

# LEAN Management



## Principles, Tools, and Techniques

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07 July 2023



**Lean is a process of eliminating waste with the goal of creating value for enterprise stakeholders.**

“Toyota Motor Corporation's vehicle production system is a way of making things that is sometimes referred to as a "lean manufacturing system," or a "Just-in-Time (JIT) system”

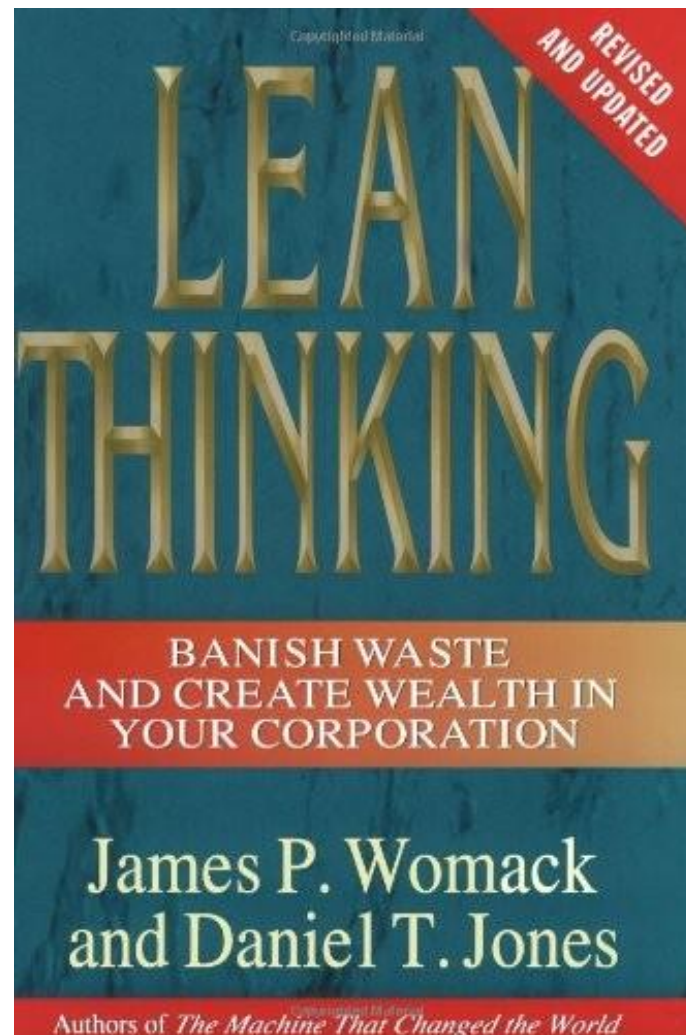
**The Toyota Production System (TPS) was established based on two concepts:**

"**Jidoka**" (which can be loosely translated as "automation with a human touch"), as when a problem occurs, the equipment stops immediately, preventing defective products from being produced; and

"**Just-in-Time**" concept, in which each process produces only what is needed for the next process in a continuous flow.

# What is Lean?

#TQMforbetterFuture, Revised Version



*James Womack & Daniel Jones published the book “Lean Thinking” in 1996-1997 where they described **Five Fundamental Principles Of Lean** as below*

***I. Specify value:*** Value is defined by customer in terms of specific products & services

***II. Identify the value stream:*** Map out all end-to-end linked actions, processes and functions necessary for transforming inputs to outputs to identify and eliminate waste

***III. Make value flow continuously:*** Having eliminated waste, make remaining value-creating steps flow

***IV. Let customers pull value:*** Customer pull cascades all the way back to the lowest level supplier, enabling just-in-time production

***V. Pursue perfection:*** Pursue continuous process of improvement striving for perfection



# *25 Essential Tools/ Techniques/ Principles / Methodologies of Lean*

## Meaning of 5S

**Seiri 整理:** Organization

**Seiton 整頓:** Orderliness

**Seisou 清掃:** Cleanliness

**Seiketsu 清潔:** Standardized Cleanup

**Shitsuke 躰:** Discipline

Reference:

5 Pillars of the Visual Workplace, Hirano, Hiroyuki (1995)

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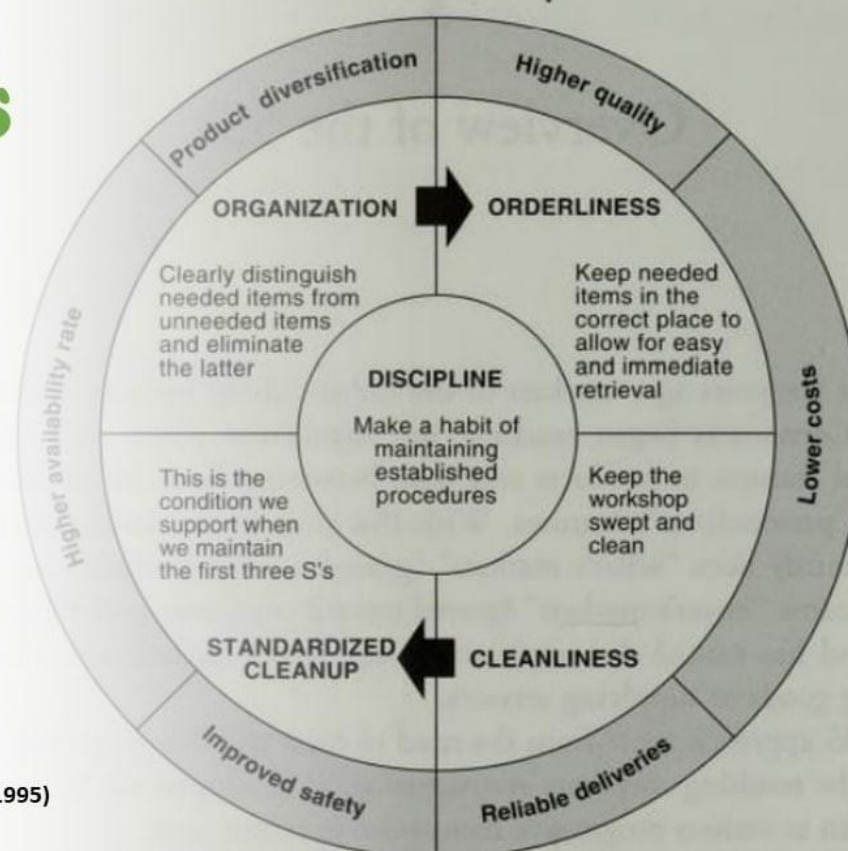


