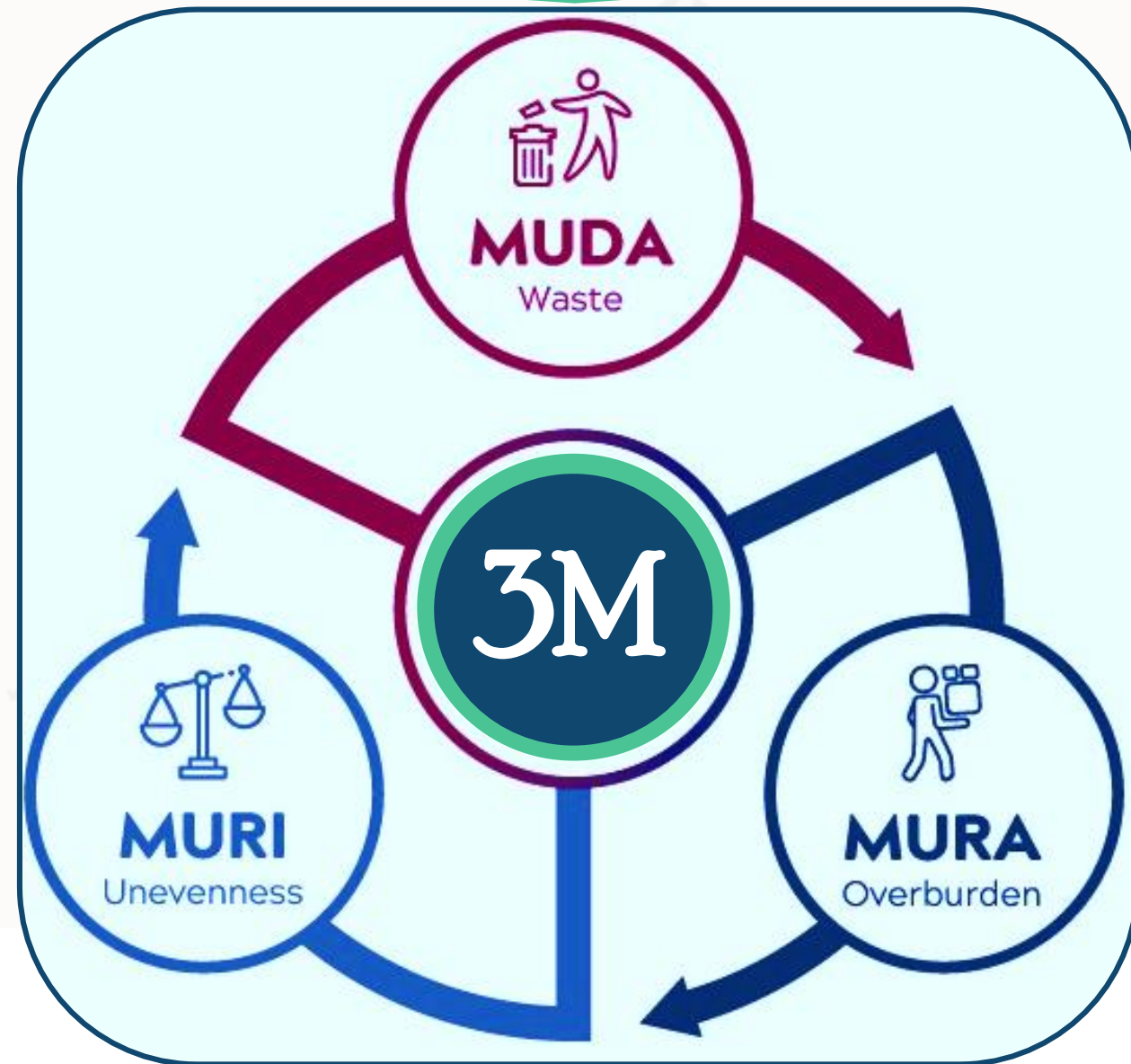


# 3M

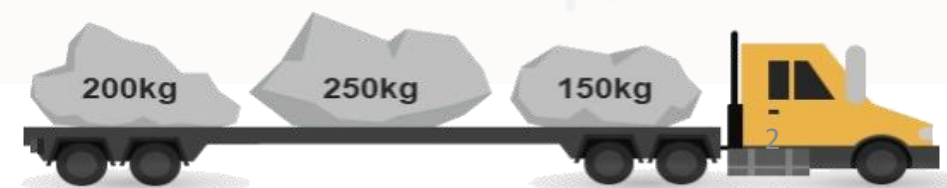
**Muda, Mura, Muri**  
**無駄 斑 無理**

*Prepared By:*  
*Dhaval J. Brahmbhatt*



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# History

3M is considered a Key concept in the Toyota Production System (TPS).


The seven wastes are categories of unproductive manufacturing practices identified by Taiichi Ohno, the father of the Toyota Production System (TPS).

The terms *muda*, *mura*, and *muri* (waste, unevenness, and overburden) are actually not an invention by Toyota.


They were used in **Japanese martial arts long before Toyota.**

In martial arts, any excess movement in a fight is a **waste**, since it tires the athlete and leaves him open for an attack. Similarly, any **uneven** or unnatural movement or thought, or unnatural stance, will delay your actions. Finally, trying to do too much at the same time or using techniques that you have not yet mastered is **overburden**.

# What is 3M ?



Muda is any activities that consume resources without creating value for the customer.



Muri overburdens either in processes, Machinery, and people. Muri can be avoided through standardization of work.



Mura is inconsistency in business operations caused by either a lack of standards or when poor standards are followed



# Relationship between Muda, Mura and Muri

Muda, Mura and Muri are interrelated, eliminating one of them will affect the other two. For example, a firm that needs to transport 8 tons of materials to a customer has several options. **Truck Capacity max 4 tons**



**MURI = Overburdened**

One truckload with all 8 tons. it would be **considered Muri due to the overburden** of the truck. This excess load can lead to a breakdown.



**MURA = Unevenness, Fluctuation, Variation**

Two trip's one with 3 tons and other with 5 tons. This would be considered Mura since the unevenness of the arrival of materials to the customer can lead to problems at the receiving dock.

