

LEAN MANUFACTURING

Assoc. Prof. Dr. Muhamad Zameri
b. Mat Saman



INTRODUCTION TO LEAN MANUFACTURING

- Lean manufacture is based upon the principle of eliminating waste at all levels throughout the manufacturing systems and to design improve methods and layouts
- It will also identify measures to monitor ongoing performance



Why Lean?

The changing world of the industry

Before

- Rapidly expanding market
- Consumer oriented towards quantity not quality
- Abundant low cost resources
- Management concerned with increased sales not decreased cost

After

- Increase competition in saturated or shrinking markets
- Consumer values more exacting quality requirements and on time delivery
- Sharp rise in material/labor cost
- Over capacity of production facilities



Why Implement Lean

■ Global Market

- World-wide competition

■ Success through People

- Involves everybody
- Begins at the front line

■ Focuses on the Process

- Improves Quality, Delivery and Cost performance



Changing of Mind Set

■ Selling Price = Cost + Profit

■ Profit = Selling Price – Cost

■ The focus should be on reducing cost

■ The best way to reduce cost is to remove the waste



What is Lean?

- The focus is on reducing Non Value Added (NVA) and waste
- Waste is anything that impedes the flow of the product as it is being transformed in the value chain

(J. Liker, Becoming Lean)



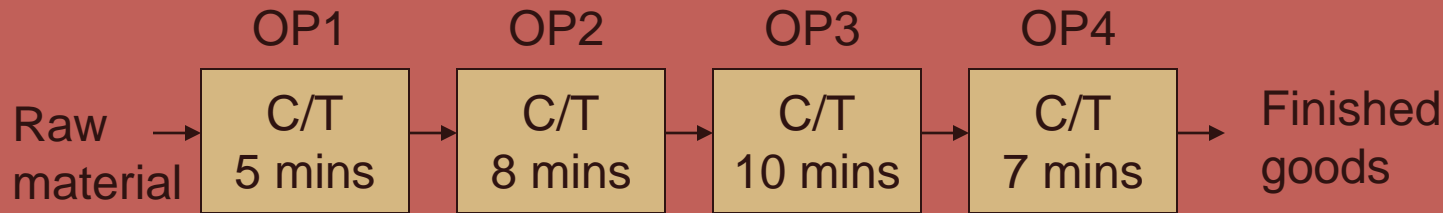
Lean Manufacturing

- Developed by the Toyota Motor Company
- To compete with highly industrialized countries, USA and UK
- Needed to maximize the efficiency of outdated equipment and limited factory floor space
- Focused on eliminating waste



Lean Thinking

The Holistic View



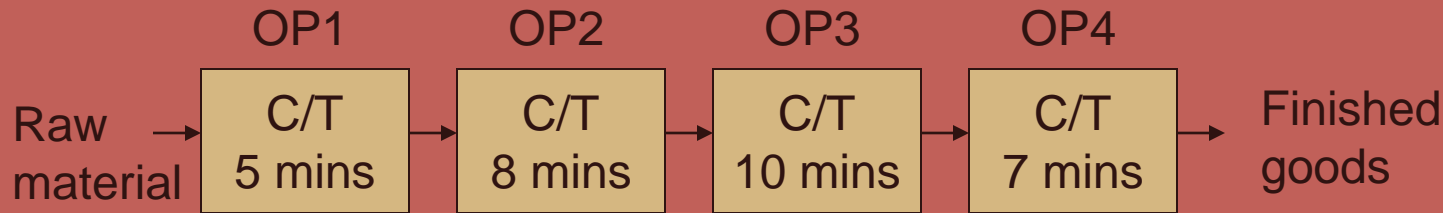
A manufacturing process

Questions

1. What is the maximum output of the line in one hour?
2. OP2 cycle time can be reduced by 50% by introducing CNC machinery, comment?