Figure 3-1. Meaning of the 5S's

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## What is 5S?

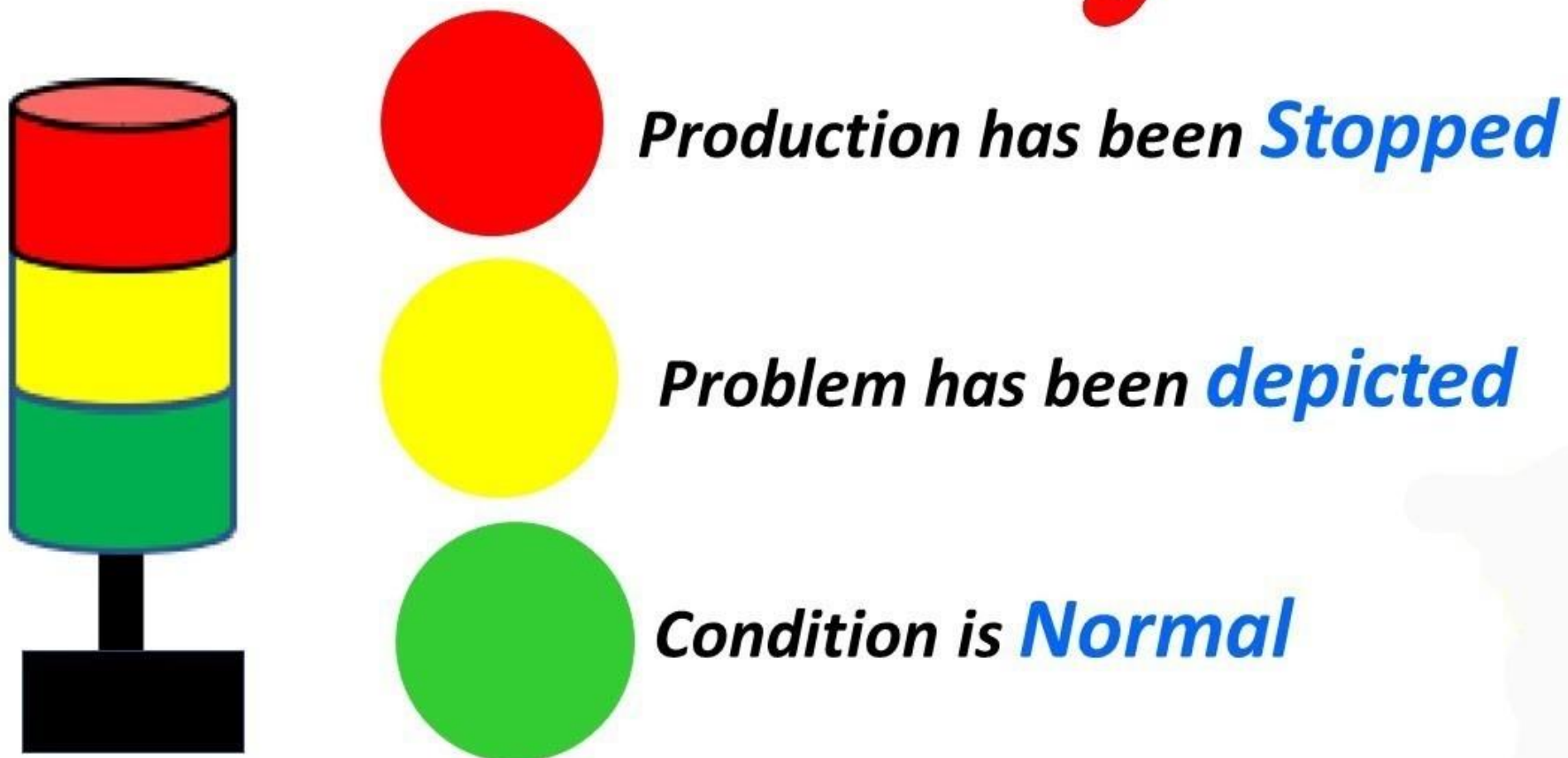
Organize and manage the work area:

- Sort (eliminate that which is not needed)
- Set In Order (organize remaining items)
- Shine (clean and inspect work area)
- Standardize (write standards for above)
- Sustain (regularly apply the standards)

## How does 5S help?

Eliminates waste that results from a poorly organized work area (e.g. wasting time looking for a tool).

