

Supply Chain Inventory Management



Lean Production



What is Lean Production? (in simple terms)

Lean production is a way of organizing manufacturing (or other operations) so that you create more value for the customer using fewer resources. It focuses on eliminating waste (anything that does not add value from the customer's view) and doing things right the first time.



Main Principles of Lean

Seek Perfection

Lean is never “done.” Continuously look for ways to **improve the process**, reduce waste, and deliver more value.



Identify Value

Determine what the **customer truly values and is willing to pay for**. Everything else is considered waste.



Map the Value Stream

From A – Z Value Mapping (Info + Materials)



Create Flow

Flow without Interruptions / waiting time



Establish Pull

Work is only done when there is a demand for it

Lean Principle Summary

Principle	Description	Example in Practice
1. Define Value		
2. Map the Value Stream		
3. Create Flow		
4. Establish Pull		
5. Seek Perfection (Continuous Improvement)		

Lean Principle Summary

Principle	Description	Example in Practice
1. Define Value	Understand what the customer truly values and is willing to pay for — everything else is waste.	<ul style="list-style-type: none">• Toyota defines value as reliable, defect-free vehicles with short lead times• Nike defines value as design and speed-to-market.

Value is **what the customer is willing to pay for** — not what the company thinks is valuable.

In Lean, we define value by asking:

1. Who is the customer?
2. What problem are we solving for them?
3. What features, functions, or services actually create satisfaction or usefulness?
4. What parts of our process don't add that value (i.e., are waste)?

Lean Principle Summary

Amazon “**Customer Obsession**” as the definition of value How Amazon defines value:
Fast, reliable delivery + wide selection + low prices + convenience.

How this shapes operations:

Prime Membership: “free (or faster) delivery.” Amazon invests in automation, warehouses, and logistics to meet that value.

Recommendation algorithms: “personalized shopping experience,” not random ads.

Customer reviews & transparency: value = “trust in purchase decisions.”

Voice ordering (Alexa): value = “Convenience.”

Lean Principle Summary

Principle	Description	Example in Practice
2. Map the Value Stream	Map all steps (information + material) that take a product from raw material to customer; eliminate non-value-adding steps.	Intel used value-stream mapping to cut chip assembly lead time by 65%.

Once value is defined, the next step is to **MAP all the activities required** to deliver that value from raw material to customer.

This includes both:

- **Value-adding activities** (those that create something the customer wants), and
- **Non-value-adding activities (waste)** (those that consume time, space, or money but don't increase customer satisfaction).

A **Value Stream Map (VSM)** visualizes the **flow of materials, information, and work** showing where delays, inventory, or bottlenecks exist.

Lean Principle Summary

Amazon **Mapping the order-to-delivery process**

Value Stream focus:

The entire journey from customer click → order → warehouse picking → delivery.

How Amazon applies VSM:

Amazon tracks every step using data: order processing, warehouse location, packing, and shipping.

Major wastes like waiting, unbalanced workloads, and unnecessary travel in fulfillment centers.

Optimized layout (robots + algorithms) to reduce picker walking distance and eliminate idle time.

Real-time inventory visibility connects the information flow (orders) to material flow (products).

Result: Reduced lead time from several days to same-day or next-day delivery, cutting waste across the value stream.

Lean Principle Summary

Principle	Description	Example in Practice
3. Create Flow	Ensure the remaining steps occur in tight sequence so products move smoothly toward the customer without interruption.	Toyota's production lines are designed so components flow continuously through stations, minimizing waiting and inventory.

Once you've defined what customers truly **value** and **mapped** the entire process (the value stream), the next step is to make that **value flow continuously** without delays, rework, or waiting.

In Lean terms, flow means that:

- Each step happens just when it's needed, and
- There are no bottlenecks, no idle inventory, and no waiting.

Lean Principle Summary

Amazon's business model is built on making **information and materials flow seamlessly** from click to doorstep

Step 1: Streamlined Order Flow (Information Flow)

- As soon as customer places an order, **data flows instantly** to the nearest fulfillment center (FC) where the item is stored.
- System automatically selects the **optimal FC and delivery route** based on proximity, inventory, and workload.
- This replaces old batch-order processing — a classic flow improvement that eliminates waiting and manual scheduling.

