Medical laboratory

NTQF Level -III

Learning Guide -31

Unit of Competence	**Prevent and Eliminate MUDA**
Module Title:	**Preventing and Eliminate MUDA**
LG Code:	**HLT MLT3 M06 LO2-LG-31**
TTLM Code:	**HLT MLT3 TTLM 1019v1**

LO No: Identify MUDA

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

- Preparing and implement Plan of MUDA identification.
- Causes and effects of MUDA
- Using of ***Tools and techniques*** to draw and analyze current situation of the work place.
- Identifying and measure Wastes/MUDA
- Reporting Identified and measured wastes.

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

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Prepare and implement Plan of MUDA identification.
- Discus Causes and effects of MUDA.
- Use Tools and techniques to draw and analyze current situation of the work place.
- Identify and measure Wastes/MUDA based on relevant procedures.
- Report Identified and measured wastes to relevant personnel.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet 4,---”**in page ---, ---, --- and ---** respectively.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4” ,---”**in page ---, ---, --- and ---** respectively
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ”**in page ---.**
6. Do the “LAP test” **in page – ---**

1.1. 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

1.2. 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.

1.3. The concept of Cost

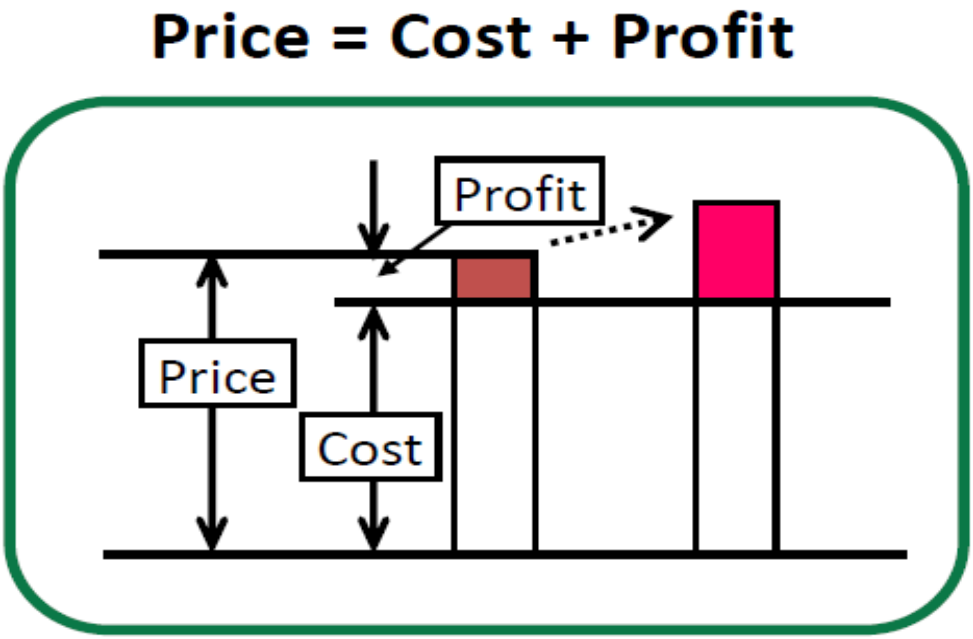
- **Cost :-** is the amount of money that is expended to accomplish a given task/operation.
- Cost can be of Manufacturing or Service Delivering cost=(material + labor + facility + utility + others)cost

  Determination of the sales price of the product/Service

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

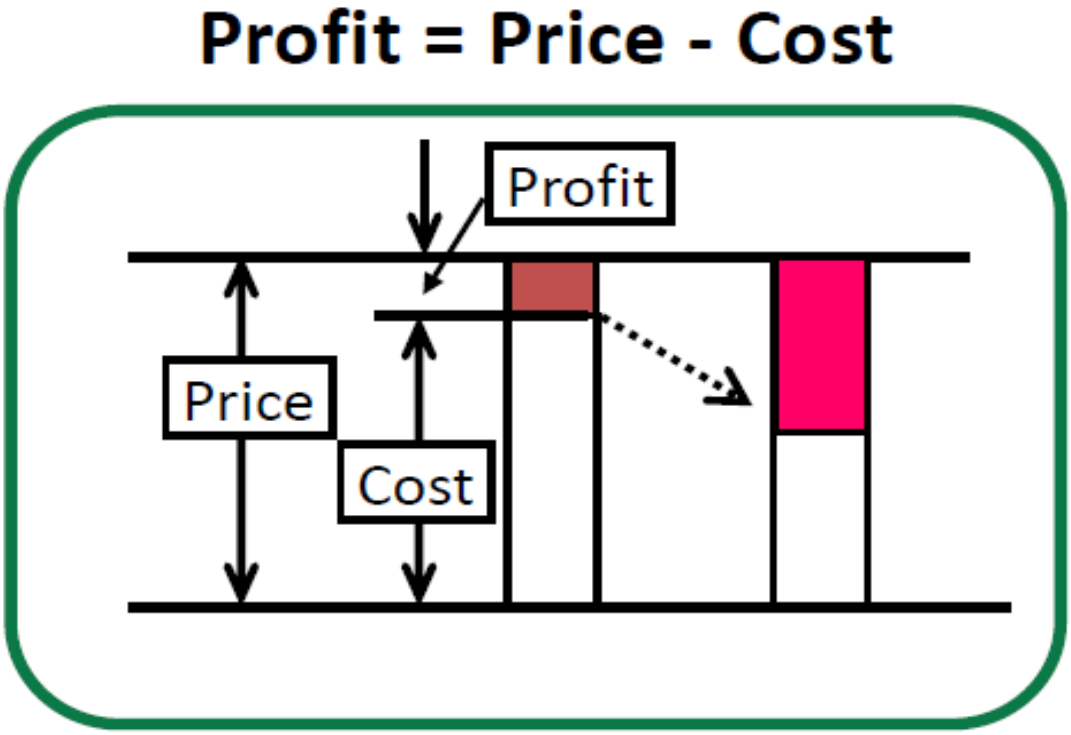
1.4. Traditional Thinking of Price Setting

- 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.



1.5. Kaizen Thinking of Price Setting

- In modern time, there are a large number of manufacturers/service providers delivering the same type of product/service offering the customers a great deal of options to buy products/services.Price is determined by the interaction between market demand and supply. Manufacturers/service providers ,who want to set selling price above the market price, customers will not be willing to buy their products/services. Manufacturers/Service providers to be competent in the market they should provide Quality product/service on time and at the market price.Since todays economy is market based, we should focus on minimizing our costs and not maximizing selling price to maximize our profit.