# Andon System

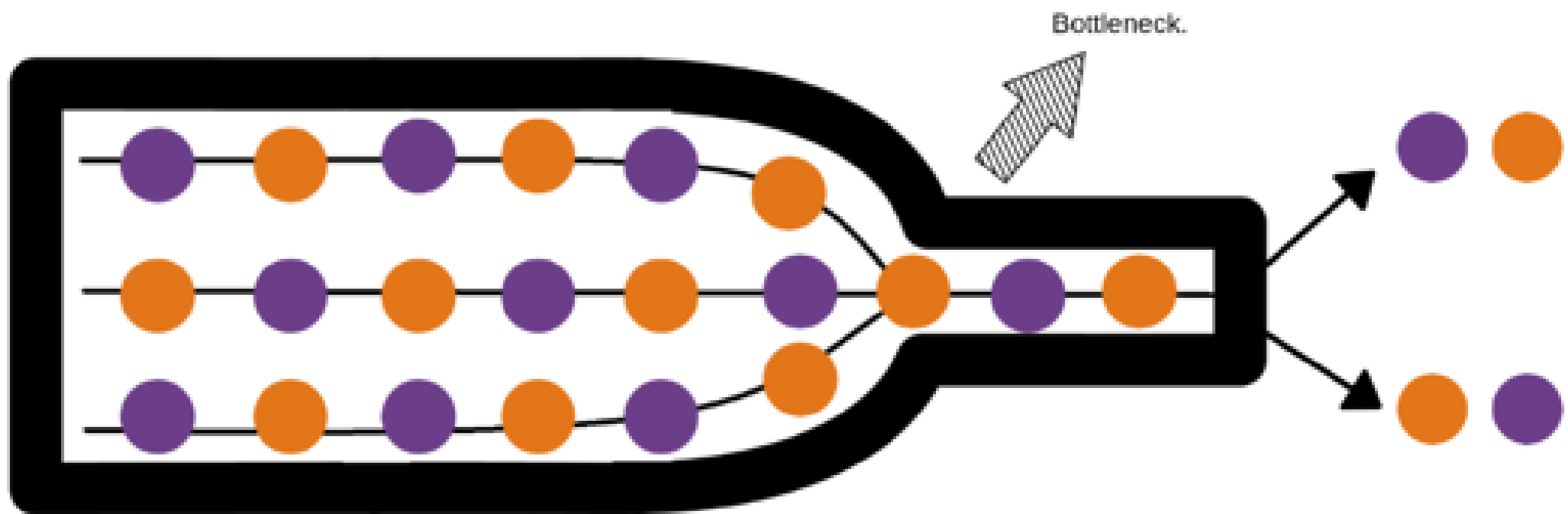


## What is Andon?

Visual feedback system for the plant floor that indicates production status, alerts when assistance is needed, and empowers operators to stop the production process.

## How does Andon help?

Acts as a real-time communication tool for the plant floor that brings immediate attention to problems as they occur – so they can be instantly addressed.



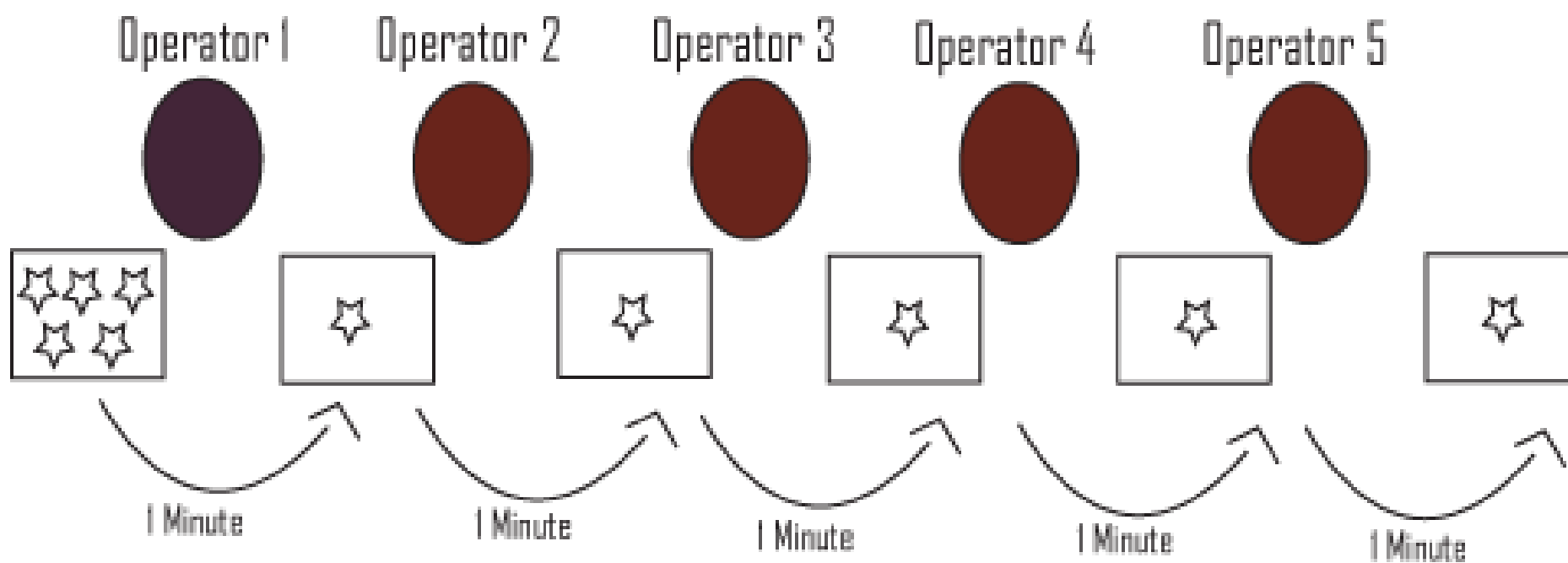
## **What is Bottleneck Analysis?**

Identify which part of the process limits the overall throughput and improve the performance of that part of the process.