Step 2: Flow Inside the Fulfillment Center (Material Flow)

- Robotics (Kiva systems) carry shelves to workers instead of workers walking miles daily.
- Each item's path through picking → packing → shipping is digitally coordinated to minimize motion and waiting.
- Stations are designed for one-piece flow: each worker completes a value-adding task quickly before the item moves to the next step.

Lean Principle Summary

Principle	Description	Example in Practice
4. Establish Pull	Nothing is produced until the customer “pulls” it – prevents overproduction and excess inventory.	Dell and Zara use pull-based systems: they only assemble or produce items after customer demand is known.

Once you've created continuous flow, the next Lean principle is to let customer demand pull the product or service through the process, instead of pushing work based on forecasts or schedules.

In a **push system**, production is based on prediction — you make goods in advance and hope customers will buy them.

In a **pull system**, every activity happens in response to actual demand — nothing is made, moved, or ordered until it's needed.

Lean Principle Summary

Amazon is one of the most advanced examples of a **global pull-based system**, both digitally and physically.

Step 1: The Customer Click – The Ultimate Pull Signal

- The customer's "**Buy Now**" click acts as the pull signal.
- That single digital action triggers the entire chain — from fulfillment center allocation to packaging to shipping.
- Nothing is picked, packed, or shipped **until** the customer demand exists.

Step 2: Inventory Replenishment (Pull between Suppliers and Amazon)

Amazon's automated systems track every SKU's stock level.

When a product reaches its reorder point, **the system automatically sends a replenishment signal** to suppliers pulling inventory just in time to meet actual demand. This prevents excess stock and obsolete items.

Pull Vs Forecast

Concept	Pull System (Lean)	Forecasting (Traditional Push)
Trigger for production	Actual customer demand	Predicted (forecasted) demand
Goal	Eliminate waste by producing only what is needed, when needed	Ensure availability by predicting future needs
Material Flow	“Just in Time” (JIT) – demand pulls materials through the system	“Push” – production pushes materials into inventory
Inventory Level	Minimal (to avoid waste)	Higher (to protect against uncertainty)
Risk	Stockouts if supply fails	Overproduction and excess inventory

Reflect on Toyota Reaction Paper

Lean Principle Summary

Principle	Description	Example in Practice
5. Seek Perfection (Continuous Improvement)	Lean is never “done” continuous pursuit of waste elimination, improved flow, and better quality through kaizen .	Toyota encourages daily small improvements; Amazon uses continuous data-driven process reviews to keep optimizing delivery times.

