal or external customers. The product could be a chair or a service, such as a fully analysis on a company's health and safety claims. Work team members are people who have the power to manage the work they do on daily basis. A work team typically consists of two to ten highly trained workers

5.6.3. Team structures and characteristics

There are many different types of teams that can be found in organizations: however, the most common that will be presented here are:

1. Intact work groups,
2. problem-solving,
3. cross-functional, and
4. Proactive or implementation teams.
5. Small group as used in Japanese companies.

Self-check-5

Part I: Say True or False (each 1 point)

1. TPM brings maintenance into focus as a necessary and vitally important part of the business.
2. The primary purpose of standardization is to create and sustain a waste-free process.

Part II: Choose

1. Of the following which one helps you to plan Muda prevention?
A. standardization B. 5W + 1 H C. visual and auditory controls D. all
2. From the following identify the target of TPM.
A. productivity B. cost reduction C. safety D. all E. none
3. All of the following are factors that affect equipment effectiveness. **Except:**
A. breakdown B. process defect C. reduced yield D. none
4. Which one is the benefit of addressing wastes?
A. save money B. enhance sustainability C. conserve resource D. all

Part III: Short Answer

1. How 5W and 1H sheet does maintains a waste free environment? (3 Points)
2. What is Total Productive Maintenance (TPM)? (3 Points)
3. What are the four types of maintenance? (4 Points)
4. Describe the four types of maintenance. (8 Points)
5. List at least 4 disadvantages of breakdown maintenance? (4 Points)

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6. What are the advantages of preventive maintenance over breakdown maintenance? (3 Points)
7. What are the eight pillars of TPM? (8 Points)
8. What are the aims of each pillars of TPM? (8 Points)

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