## **How does Bottleneck Analysis help?**

Improves throughput by strengthening the weakest link in the process.

### Lean Flow - Example



**Total Time for process = 9 Minutes**

### What is Continuous Flow?

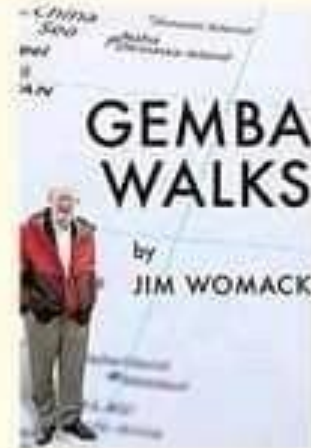
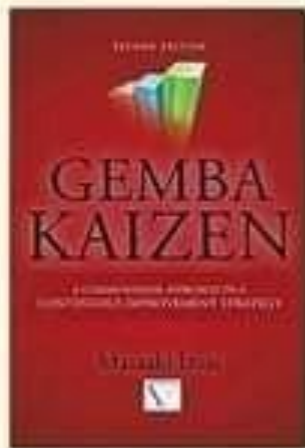
A process where work-in-process smoothly flows through production with minimal (or no) buffers between steps of the process.

### How does Continuous Flow help?

Eliminates many forms of waste (e.g. inventory, waiting time, and transport).

Did you know?

GEMBA is not a Japanese Term!



Due to pronunciation matter, the original Japanese term "Genba" is sometimes written as "Gemba".

TCM for better future

Many people say "Gemba" is a Japanese term which means actual place.

But if we google it for translation, we can never get it as Japanese word. Logically meaning will also not come out!

Basically "Genba" is the original Japanese term.

In hiragana:げんば; in kanji 現場;  
If we split the word,  
現 (gen) : actual/current,  
場 (ba): location/place

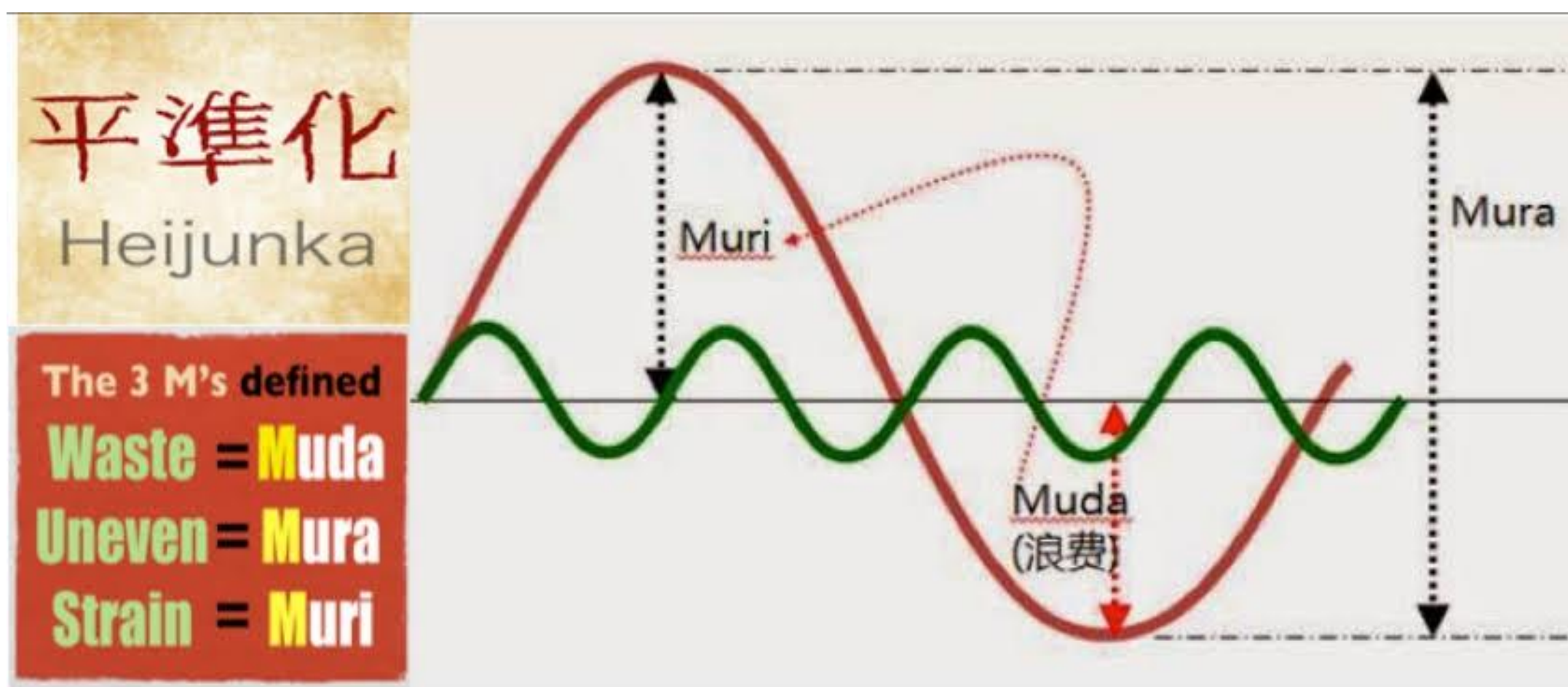
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## What is Gemba?