Step 1: The “Day 1” Philosophy – Never Stop Improving

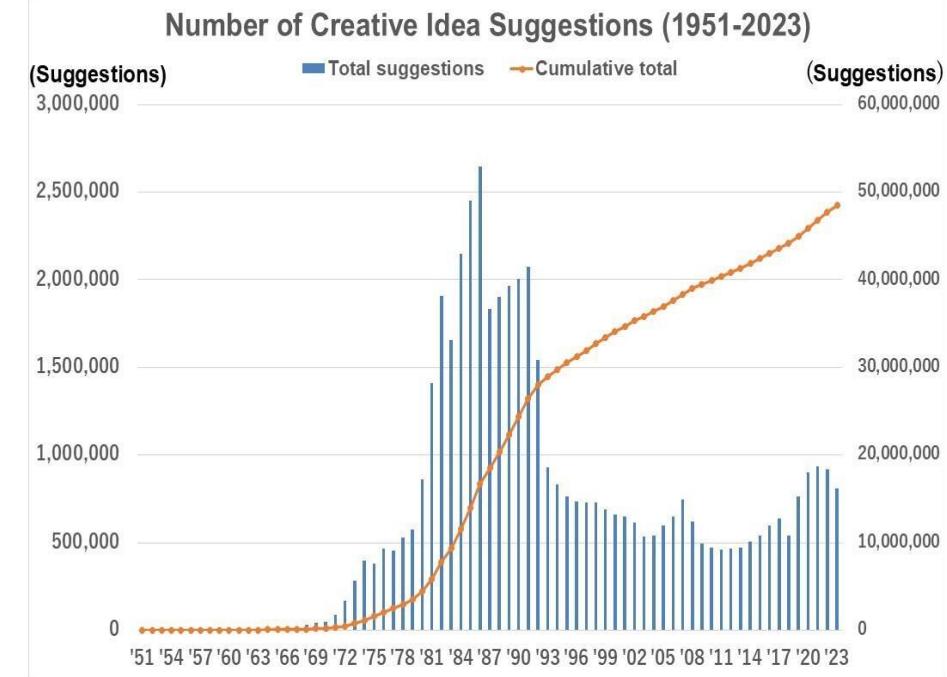
Step 2: Data-Driven Problem Solving

Step 3: Experimentation and Innovation

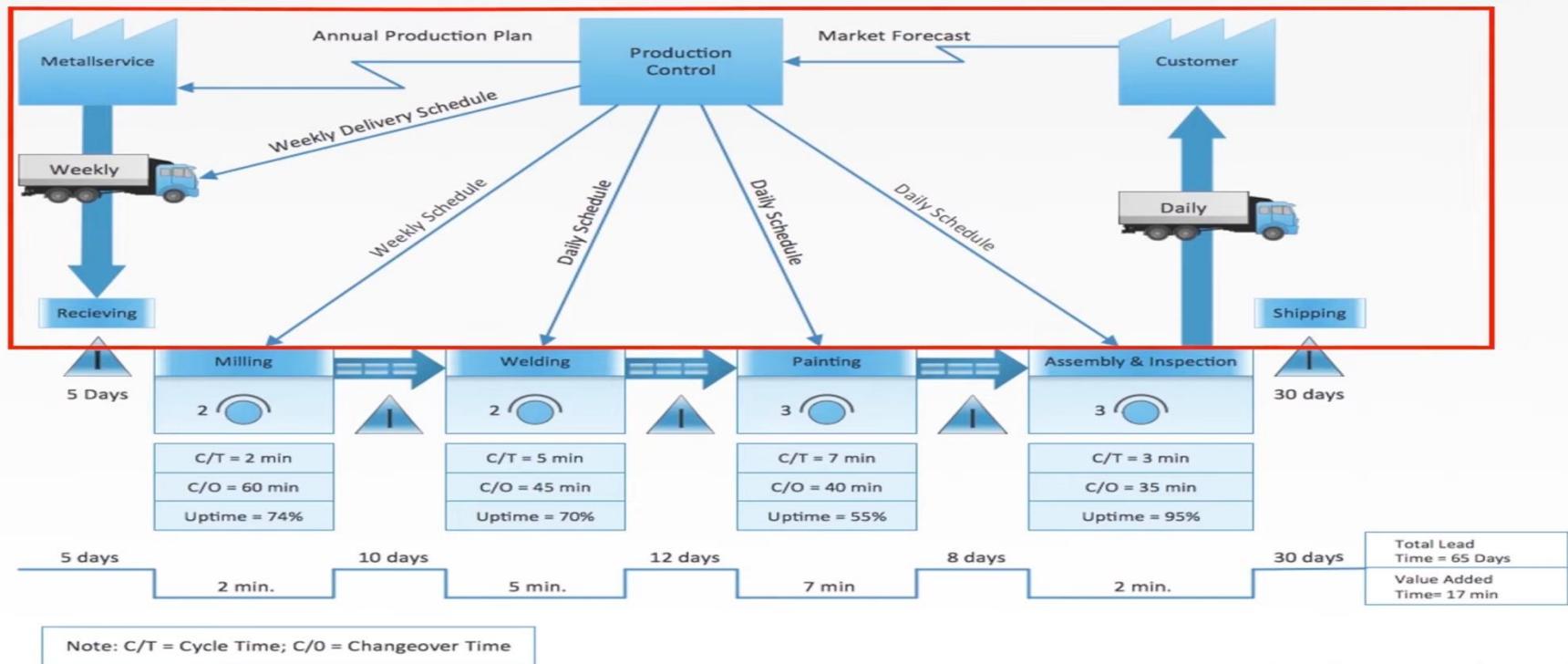
Step 4: Employee Empowerment and Learning Culture