On the first trip, the delivery may be too little for the production necessary on-site.

On the second trip, the amount of delivered material may be too much for on-site storage and material handling. This leads to Muri since one of the trucks is overburdened and the receiver is also overburdened for that delivery. Additionally, Muda can be seen from the uneven workload.

# Relationship between Muda, Mura and Muri



**MUDA = Waste**

Three trips with load of 2 tons on each truck. Even though this option has no Mura and Muri, it has Muda not be fully loaded on each trip.



**Optimum**

Trucks are carrying the loads at their maximum capacity. There is no excess capacity nor unnecessary trips with this strategy. Mura does not exist because the workload between the two deliveries is uniform. As a result, there is no unevenness. And finally, Muri is absent from this option because both the truck and the operators are not working beyond their capacity.

# MUDA Waste

How often have you used the expression:

“That was a waste of time!”

Or

“That was a waste of money!”

Or

“That was a waste of effort!”

**Wasted Time** Just imagine if we could collect all our time together that we have wasted in the past –

How much time would that be?



**Wasted Money** Just imagine if we could collect all the money together that we have wasted in the past –

How much money would that be?



**Wasted Effort** Just imagine if we could collect all the effort together that we have wasted in the past –

How much effort would that be?



# MUDA Waste

How often have you used the expression?

“That was a waste of time!”



“That was a waste of money!”



“That was a waste of effort!”



**Wasted Time** Just imagine if we could collect all our time together that we have wasted in the past –  
How much time would that be?

**Wasted Money** Just imagine if we could collect all the money together that we have wasted in the past –  
How much money would that be?