A philosophy that reminds us to get out of our offices and spend time on the plant floor or any of the place where real action occurs.

### How does Gemba help?

Promotes a deep and thorough understanding of real-world issues – by first-hand observation and by talking with shop floor employees or owner of the process.



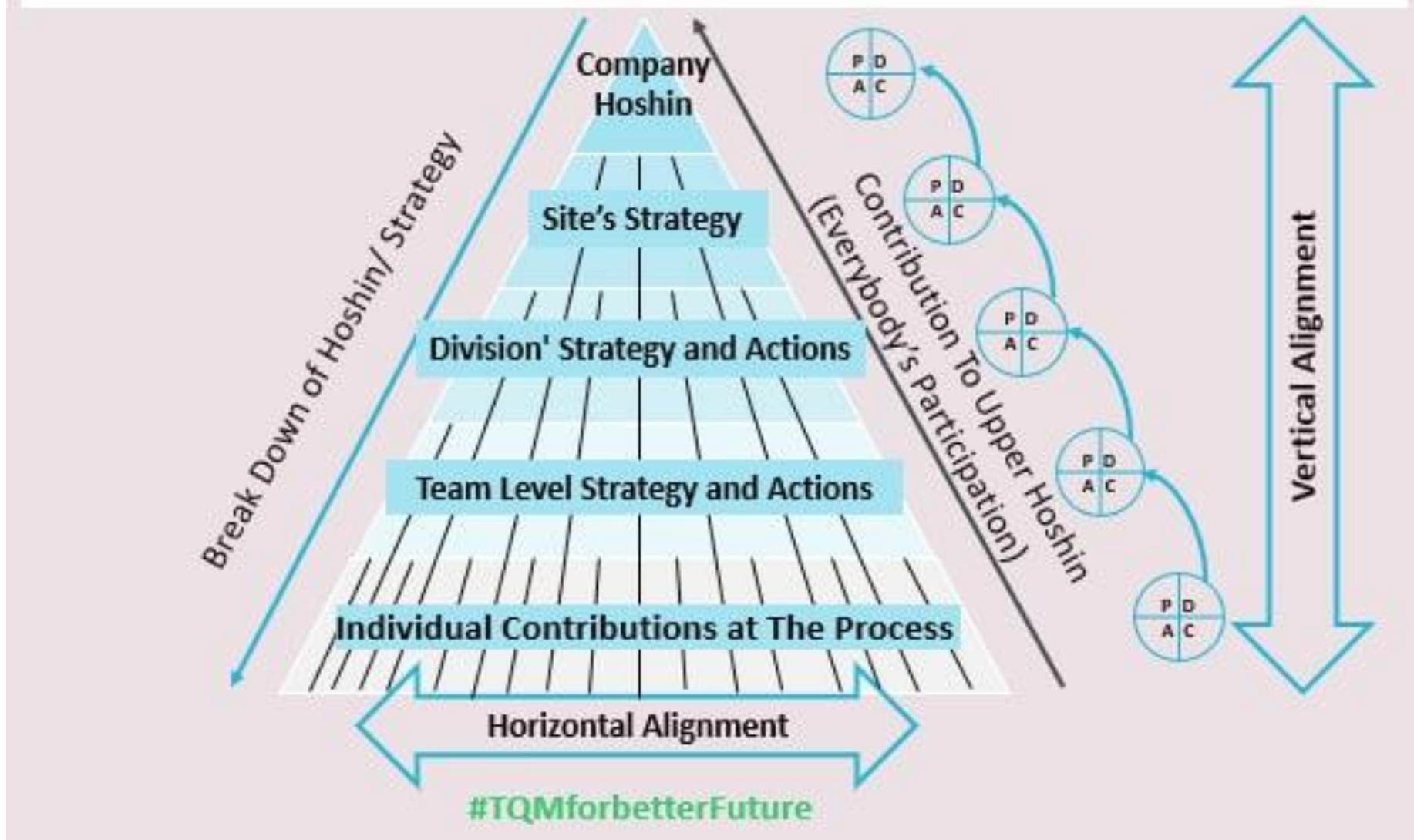
## What is Heijunka?

A form of production scheduling that purposely manufactures in much smaller batches by sequencing (mixing) product variants within the same process.

### How does Heijunka help?

Reduces lead times (since each product or variant is manufactured more frequently) and inventory (since batches are smaller).