Step 5: Learning from Failures

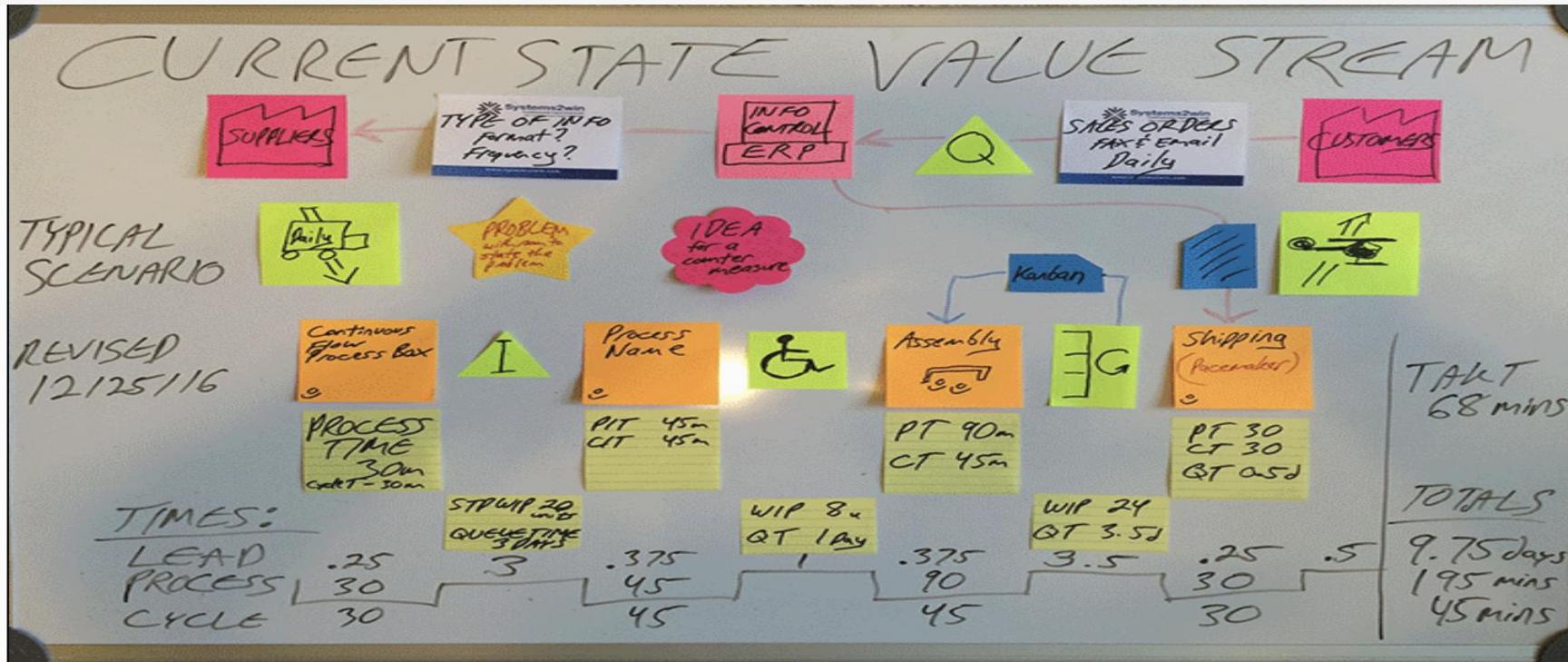
Lean Principle Summary



Valu Stream Mapping



Value Stream Mapping



Value Stream Mapping



What is Kaizen

Kaizen is a Japanese term that means "continuous improvement." It's a philosophy and approach focused on constantly improving processes, products, or practices through **small, incremental changes**.

Kaizen = small, continuous improvements by everyone, everywhere.

Breakdown of the Word:

Kai [改] = Change

Zen [善] = Good

So literally, Kaizen = good change.

What is Kaizen

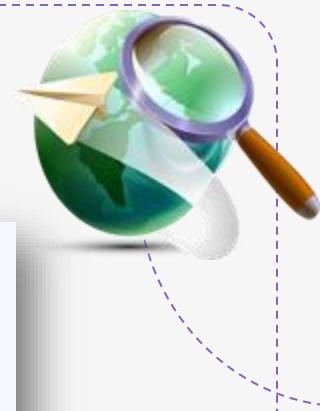
The Kaizen Philosophy

Kaizen is not a one-time project — it's a daily mindset:

- Improve a little **every day**.
- Involve **everyone**, not just managers.
- Focus on process, not **blame**.
- Use data and observation to find the root cause.
- Celebrate **small** wins and learn from mistakes.



What is Kaizen



What is Kaizen

Type	Description	Example
Daily Kaizen	Small, ongoing improvements suggested by employees.	A worker moves label printer closer to reduce motion.
Kaizen Event	Short, focused project (2–5 days) to fix a specific issue.	A team reduces order picking time in a warehouse.
Cross-functional Kaizen	Teams from different departments solve a shared problem.	HR + Production + Safety team redesign shift change process.