**Wasted Effort** Just imagine if we could collect all the effort together that we have wasted in the past –  
How much effort would that be?



# Way to Eliminating Waste

So what can we do to eliminate waste?

STEP

1

First need to identify **what is & is not waste**



STEP

2



Then we can look at ways of eliminating or at least **reducing waste**

# Identifying Waste in the Workplace

## Operational Activity

**Value-added** activities are processes where the **customer is ready to pay money**

- Any process that changes the nature, shape, or characteristic of the product in line with customer requirements
- e.g. pressing, welding, heat treatment, cutting, drilling, bending, painting, polishing, etc.

**This is where we make a profit !**

**Non-value-added** activities are processes where the **customer is not willing to pay money**

- Work carried out which is necessary under current conditions, but does not increase product value.
- e.g. Inspection, tool change, maintenance.

**This is where we make a loss !**

# 8 Types of MUDA / Waste

There are two types of Muda, Type 1 and Type 2

Type 1 includes non-value-added activities in the processes that are **necessary for the end customer**.

For example, inspection and safety testing does not directly add value to the final product; however, they are necessary activities to ensure a safe product for customers.

## **Non-value-added but essential**

In addition to these two categories (value-added and non-value-added), there is a third category of activities, and that is "non-value-added but essential".

These are also called:

- Necessary non-value-adding activities
- Business Value Adding Activities

# 8 Types of MUDA / Waste

Type 2 includes non-value-added activities in the processes, but these **activities are unnecessary for the customer**. As a result, Muda Type 2 should be eliminated.

There are seven categories of waste under Muda Type 2 that follow the abbreviation TIMWOOD. The seven waste are (1) Transport (2) Inventory (3) Motion (4) Waiting (5) Overproduction (6) Over-processing and (7) Defects.

The “7 Wastes of Lean” were **originally categorized by Taiichi Ohno**, one of the fathers of the Toyota Production System. He separated the waste he saw into seven categories, which made them easier to identify and eliminate.

As such, an eighth waste was recognized and added in the early 2000s – the **“Waste of Human Potential” or the “Waste of Talent.”**