1.6. **Waste/Muda**

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

Value

- Value is defined by the next customer (Know your Customer's Need).
- The next process is your customer.The activity/effect exactly what the next customer needs is value adding activity.
- There are two types of customers:-
    - ✓ Internal customer
    - ✓ External customer
- **Internal customer:-** is the customer within a production line/service delivering sequence that is next to the prevous process and makes his/her own process.
- **External customer:-** is the customer that buys the final out put product/service of the enterprise.

1.7. The three Categories of Operation

1. Net Operation/Value Adding Operation
2. Non-Value Adding Operation
3. "Muda''

(1) 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 - Milling, Turning, Grinding, Assembling and Welding.
  - Printing/photocopying a document etc.

2. Non-Value Adding Operation

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

(3)"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.

Example

Very simple drill to elaborate the three Categories of Operation.

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

Needed materials and tools for the activity

- ✓ Two pieces of paper
- ✓ Stapler
- ✓ Staples

The result in the disorganized sample work place is summarized below.

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

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-Check -1	Written Test

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

1. What are the targets of customers?(9 points)
2. What is the target of manufacturer/service provider? (3 points)
3. What is the difference between traditional and kaizen thinking on price setting, cost and profit? (3 points)
4. What is value? (2 points)
5. List out the three categories of operation. (3 points)
6. Define the three categories of operation. (6 points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
   _____
   _____
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3. _____
   _____
   _____

4. _____

5. _____

6. _____

2.1. Causes of Muda of Overproduction

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

2.2. Effects of Muda of Overproduction

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

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

2.3. Causes of Muda of Inventory

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

- Upstream process is too fast for the downstream proces

2.4. Effects of Muda of Inventory

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

2.5. Causes of Muda of motion

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

2.6. Effects of Muda of motion

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

2.7. Causes of Muda of Conveyance/Transportation

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

2.8. Effects of Muda of Conveyance/Transportation

- Waste of space
- Production deterioration
- Expansion of transportation

- facilities
- Occurrence of scratches
- Increase production time and cost
- wastes time and energy

2.9. Causes of Muda of Waiting/ Idle time

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

2.10. Effects of Muda of Waiting/ Idle time

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

2.11. Causes of Muda of Defect making

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

2.12. Effects of Muda of Defect making

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

2.13. Causes of Muda of Processing

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

2.14. Effects of Muda of Processing

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

Self-Check -3	Written Test

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

1. Write at least two causes and effects of each type of the seven deadly wastes/Muda. (28 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

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3.1. Classification of Waste

- 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

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.

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. See the next figure.

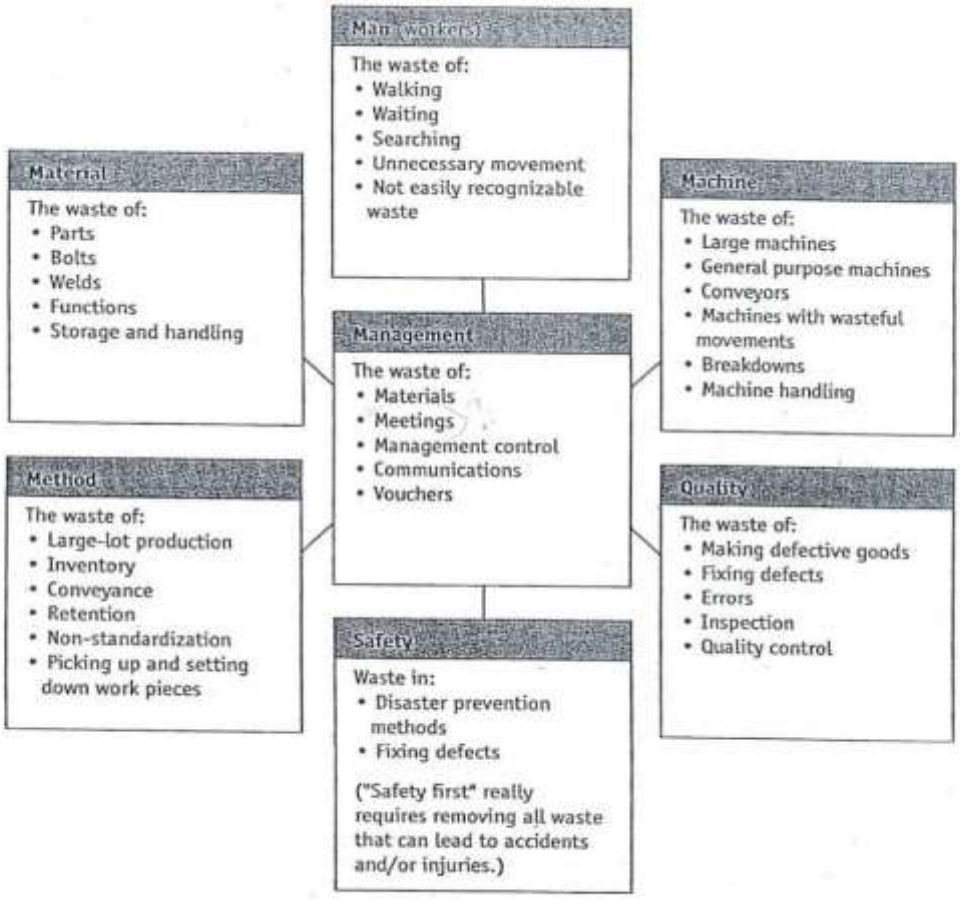


Figure 1-4. The 5M + Q + S Classification of Waste

- 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.

The Flow of Goods

- A third way of thinking about waste is to focus on the flow of goods in production. The flow of goods typically looks like this:

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 ➡ 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.**

- 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.It is called stockpiling, warehousing,
- 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.

- Retension 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 retension 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 retension point is often called “conveyance” and movement between a retension 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 fulfil 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 occuring.

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 istinict for seeing and removing waste. Identifying and eliminating these seven types of waste will forge the path to lean production.
  - ✓ Overproduction
  - ✓ Inventory
  - ✓ Motion
  - ✓ Conveyance/Transportation
  - ✓ Waiting/ Idle time
  - ✓ Defect making

- ✓ Processing

- **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, 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.