Lean Thinking

The Holistic View



A manufacturing process

Questions

1. What is the maximum output of the line in one hour?

6 products as 10 minutes is the limiting operation

2. OP2 cycle time can be reduced by 50% by introducing CNC machinery, comment?

This will not improve the performance of the system as the limiting operation is still present

Typical Processing operation

No	Term	Description
1	Batch Quantity (q units)	The number of components that is delivered to a machine prior to processing-usually constant
2	Set-up time (t_{su})	The time it takes to arrange, calibrate, fix-up, do trial runs on the machine before the actual processing operation
3	Operation time (t_o)	The time it takes to process a component from start to finish
4	Handling Time (t_{np})	Time taken to handle each components prior to and after processing operations
5	Total Time (Tt)	The time it takes to complete the whole batch from set-up to completion
6	Yield (sq)	Percentage of Good Parts



- Supposing we add another process to the first process.
- What happens?





Derive a simple equation to calculate total time based on the 4 variables

Tt =				



Where can we implement lean principles?

No	Term	Any Impact on Lean?	Possible How's
1	Batch Quantity		
2	Set-up time		
3	Operation time		
4	Handling Time		
5	Total Time		
6	Yield		



Learning Lessons

1. Every reduction of waste contributes to lean
2. Each improvement however little compared to the other is potentially valuable
3. Focus on the whole value chain

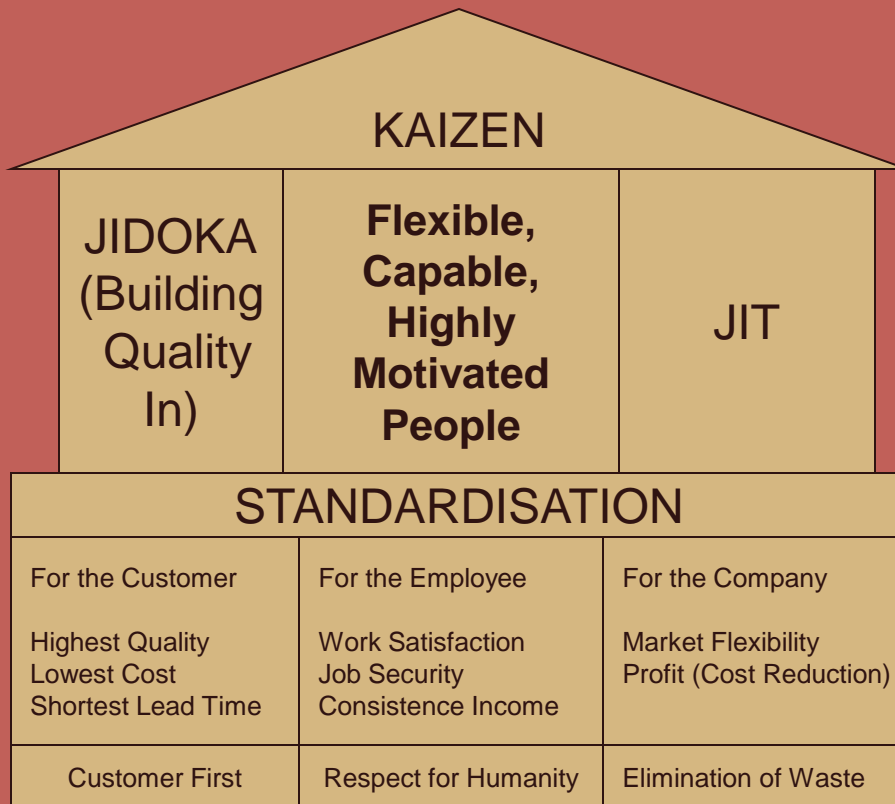


How to Become Lean

- A number of philosophies exist
 - Toyota Production System
 - Lean Thinking
 - Ford Production System
- All share Common views and standard techniques



Toyota Production system



Lean Thinking - Principles

- Specify Value: value can only be defined by the ultimate customer
- Identify the Value Stream: all the specific tasks required to bring a product to delivery
- Flow: eliminate waste to design systems to allow value creating steps to flow
- Pull the product: only make what the customer requires
- Perfection: continue to look for and eliminate waste



Ford Production System

The 5 Phases Implementation Plan

Phase	Tools
1. Stability	TPM, SMED, Standard Operation, Poke Yoke, 5S
2. Continuous Flow	Facility Layout, Small Lots
3. Synchronous Production	One Piece Flow, Supplier Partnership
4. Pull System	Kanban
5. Level Production	Load Leveling (Heijunka)