# Types of MUDA



T

Transportation



I

Inventory



M

Motion



W

Waiting

## 8 Deadly Wastes



O

Over Production



O

Over Processing



D

Defects



S

Skill Underutilized



# Transportation

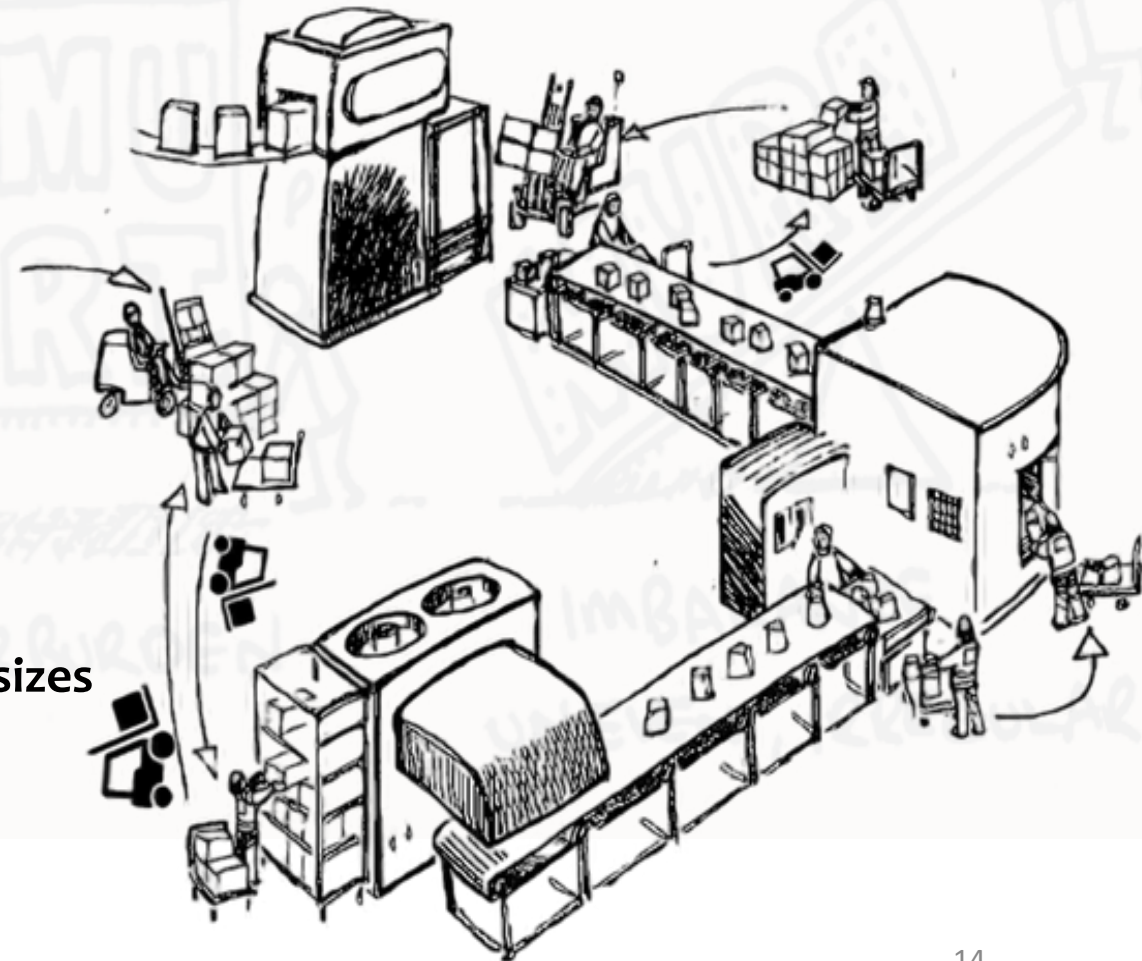


## Meaning:

Unnecessary **movements of products, machines, and materials** within a process

## For Example:

- Unnecessary moving or handling of parts
- Poor layout
- Multiple storage locations
- Equipment moving with no parts
- Material stored a long way from point of use
- Material stored a long way from point of use
- Raw material batch sizes not matching production batch sizes



**Waste of**



# Transportation



## ❖ Cause of Transportation:

- Isolated place
- Large lot production
- Poor process planning with unnecessary steps
- Single-skilled workers
- Sitting to perform operations
- Need for a transportation system is assumed

## ❖ How to eliminate Transportation:

- U-shaped manufacturing cells
- Flow production
- Multi-skilled workers
- Milk van concept
- Standing to perform operations
- Higher utilization rate
- Water beetles (Kanban/pull production)

# Inventory



## Meaning:

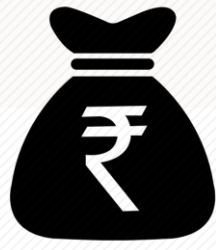
Excess materials and products are not being processed Also insufficient products and materials are processed

## For Example:

- Stock of raw materials in stores
- Stock pile of finished goods
- High WIP
- Excessive racking and warehouse space
- Excessive handling of equipment



**Waste of**



# Inventory



## ❖ Cause of Inventory:

- Acceptance of inventory as normal or as a “necessary evil”
- Poor equipment layout
- Long changeover times
- Defective parts
- Lack of proper monitoring systems
- Upstream process is too fast for the downstream process
- Shish-kabob or large lot production
- Anticipatory production
- Obstructed flow of goods
- Production speed not aligned to demand

## ❖ How to eliminate inventory

- U-shaped manufacturing cells, layout of equipment by process instead of operation
- Regulating the flow of production
- Quick changeover operation
- Production leveling
- Pull production using Kanban
- Line balancing