Self-Check -3	Written Test

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

1. Describe the 3MU's and their relationships. (9 points)
2. What are the seven deadly wastes/Muda? (7 points)
3. Describe the seven deadly wastes/Muda? (7 points)
4. What are the focus areas of 5M + Q + S ? (7 points)
5. What are the four things going on during the flow of goods? (4 points)
6. Explain the four things going on during the flow of goods in relation to waste? (8 points)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
3. _____

4. _____

5. _____

6. _____

3.1 **Some of the benefits of identifying and eliminating waste To the company**

Benefits to the company include:

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

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

To Shopfloor workers

Benefits to individuals include:

1.*Increased job satisfaction*- No longer will you spend hours looking for missing tools, waiting for materials to arrive, walking around piles of inventory,lifting and setting down heavy parts or tools, working in unsafe conditions and all the other things you have to do that are not essential to your job. The frustrating non-value-added aspects of your job will disappear and what you are trained to do and enjoy doing will be the major part of how you spend your time.

2.*Contributing to improvement*- Your ideas about how to improve your job will be listened to and you will participate in taking the frustration out of the workplace.Part of your job will be to find root causes and to create solutions that last. You will not have to make short-term fixes or live with someonelse's short-term fixes that no longer solves the problems you face.

- There is no question that when production waste is rooted out everyone is happier. The flow of materials creates a hum in the workplace: a rhythm of the flow of materials from supplier to customer emerges as the value-added processes are freed up to operate at the rate of customer demand.

Plan and procedure for Waste/Muda Identification

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

harder to discover waste that may be right infront 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:
    1. Make waste visible
    2. Be conscious of the waste
    3. Be accountable for the waste.
    4. Measure the waste.

1.Make waste visible

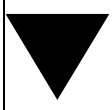
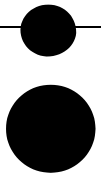
- Waste can be made visible in several ways such as:
    - ✓ Shop layout analysis
    - ✓ Process flow analysis
    - ✓ Take photoes/video
    - ✓Etc

Shop layout analysis and Process flow analysis

- There are several tools you can use to analyze current conditions of shop layout and process flow quickly and effectively. We will describe some of them.

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

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

Figure showing symbols used in Arrow Diagram

There are four steps for creating your arrow diagram.

1. *Understand the purpose*-The purpose is to discover major forms of waste. The arrow diagram will help your improvement team “see” the waste.
2. *Select the product to be analysed*- You can do a product/quantity(PQ) analysis to compare products and quantity. Choose products with a large output and those with many production problems as starting points for your analysis of current conditions using the arrow diagram.
3. *Prepare a factory layout diagram*- Include the entire factory layout, indicating the position of machines, worktables and other equipment. Store the original in a safe place so that you can make a copy of it each time you want to analyze another product line.
4. *Make the arrow diagram*- Do this on the factory floor. Use the symbols below to show the different types of activities that occur. The map will make the waste more obvious to you and your team than when you are simply standing on the factory floor observing standard operations. Connect the symbols with lines that show the direction of the flow and the sequence of product through each operation. Create other symbols as you need to. At all conveyance points, note the conveyance distance and type of conveyance. At all retention points, note average work-in- process inventory.

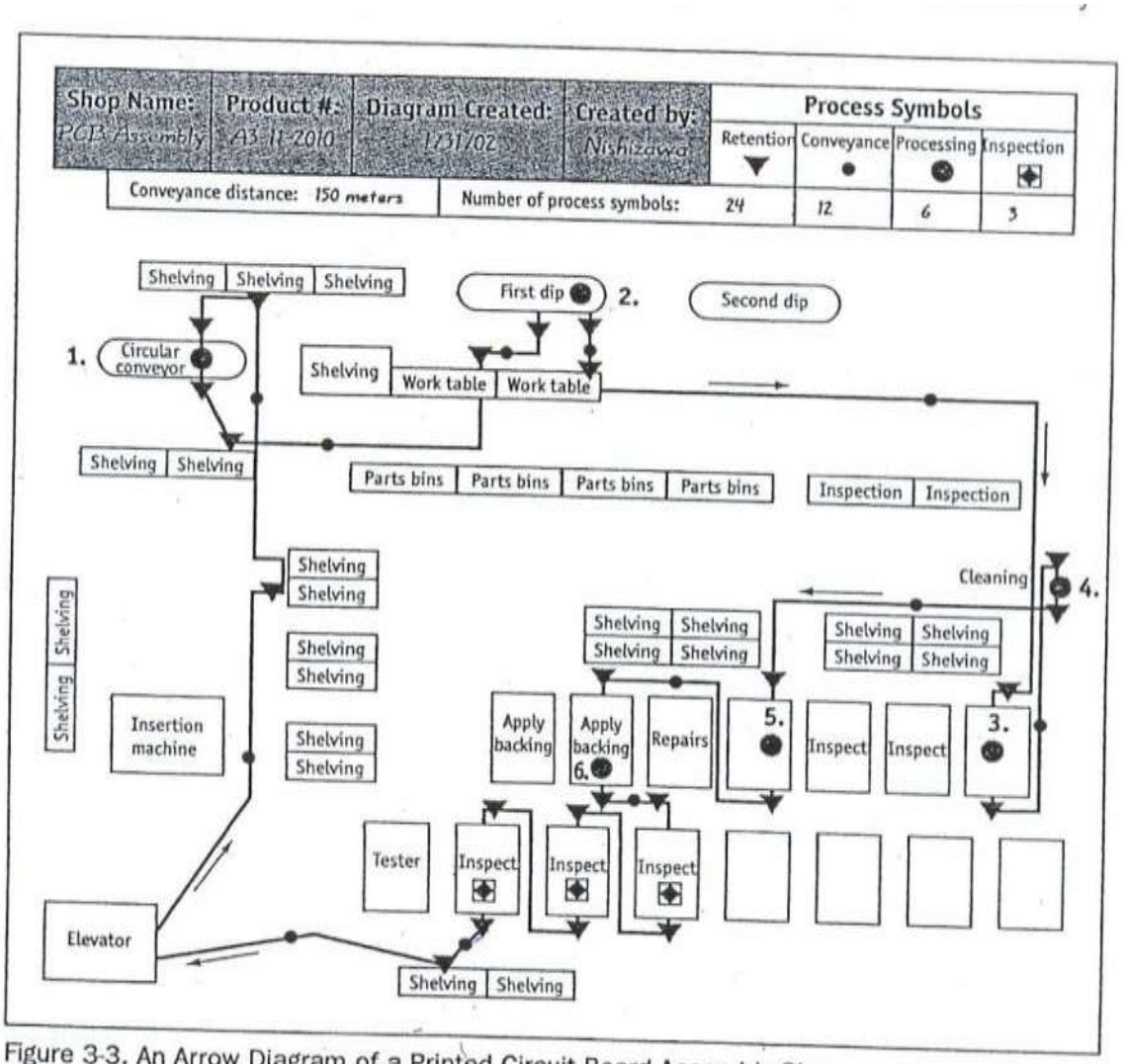


Figure 3-3. An Arrow Diagram of a Printed Circuit Board Assembly Shop

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.