Tools Used in Kaizen

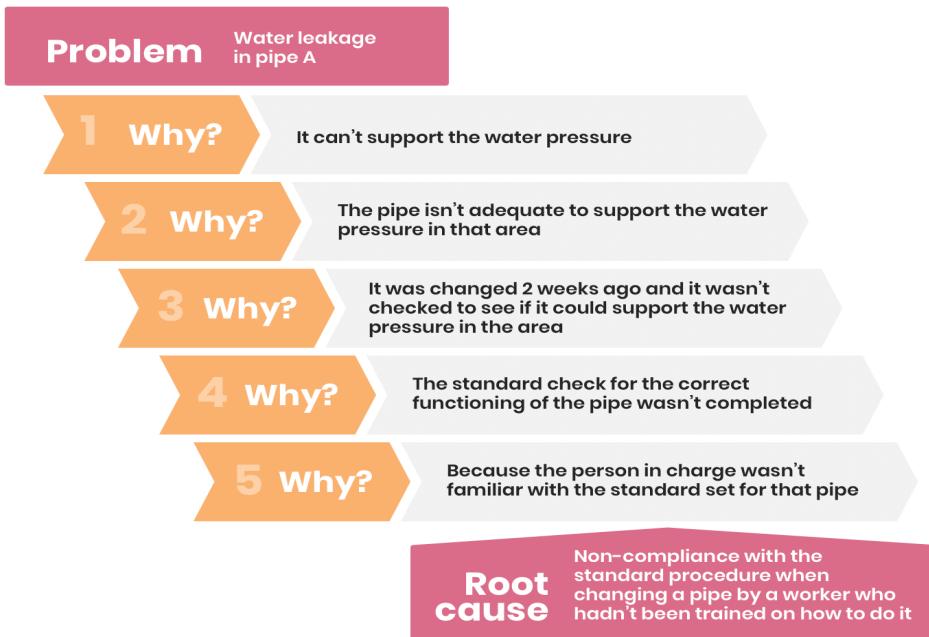
Tools Used in Kaizen

Tool	Purpose	Simple Explanation
5 Whys	Find root cause	Keep asking “Why?” until you reach the real issue.
PDCA Cycle	Continuous improvement loop	Plan → Do → Check → Act, then repeat.
Gemba Walk	Observe where work happens	Go to the “real place” to see the real problem.
Visual Management	Make problems visible	Charts, labels, colors, or boards show performance.



5 Whys

5 Whys



The **5 Whys** is a simple problem-solving method where you keep asking “**Why?**” until you find the **root cause** of a problem not just the surface symptom.

Fix the real cause, not the visible effect.

How It Works:

1. Write down the problem.
2. Ask “**Why did this happen?**”
3. Write the answer.
4. Ask “**Why?**” again about that answer.
5. Continue 5 times (or until you find the root cause).
6. Identify and fix the root cause.

5 Whys

At an Amazon fulfillment center, customer complaints about late deliveries have increased over the past two months.

Step 1: Define the Problem

Customers are receiving their packages later than the promised delivery date.

Step 3: Identify the Root Cause

The root cause is the lack of an automated inventory monitoring and reordering system for packaging materials.

Step	Question	Answer
1	Why are deliveries reaching customers late?	Because orders are leaving the warehouse later than scheduled.
2	Why are orders leaving the warehouse late?	Because the packaging process is taking longer than usual.
3	Why is the packaging process taking longer?	Because there are frequent shortages of packaging materials (boxes and tape).
4	Why are packaging materials often out of stock?	Because the inventory team did not reorder materials on time.
5	Why did the inventory team fail to reorder on time?	Because there is no automated system to track and alert low stock levels — the team relies on manual checks.



Group Discussion

5 Whys

Background:

The university noticed that a large number of students are submitting assignments after the deadline in several subjects. This has caused delays in grading and affects overall class performance. The professors want to understand why this keeps happening and how to fix it.

Your group's task is to use the **5 Whys technique** to find the **root cause** and suggest **practical solutions**.

Expected Output:

Each group should prepare a short summary that includes:

- Defined problem
- Five “Why” questions and answers
- Root cause
- Recommended solutions

5 Whys

Background:

A small factory that produces metal parts has noticed that one of its cutting machines breaks down almost every week. Each breakdown causes delays in production and extra repair costs.

Your group's task is to use the **5 Whys technique** to find the **root cause** and suggest **practical solutions**.