# HOSHIN KANRI, STRATEGY TO ACTION! POLICY MANAGEMENT



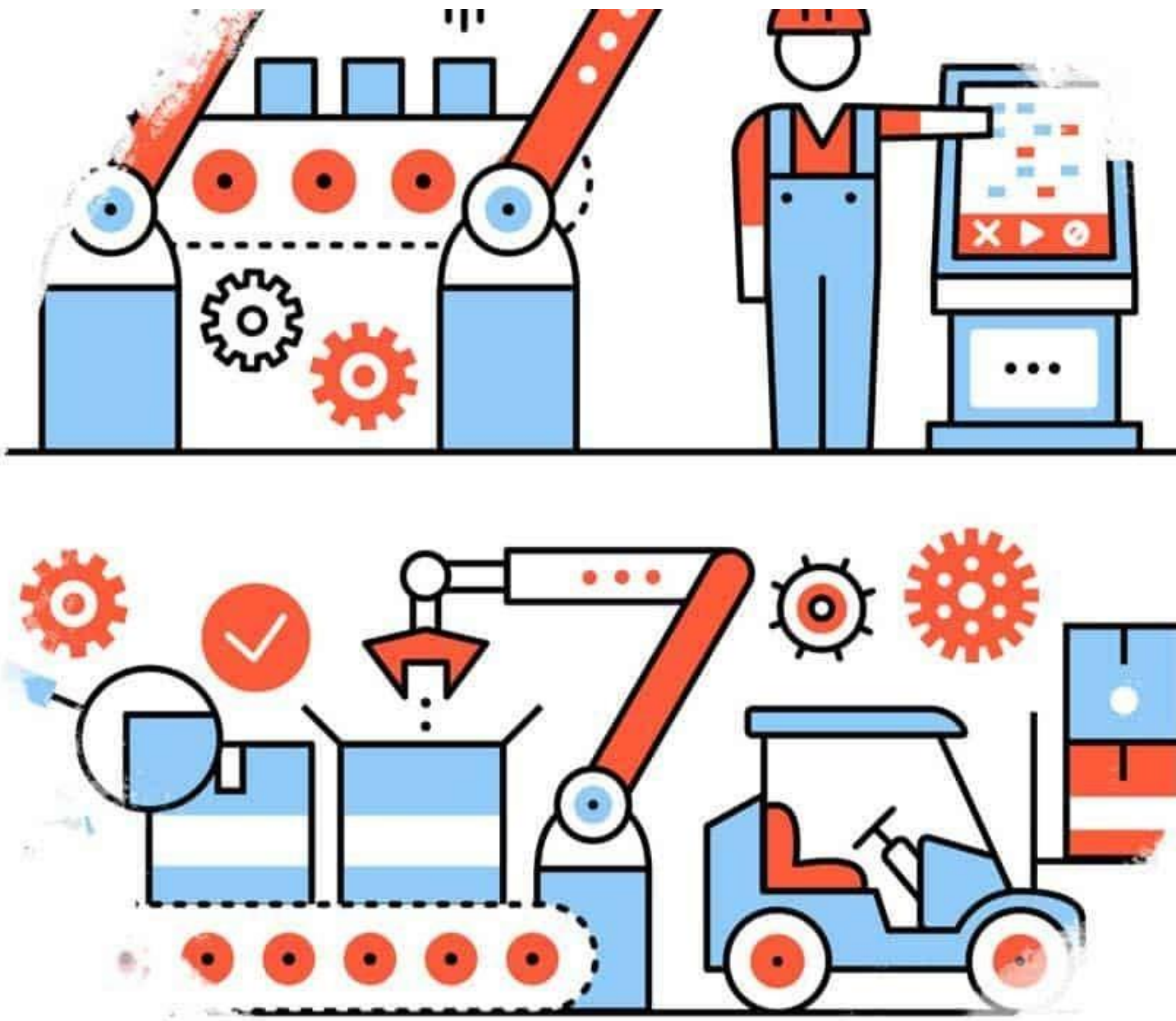
## What is Hoshin Kanri?

Align the goals of the company (Strategy), with the plans of middle management (Tactics) and the work performed on the plant floor (Action).

## How does Hoshin Kanri help?

Ensures that progress towards strategic goals is consistent and thorough – eliminating the waste that comes from poor communication and inconsistent direction.