Summary Chart of Flow Analysis

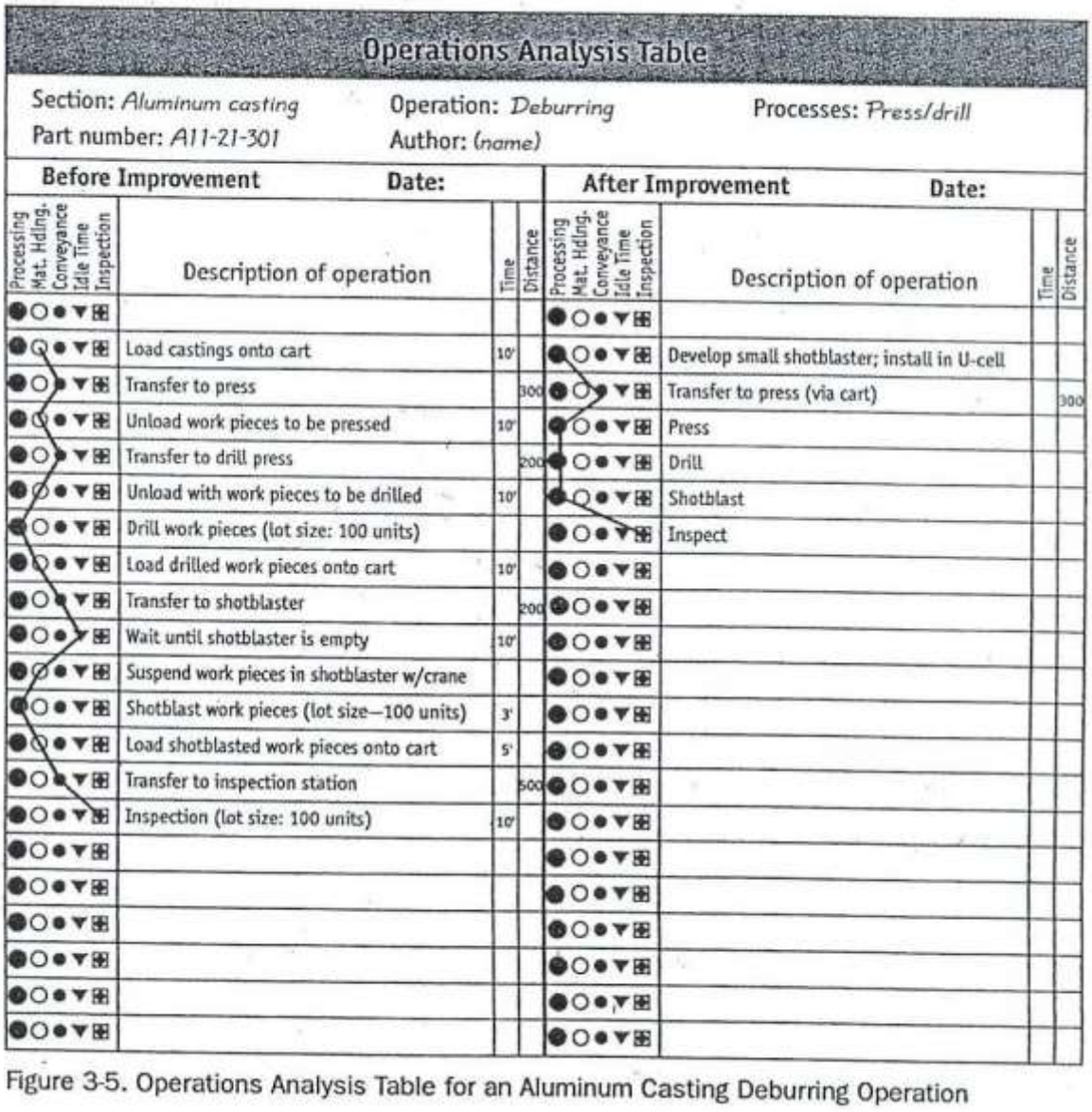
Date:

	Shop name: PCB Assembly	Before Improvement								After Improvement							
		Retention			Conveyance		Processing		Inspection	Retention			Conveyance		Processing		Inspection
	Part name/number	# of times	# of units	Time	# of times	Distance	# of times	Lots	# of times	Lots	# of times	# of units	Time	# of times	Distance	# of times	Lots	# of times	Lots
1	PCB1 (A3-11-2010)	24			12	150	6		3										

Figure 3-4. A Summary Chart of Flow Analysis

The Operations Analysis Table

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



Operations Analysis Table

Section: *Aluminum casting* Operation: *Deburring* Processes: *Press/drill*

Part number: *A11-21-301* Author: *(name)*

Before Improvement Date:				After Improvement Date:			
Processing Mat. Hdlng. Conveyance Idle Time Inspection	Description of operation	Time	Distance	Processing Mat. Hdlng. Conveyance Idle Time Inspection	Description of operation	Time	Distance
	Load castings onto cart	10'			Develop small shotblaster; install in U-cell		
	Transfer to press		300		Transfer to press (via cart)		300
	Unload work pieces to be pressed	10'			Press		
	Transfer to drill press		200		Drill		
	Unload with work pieces to be drilled	10'			Shotblast		
	Drill work pieces (lot size: 100 units)				Inspect		
	Load drilled work pieces onto cart	10'					
	Transfer to shotblaster		200				
	Wait until shotblaster is empty	10'					
	Suspend work pieces in shotblaster w/crane						
	Shotblast work pieces (lot size—100 units)	3'					
	Load shotblasted work pieces onto cart	5'					
	Transfer to inspection station		500				
	Inspection (lot size: 100 units)	10'					

Figure 3-5. Operations Analysis Table for an Aluminum Casting Deburring Operation

1. *Fill in the table on the factory floor*- It is important to look at the real situation as you fill in the table, even if you know the situation by heart. As you fill in the form, you will see things differently.

2. *Look for detail* – Write everything down that you possibly can.

3. *Now identify the waste* – Analyze as critically as you can to distinguish work from wastefull movement. Everything that is not value-added must be counted as waste.

4. *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.

5. *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.