Expected Output:

Each group should prepare a short summary that includes:

- Defined problem
- Five “Why” questions and answers
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- Recommended solutions

5 Whys

Background:

A local online store has received many complaints from customers saying their orders arrive late. The manager wants to understand why this keeps happening and how to fix it.

Your group's task is to use the **5 Whys technique** to find the **root cause** and suggest **practical solutions**.

Expected Output:

Each group should prepare a short summary that includes:

- Defined problem
- Five “Why” questions and answers
- Root cause
- Recommended solutions



PDCA Cycle (Plan–Do–Check–Act)

PDCA

A **continuous improvement cycle** used to test and refine ideas safely and systematically.

PDCA = the “engine” of Kaizen.

Problem: Amazon Workers spend too much time finding the next order bin.

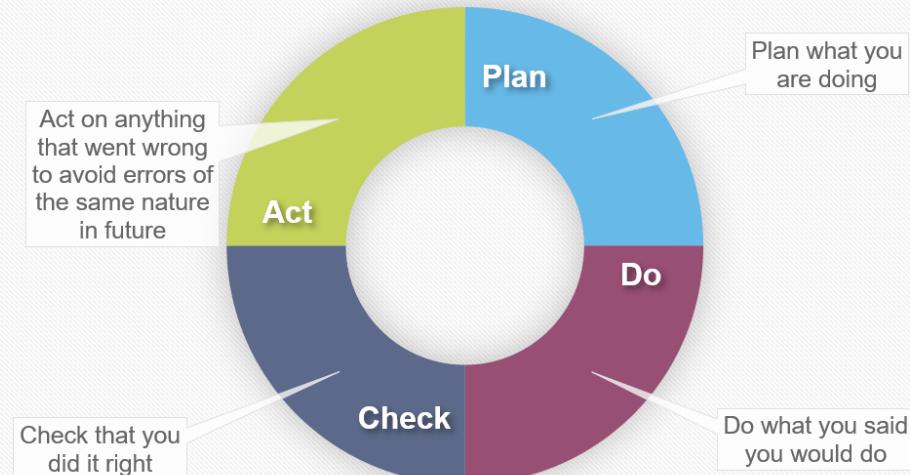
Plan: Introduce color-coded bins for faster visual identification.

Do: Test in one warehouse section for 1 week.

Check: Picking speed improved by 15%.

Act: Roll out across all warehouses.

PDCA Cycle





Gemba Walk

Gemba Walk

Gemba means “the real place” in Japanese where the actual work happens.

A Gemba Walk means managers and leaders go to the workplace to observe, ask, and learn rather than blame or control.

“Go and see, ask why, and show respect.”