# Automation

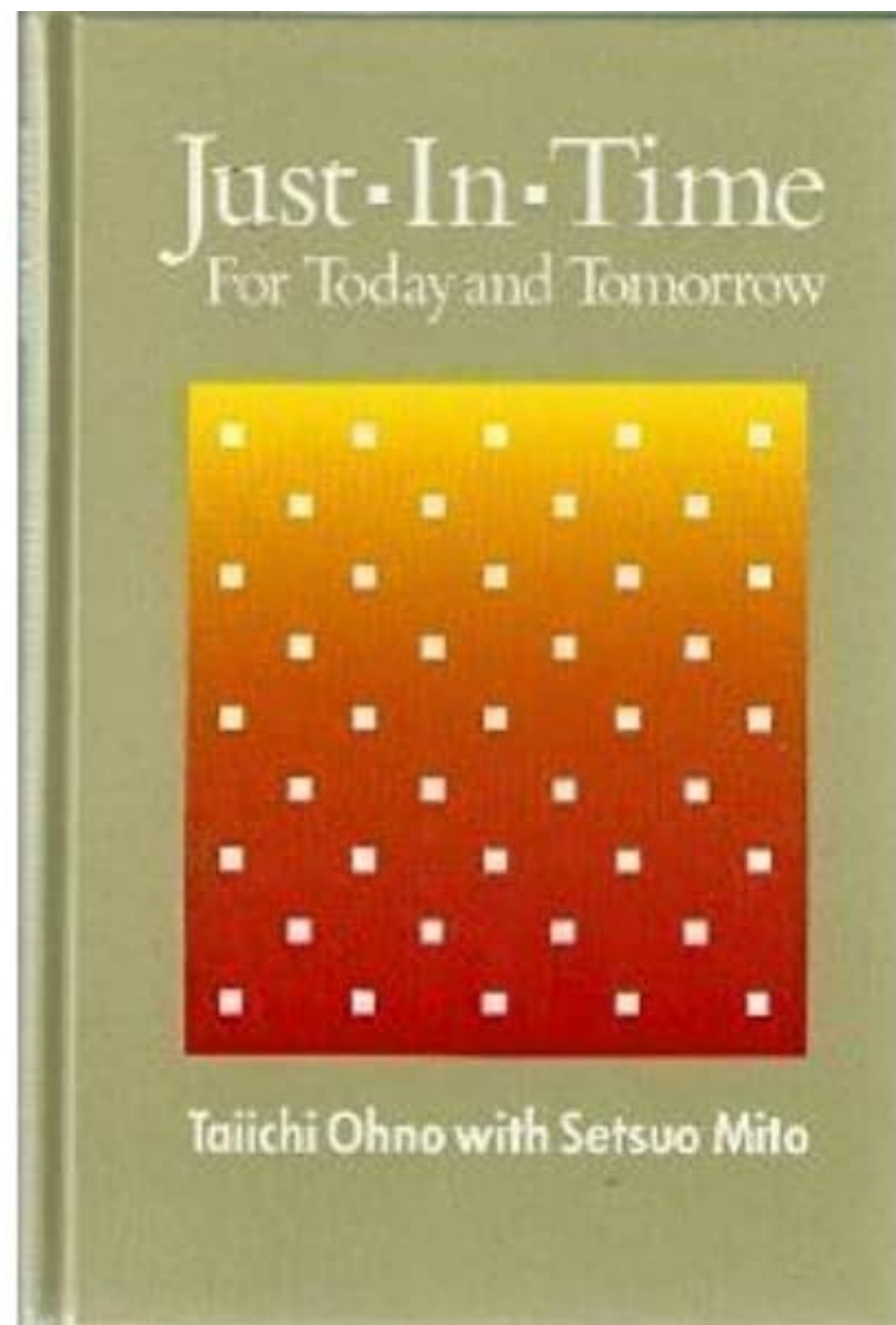


## What is Jidoka?

Design equipment to partially automate the production process (partial automation is typically much less expensive than full automation) and to automatically stop when defects are detected.

## How does Jidoka help?

After Jidoka, workers can frequently monitor multiple stations (reducing labor costs) and many quality issues can be detected immediately (improving quality).