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. See the figure below for an example of a combination chart

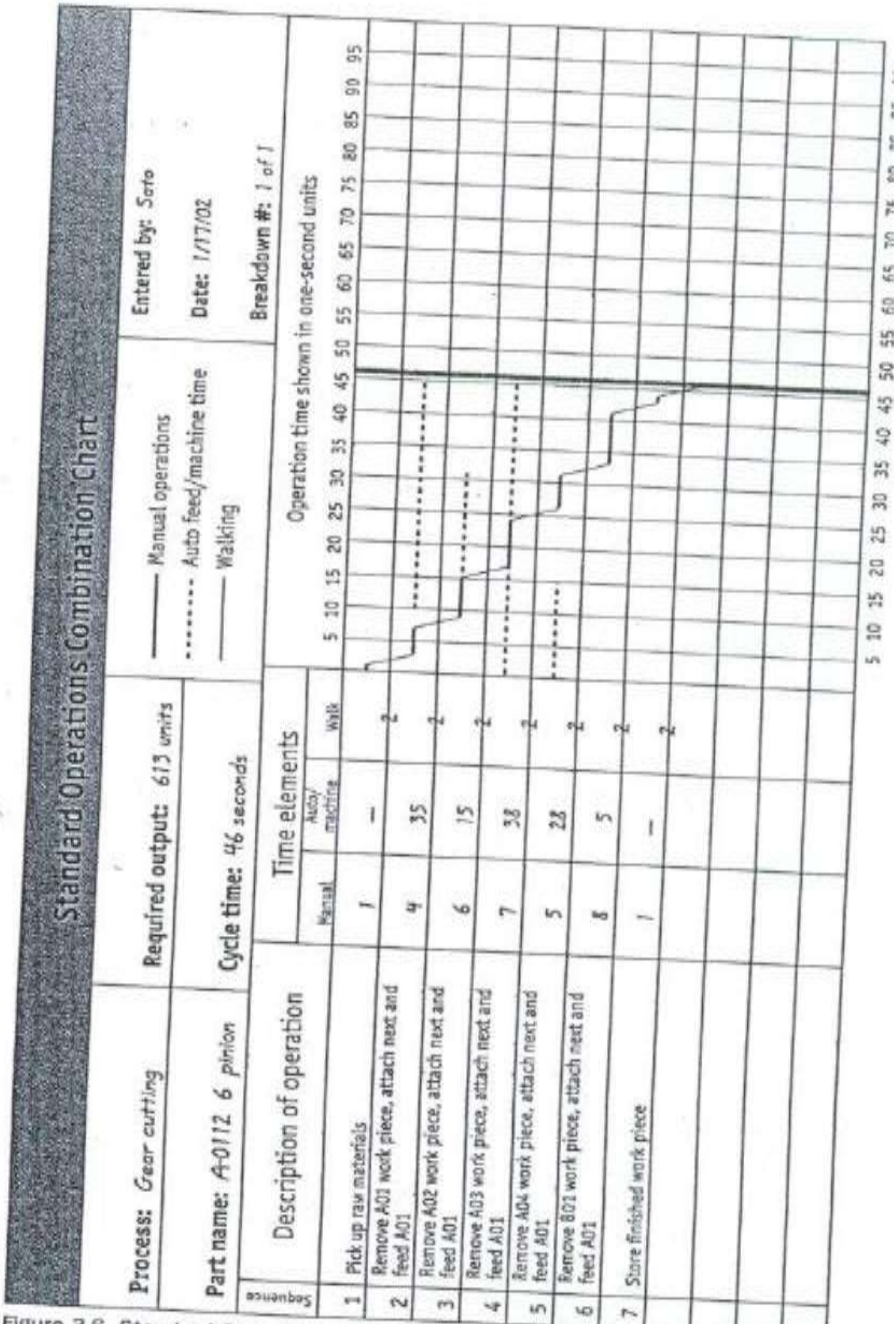


Figure 3-6. Standard Operations Combination Chart for a Gear Cutting Process

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. See the figure below. You might want to use this checklist before using the detailed checklists. Checklists are good tools for identifying waste and recording improvement ideas.

Workshop Checklist for Major Waste Finding

Workshop Name: **Date:**

#	Process Name	1 Overproduction waste	2 Inventory waste	3 Conveyance waste	4 Defect waste	5 Processing waste	6 Operation waste	7 Idle time waste	Waste Magnitude Total	Improvement Ranking	Improvement Ideas and Comments

Use these four steps to follow to discover and remove waste

1. Choose several processes or work areas and look for waste.
   - Using the above figure find the major forms of waste at each process.
   - Note the magnitude of each waste (Using the figure below).
2. Rank the improvements that are needed. Focus improvements on the process with the greatest total when you add up the magnitude columns.
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.
4. Brainstorm improvement ideas and then carry out them.

Taking photoes/Video :- Taking photoes and videos and analyzing are also valuable techniques to find waste.

2.Be conscious of the waste

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

3.Be accountable for the waste

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

4.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.

Tools and Equipment for Waste/Muda Identification

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

Use of Tools and Equipment

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

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

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

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

Calculator – required to make arithemetic calculations.

Self-Check -4	Written Test

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

1. What are the benefits of identifying and eliminating wastes/Muda to a company? (4 points)
2. What are the benefits of identifying and eliminating wastes/Muda to the workers of a company? (4 points)
3. Write down the steps to identify wastes/Muda. (4 points)
4. List out at least three ways to make waste visible. (3 points)
5. What are the four factors to be identified in arrow diagram? (4 points)
6. What is the focus of Operation Analysis Table? (2 points)
7. What is the focus of a Standard Operation Combination Chart? (2 points

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____

_____

2. _____

_____

3. _____

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4. _____

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5. _____

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6. _____

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_____

7. _____

_____

_____

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

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

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

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

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

			Total		
Defect Waste-finding Checklist **Process:** **Date:**					
Description of waste		**Yes**	**No**	**Magnitude**	**Causes and/or Improvement plans**
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 improvement activities.				
			Total		

Processing Waste-finding Checklist **Process:** **Date:**					
Description of waste		**Yes**	**No**	**Magnitude**	**Causes and/or Improvement plans**
1	Process is not required for product function.				
2	Process includes unnecessary operations.				
3	Process can be replaced by something less wasteful.				
4	Part of process can be eliminated without detracting from product.				
		Total			

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

1. Select one operation.
2. Identify and write your customer.
3. Identify/Define what your customer needs.
4. Observe and list out the contents of the operation.
5. Categorize the contents of the operation as Net operation/Value adding operation, Non-value adding operation and Muda.
6. Measure the three categories of the operation (Time).
7. Compare them.
8. Write the action needed to be taken for the three categories of the operation.