# Motion

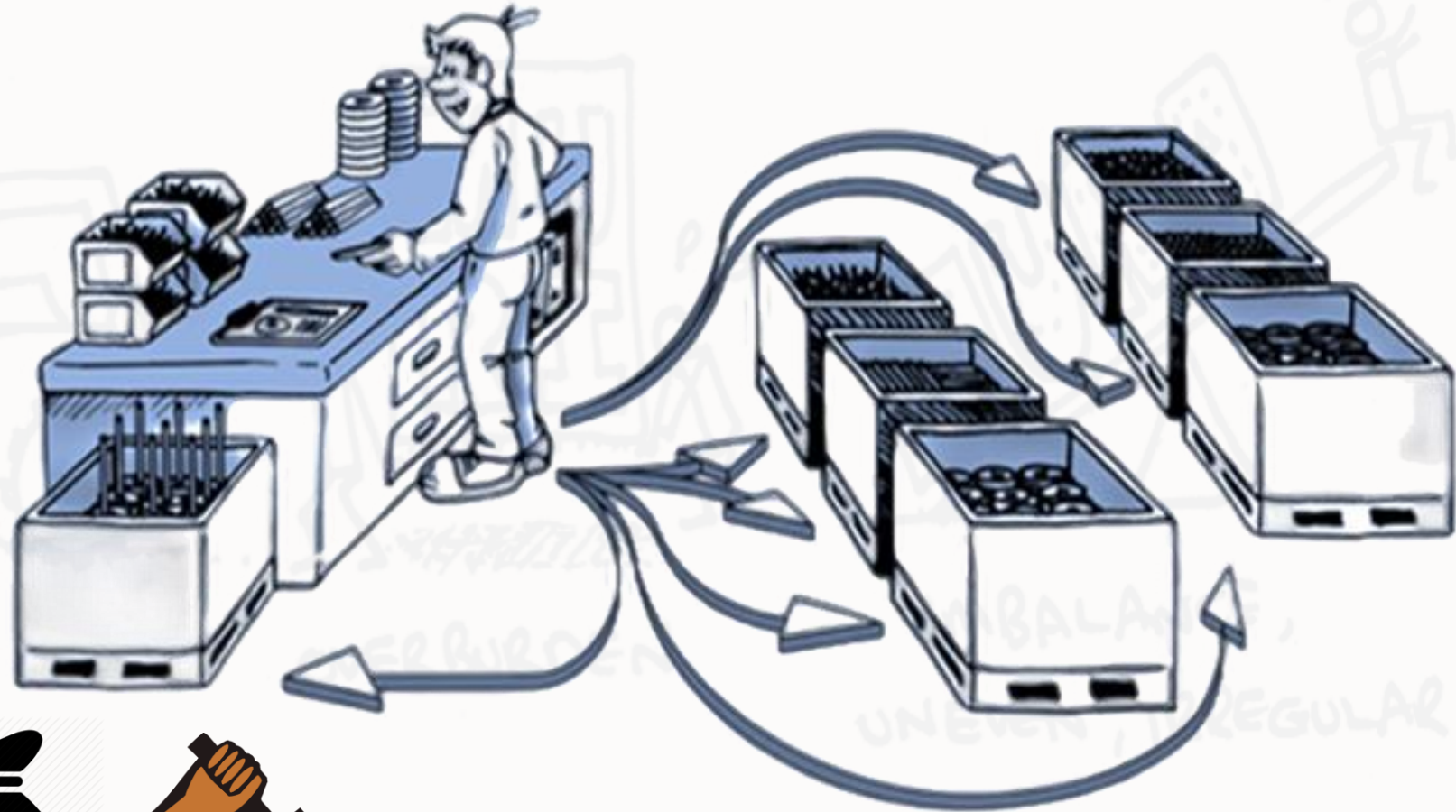


## Meaning:

Unnecessary or repetitive movement of people within a process

## For Example:

- Looking for tools, materials etc.,
- Double Handling
- Turning
- Bending
- Stretching
- Walking