6-Step Gemba Walk Preparation



Choose a Theme
for Your Walk



Prepare a Plan and
a Map for the Walk



Prepare the Team
to be Observed



Record Observations
and Share with the Team



Set a Schedule
and Follow Suit



Identify Process
Walkers and Interviewees

Gemba Walk



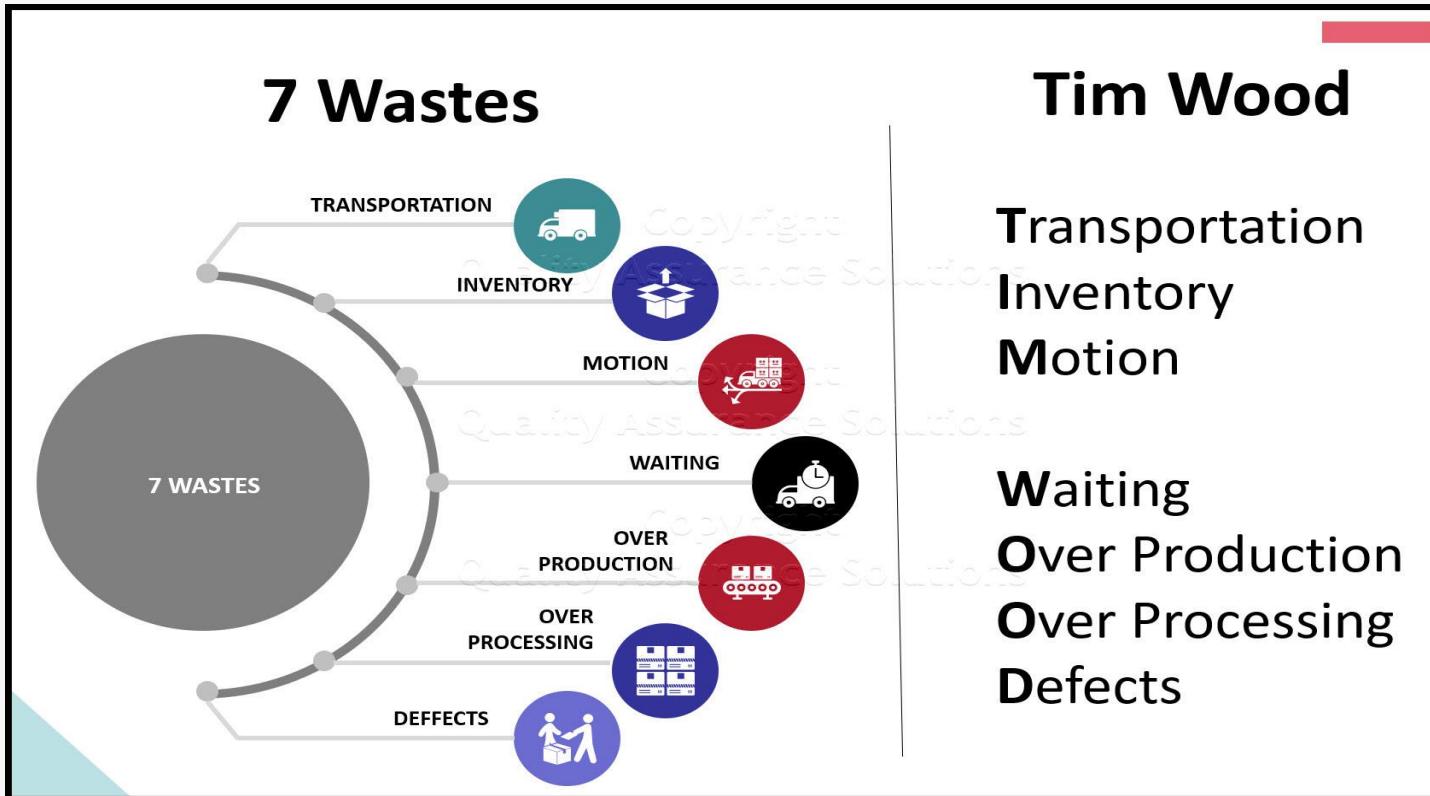
How It Works:

1. Go to the real place (factory floor, warehouse, office).
2. Observe processes firsthand.
3. Ask employees about what's working and what's not.
4. Identify waste, safety issues, or improvement ideas.
5. Record and follow up with small improvements.



Waste (Muda)

Waste (Muda)



Waste (Muda)

#	Type of Waste	Description
1. Overproduction	Producing more than needed or earlier than required.	A factory produces 10,000 parts while the customer only needs 5,000 resulting in excess inventory and storage cost.
2. Waiting	Idle time when resources (people, machines, or materials) are not in use.	Workers waiting for raw materials due to delayed delivery or for a machine to finish a cycle.
3. Transportation	Unnecessary movement of materials or products.	Moving components back and forth between distant workstations in a large warehouse without value being added.
4. Overprocessing	Doing more work or using more resources than necessary to meet customer requirements.	Polishing a surface to mirror-finish when the customer only needs a matte finish.
5. Inventory	Excess raw materials, work-in-progress (WIP), or finished goods that tie up capital.	Keeping months of spare parts "just in case," increasing storage cost and risk of obsolescence.
6. Motion	Unnecessary movement by people that does not add value.	An operator walking across the workshop frequently to fetch tools due to poor workstation layout.
7. Defects	Efforts involved in inspecting, reworking, or scrapping faulty products.	Producing car parts with wrong dimensions requiring rework or scrapping.

Waste (Muda)

#	Type	Example
1	Overproduction	Making 500 desks when 300 are needed
2	Waiting	Workers idle waiting for parts
3	Transportation	Moving raw food between buildings
4	Overprocessing	More features than needed
5	Inventory	Overstocking phones
6	Motion	Nurses walking for supplies
7	Defects	Mislabelled water bottles

8th Waste

8th Waste: Unused Employee Talent (or Underutilized People)

Definition:

The failure to make full use of employees' skills, knowledge, creativity, and experience.

This waste happens when workers are treated as "hands" instead of "minds" when management doesn't listen to their improvement ideas or fails to give them responsibility for problem-solving.