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Operation Sheet 2	Procedure for analyzing the existence of Mura, Muri and Muda

Procedures

1. Select a workplace.
2. Write the work load on each machine/worker in process.
3. Recognize the actual capacity of each worker/machine in the process.
4. Compare capacity against work load of workers/machines.
5. Explain the existence of Mura, Muri and Muda on each machine/worker.
6. Write their causes.

Method Using Arrow Diagram

1. *Select the product to be analysed*- Choose products with a large output and those with many production problems as starting points for your analysis of current conditions using the arrow diagram.
2. *Prepare a factory layout diagram*- Include the entire factory layout, indicating the position of machines, worktables and other equipment. Store the original in a safe place so that you can make a copy of it each time you want to analyze another product line.
3. *Make the arrow diagram*- Do this on the factory floor. Use the symbols below to show the different types of activities that occur. The map will make the waste more obvious to you and your team than when you are simply standing on the factory floor observing standard operations. Connect the symbols with lines that show the direction of the flow and the sequence of product through each operation. Create other symbols as you need to. At all conveyance points, note the conveyance distance and type of conveyance. At all retention points, note average work-in-process inventory.

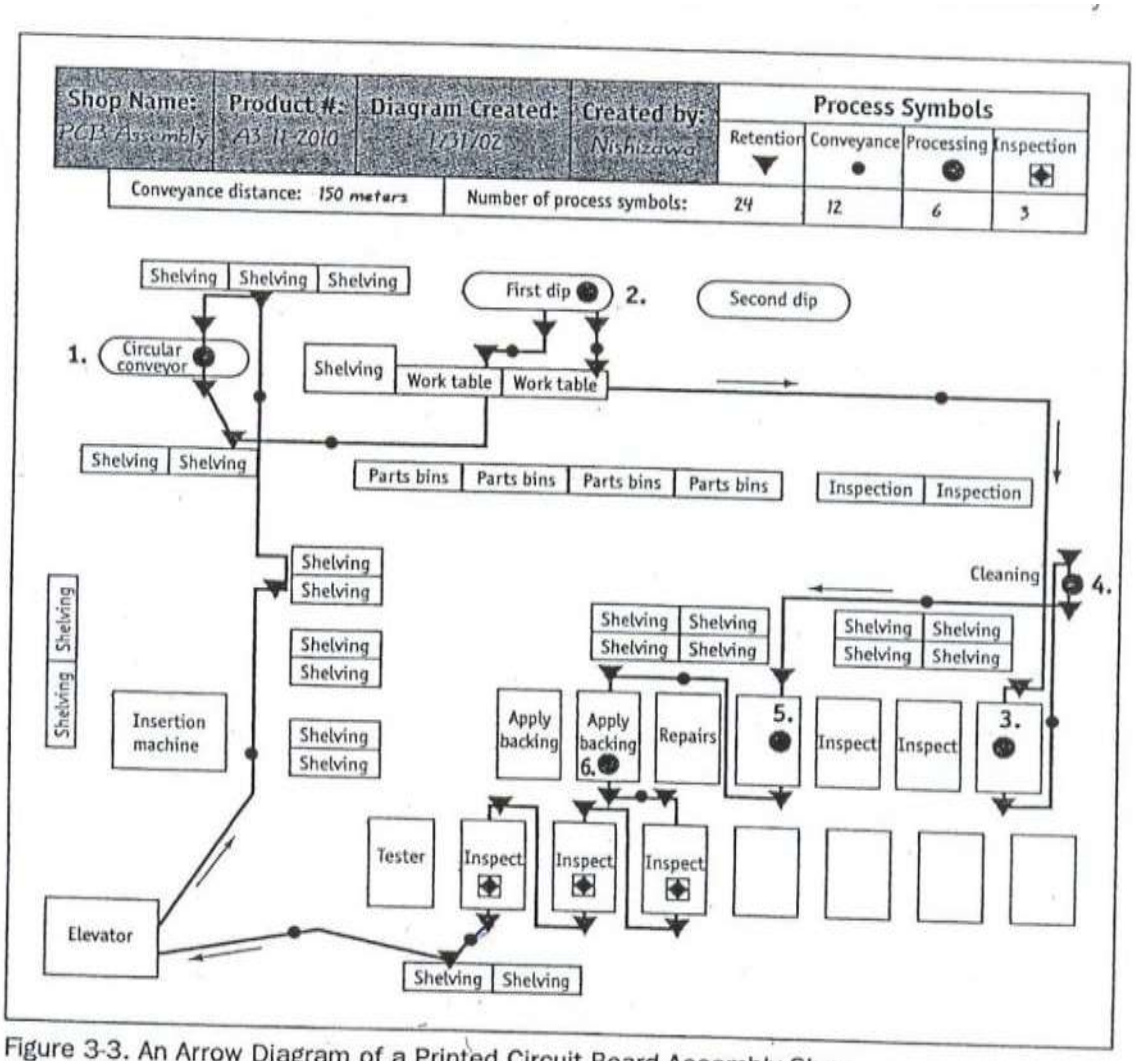
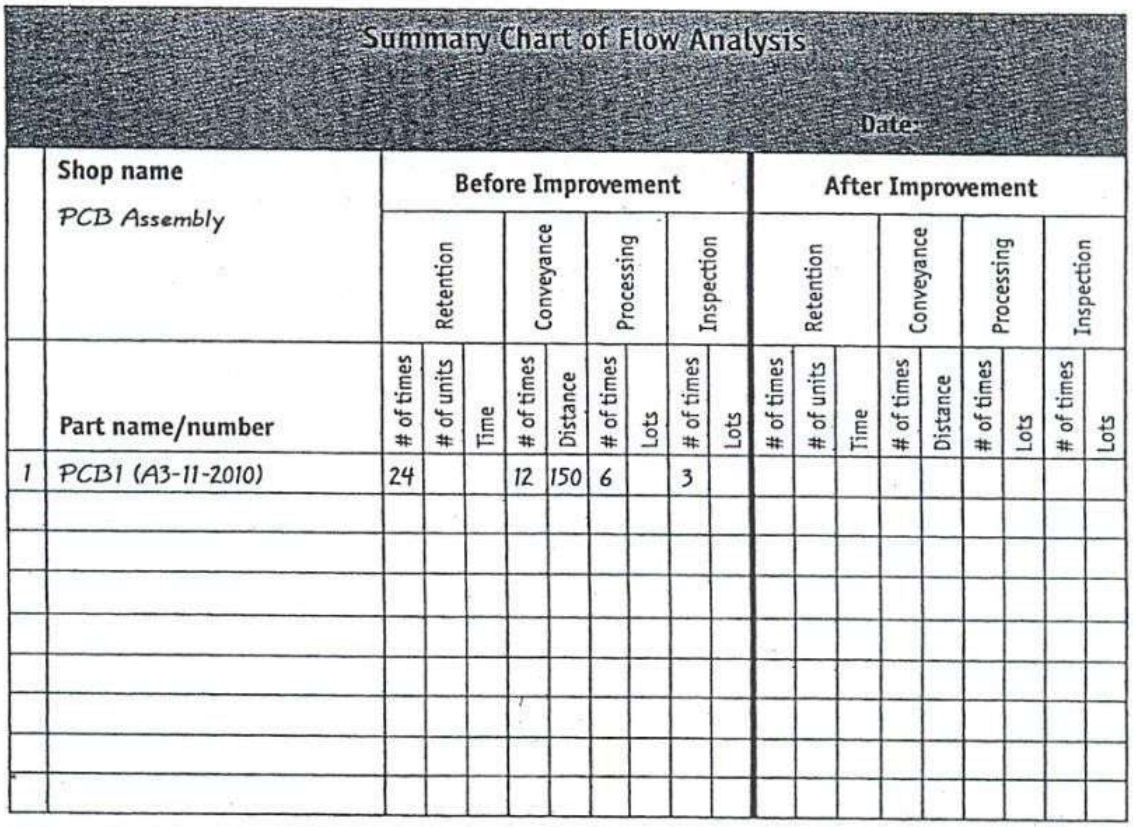