**Waste of**







## ❖ Cause of Motion:

- Isolated operation
- Low employee morale
- Instability in operations
- Sharing of machines and tools
- Processes are not aligned and result in motion overhead
- Poor work layout
- Undeveloped skills
- Increase in staff or worker hours
- Work standards are not in place

## ❖ How to eliminate Motion:

- Gradually switch to flow production
- Create u-shape cell layout of equipment
- Increase operator awareness about motion during an operation
- Increase training
- Make standardization through
- Separate tools at each workstation

# Waiting



## Meaning:

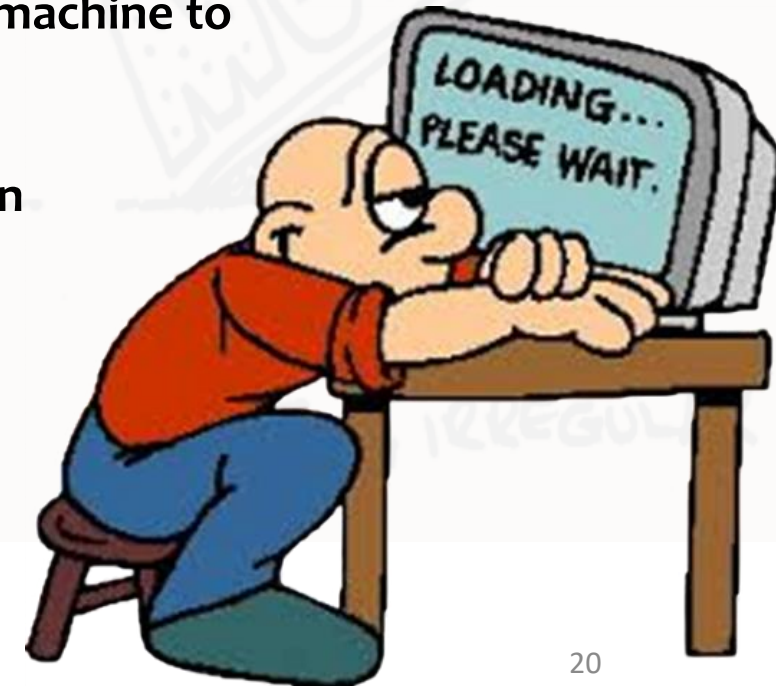
People have to **wait to start the next step** in a process

**Waiting times of the material or information flow** that cause delays

## For Example:

- Waiting for material / Resource
- Waiting for maintenance
- Waiting for Tool change
- Waiting for Quality check
- Machine / Operator inactivity during cycle
- Support to resolve issues
- Also, people waiting for a machine to complete its cycle
- Waiting for the next station

**Waste of**



# Waiting



## ❖ Cause of Motion:

- Unplanned machine downtime
- Long set up and machine changeover times
- Inadequate staffing
- Lack of communication tools
- Time require for rework

## ❖ How to eliminate Motion:

- Standardization work flow
- Create u-shape cell layout of equipment
- Make resources available

- Poor work layout
- Absence from work
- Poor planning and process documentation
- Less resources

- Standardizing instructions, training and processes
- Developing multi-skilled human resources

# Over Production



## Meaning:

Production that is **more than needed or before** it is needed  
**More production** than needed or before it is needed

## Causes of Overproduction:

- Large-lot production
- Anticipatory production
- Overrunning an unstable process
- Overstaffing or too much equipment
- Machine that turns out parts too quickly
- Poor Planning of Production



**Waste of**



# Over Production



## ❖ Cause of Over Production:

- Poor Production Planning
- Long setup and machine changeover times
- Lack of communication
- Excess raw material

## ❖ How to eliminate overproduction

- Proper Planning
- Line balancing
- One-piece flow
- Pull production using Kanban
- Quick-changeover operations
- Level production small lot, mixed production



# Over Processing



## Meaning:

Doing more work or higher quality work than your customer requires  
More work or higher quality than required by the customer.

## For Example:

- Wrong choice of equipment
- Bad definition of customer's needs
- Frequent inspections
- Excessive movement in process
- Useless operations
- Excessive set-up or downtime
- Unbalanced process
- Follow-up



**Waste of**



# Over Processing



## ❖ Cause of processing waste:

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

## ❖ How to eliminate Over Process

- More appropriate process design
- Review of operations
- Improvement of jigs using automation
- Thorough standardization
- Promotion of value analysis and value engineering techniques

# Defect / Reject



## Meaning:

Rework, scrap and incorrect information the first time  
Additional effort due to rework, scrap and incorrect data.

## For Example:

- Scrap
- Rework / Reject
- Recalls
- Delay due to defects
- Transportation due to defects
- Re-inspection and sorting



**Waste of**



# Defect / Reject



## ❖ Cause of defects:

- Emphasis on downstream inspection
- No standards for inspection work
- Omission of standard operations
- Material handling and transportation
- Operator error
- The lack of sufficient quality control processes
- Missing repair and documentation standards
- Undocumented design changes
- Misunderstood customer requirements
- Raw material not as per require

## ❖ How to eliminate Defect / Reject

- Standard operations
- Mistake-proofing devices
- Full lot inspection
- Flow production
- Building quality in each process
- Elimination of the need to pick up and set down pieces
- Improvement of jigs using human automation
- Promotion of value analysis and value engineering



# Unused Human Talent / Skill Underutilized



## Meaning:

Underutilizing / Inadequate teammates' talents, skills, and knowledge

## For Example:

- Not tapping into, and following up on the ideas and thoughts of the employees
- Underutilization of human potential



**Waste of**





# Unused Human Talent / Skill Underutilized



## ❖ Cause of defects:

- Assign employees to the wrong tasks
- Tedious administrative work
- Lack of communication and communication tools
- Poor management
- Inadequate training
- Missing teamwork

## ❖ How to eliminate Defect / Reject

- Skill evaluation
- Education and training
- Connect with employees
- Identify hidden skill

# Mnemonics to remember

## TIMWOODS

**Transportation**

**Inventory**

**Motion**

**Waiting**

**Over production**

**Over Processing**

**Defect**

**Skill Underutilized**

## WORMPITS

**Waiting**

**Over production**

**Reject / Rework**

**Motion**

**Processing**

**Inventory**

**Transportation**

**Skill Underutilized**

**All other meaningless, non-essential activities that do not add value to the product you can eliminate immediately**

# MURA

Mura is any kind of **Unevenness, non-uniformity or Irregularity**. While often used mainly for material flow, it is also a problem in many other cases outside of material flow.

unevenness in the reception of raw material quantity  
variation of order from the customer  
unevenness in the scheduling of work centers  
uneven production output due to variation in the process

## Examples:

- Uneven customer demand
- Inventory swings – from too much to too little
- Uneven production speed or changing production quantities
- Uneven quality of good parts (however, if the part fails or has to be scrapped it is waste)
- Irregular or erratic working rhythm
- Uneven training of the workers
- Uneven distribution of the workload



# MURI

Muri is overburden, beyond one's power, excessiveness, impossible unreasonableness, and things that are too difficult. Naturally, the main focus here is on people. However, it also can apply to materials, machines, and organizations.

Here are a few examples:

## People

Assigning work to an employee more than what he can do.  
Unsuitable posture or inadequate ergonomics

## Organizations

Demanding that the supplier deliver what we want whenever we want it without providing a good and stable signal from our side.

## Machines and Materials

Running a machine more than its designed speed, for producing more products than standard output.



# ***Thank You For Your Attention***



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\* Reference and Pictures have been taken from internet.