Figure 3-3. An Arrow Diagram of a Printed Circuit Board Assembly Shop

After preparing Arrow Diagram we continue to prepare a Summary Chart of Flow Analysis to show totals for the number of retention, conveyance and inspection points as follows:

Summary Chart of Flow Analysis



Summary Chart of Flow Analysis

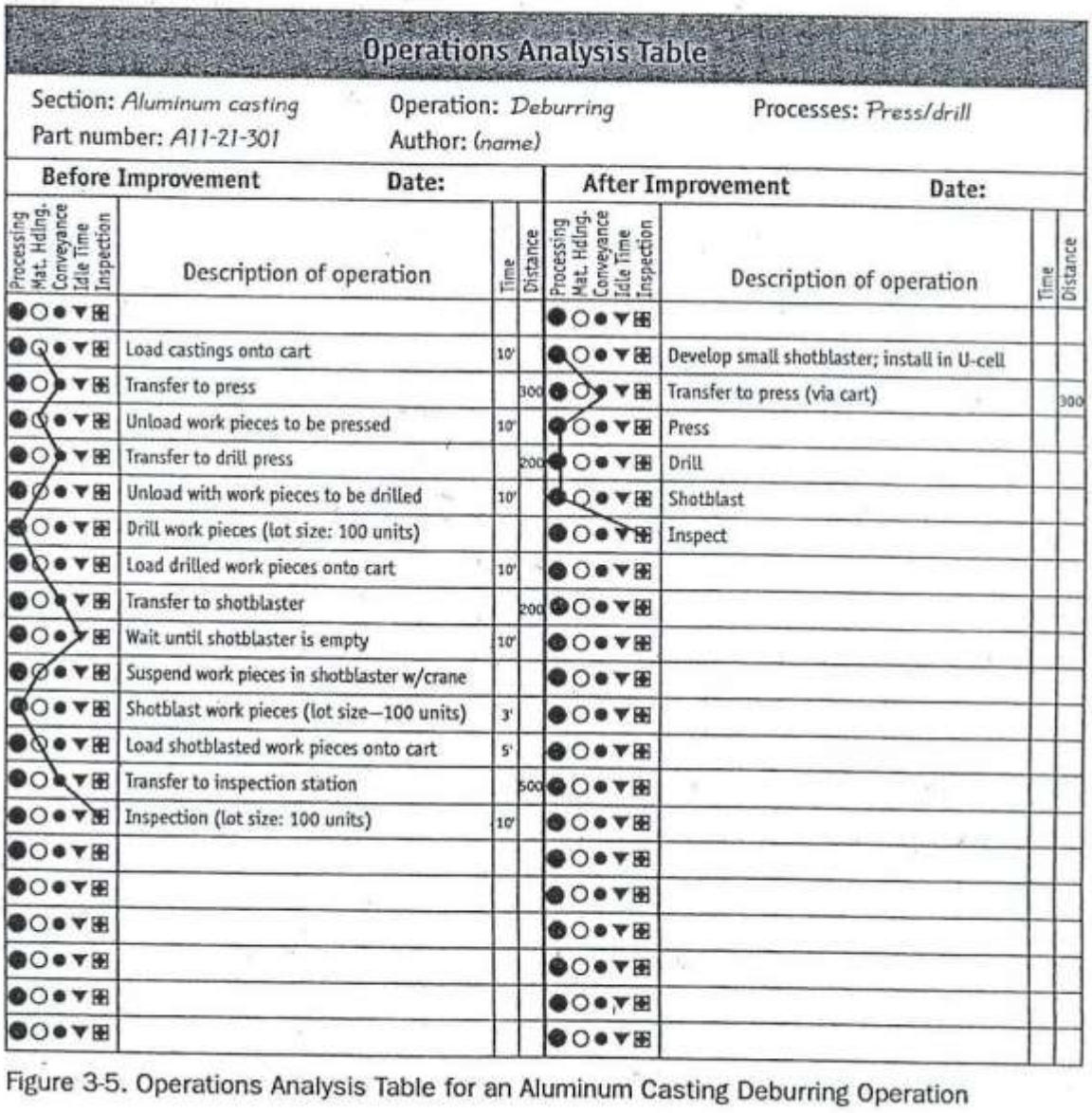
Date:

	Shop name: PCB Assembly	Before Improvement								After Improvement							
		Retention			Conveyance		Processing		Inspection	Retention			Conveyance		Processing		Inspection	
	Part name/number	# of times	# of units	Time	# of times	Distance	# of times	Lots	# of times	Lots	# of times	# of units	Time	# of times	Distance	# of times	Lots	# of times	Lots
1	PCB1 (A3-11-2010)	24			12	150	6		3										

Figure 3-4. A Summary Chart of Flow Analysis

The Operations Analysis Table

Since it is hard to do it for yourself because you can't watch yourself the same way someone else can, either have your supervisor fill in the table or do it as a team filling it in for each other



Operations Analysis Table

Section: *Aluminum casting* Operation: *Deburring* Processes: *Press/drill*

Part number: *A11-21-301* Author: *(name)*

Before Improvement Date:				After Improvement Date:			
Processing Mat. Hdlng. Conveyance Idle Time Inspection	Description of operation	Time	Distance	Processing Mat. Hdlng. Conveyance Idle Time Inspection	Description of operation	Time	Distance
	Load castings onto cart	10'			Develop small shotblaster; install in U-cell		
	Transfer to press		300		Transfer to press (via cart)		300
	Unload work pieces to be pressed	10'			Press		
	Transfer to drill press		200		Drill		
	Unload with work pieces to be drilled	10'			Shotblast		
	Drill work pieces (lot size: 100 units)				Inspect		
	Load drilled work pieces onto cart	10'					
	Transfer to shotblaster		200				
	Wait until shotblaster is empty	10'					
	Suspend work pieces in shotblaster w/crane						
	Shotblast work pieces (lot size—100 units)	3'					
	Load shotblasted work pieces onto cart	5'					
	Transfer to inspection station		500				
	Inspection (lot size: 100 units)	10'					

Figure 3-5. Operations Analysis Table for an Aluminum Casting Deburring Operation

1. *Fill in the table on the factory floor*- It is important to look at the real situation as you fill in the table, even if you know the situation by heart. As you fill in the form, you will see things differently.
2. *Look for detail* – Write everything down that you possibly can.
3. *Now identify the waste* – Analyze as critically as you can to distinguish work from wastefull movement. Everything that is not value-added must be counted as waste.
4. *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.
5. *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.

The Standard Operation Combination Chart

Plot the cycle time of all activities in the process to discover where the waste is and design the process to create a more efficient combination and reduce overall cycle time. See the figure below for an example of a combination chart.

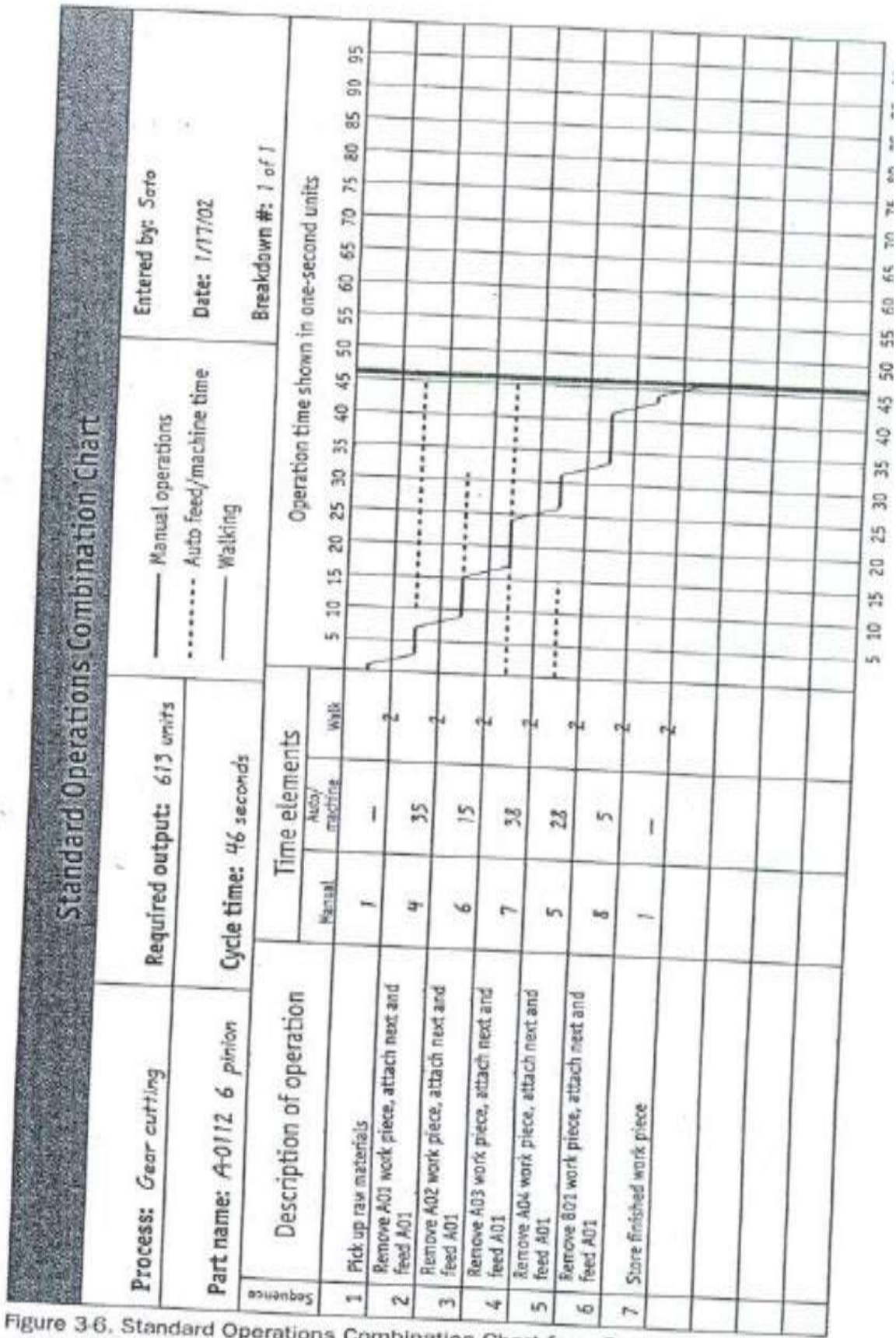


Figure 3-6. Standard Operations Combination Chart for a Gear Cutting Process

The Workshop Checklist for Major Waste Finding

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. You might want to use this checklist before

using the detailed checklists.

Workshop Checklist for Major Waste Finding

Workshop Name: **Date:**

#	Process Name	1 Overproduction waste	2 Inventory waste	3 Conveyance waste	4 Defect waste	5 Processing waste	6 Operation waste	7 Idle time waste	Waste Magnitude Total	Imporvement Ranking	Improvement Ideas and Comments

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within --- hour.

Task 1: In the given operation, identify the three categories of operation, measure their magnitude interms of time and compare them.

Task 2: In the given workplace and check the existence of Mura, Muri and Muda in each process and list out them.

Task 3: Using appropriate method identify the Seven types of Muda in the workplace.

Task 4: Using the given template list out the types of Muda identified and analyze their causes and measure their magnitude.

List of Reference Materials

BOOKS

1- Identifying Waste on the Shopfloor (1996).

2- Ethiopian Kaizen Manual (2011).