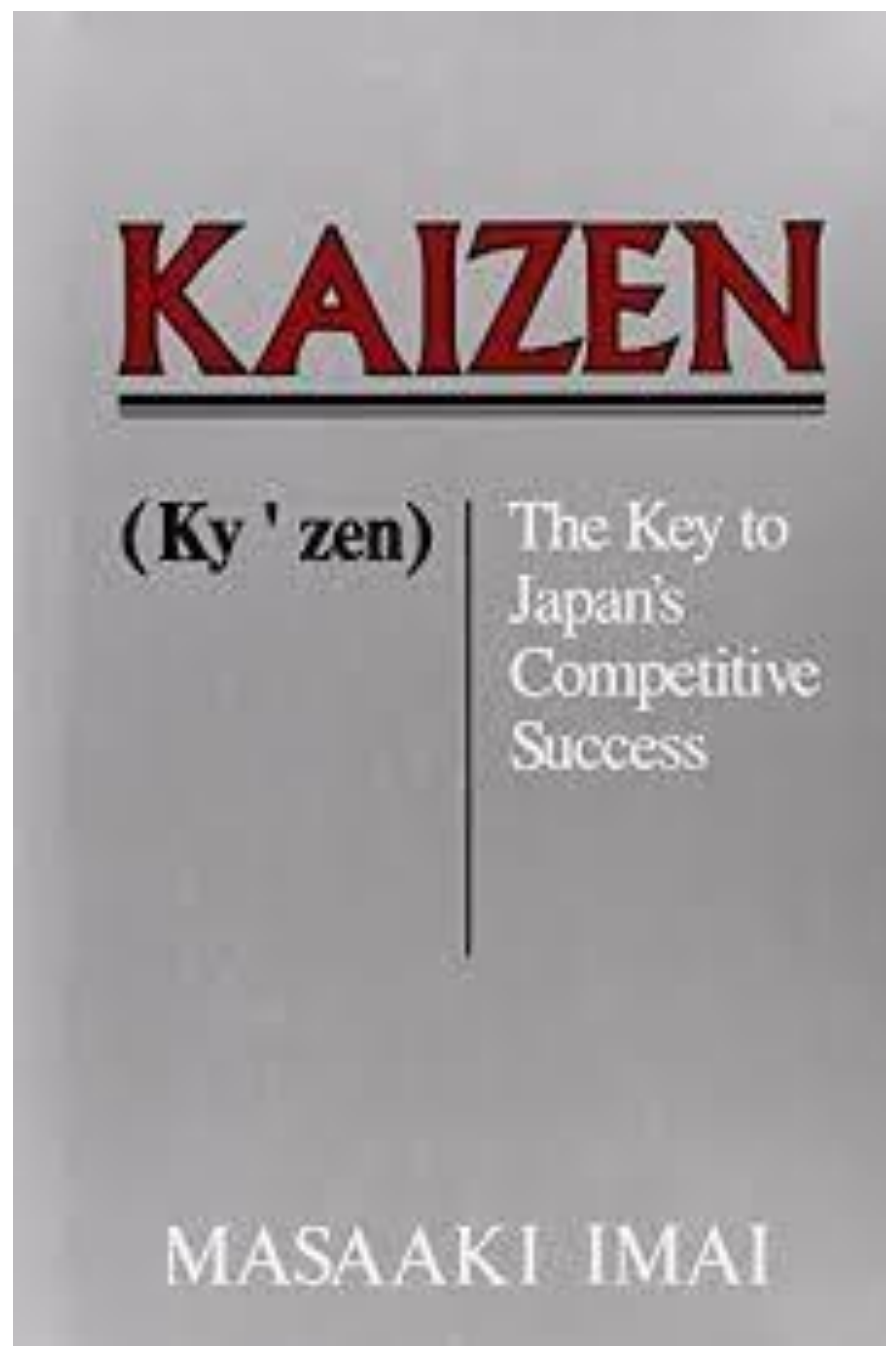


## **What is Just-In-Time?**

Pull parts through production based on customer demand instead of pushing parts through production based on projected demand. Relies on many lean tools, such as Continuous Flow, Heijunka, Kanban, Standardized Work and Takt Time.

## **How does Just-In-Time help?**

Highly effective in reducing inventory levels. Improves cash flow and reduces space requirements.



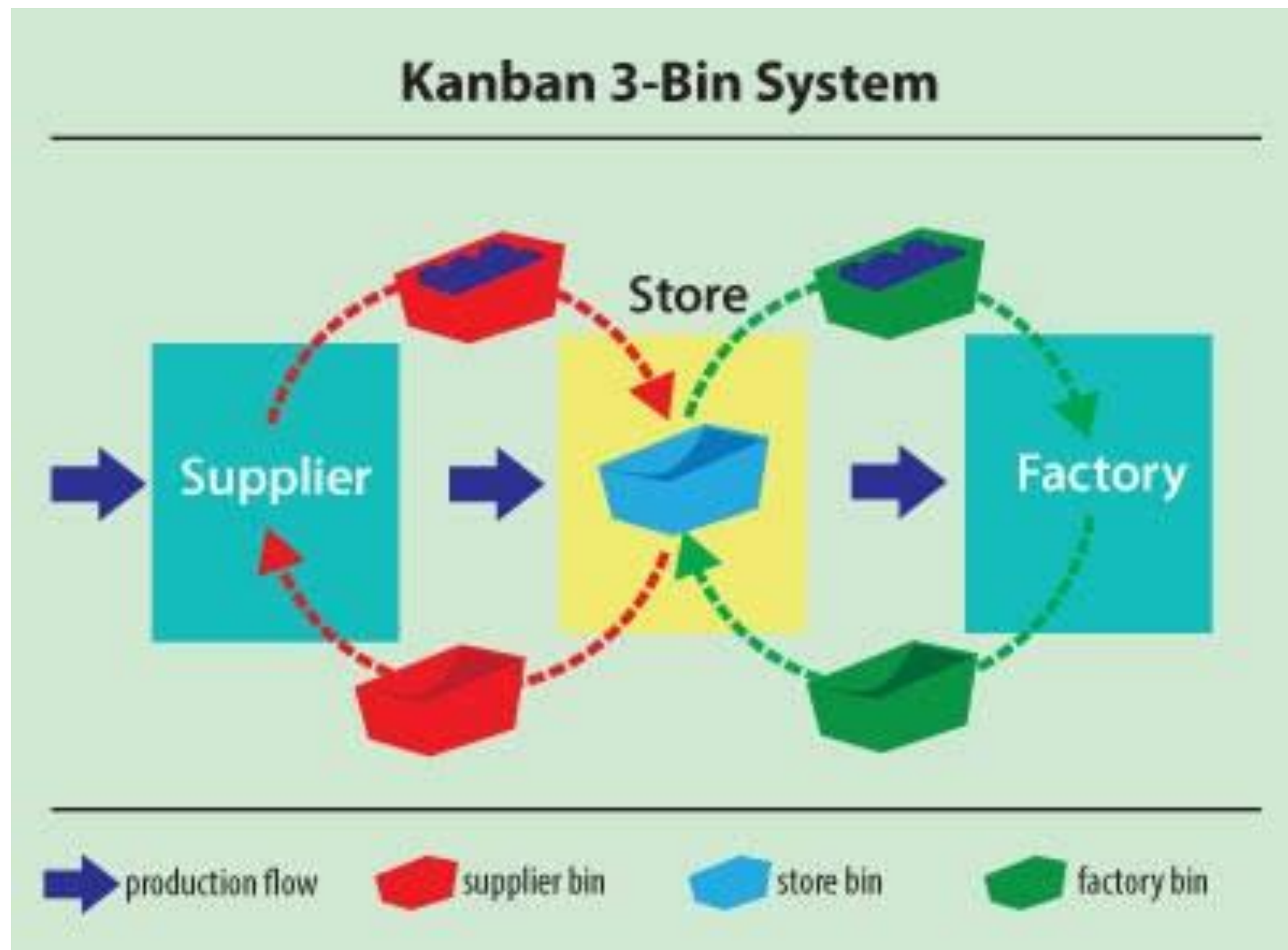
## **What is Kaizen?**

A strategy where employees work together proactively to achieve regular, incremental improvements in any process.

It's applicable in both of personal and professional life.

## **How does Kaizen help?**

Combines the collective talents of a company to create an engine for continually eliminating waste from the process.



## What is Kanban?

A method of regulating the flow of goods both within the factory and with outside suppliers and customers. Based on automatic replenishment through signal cards that indicate when more goods are needed.

### How does Kanban help?

Eliminates waste from inventory and overproduction. Can eliminate the need for physical inventories (instead relying on signal cards to indicate when more goods need to be ordered).



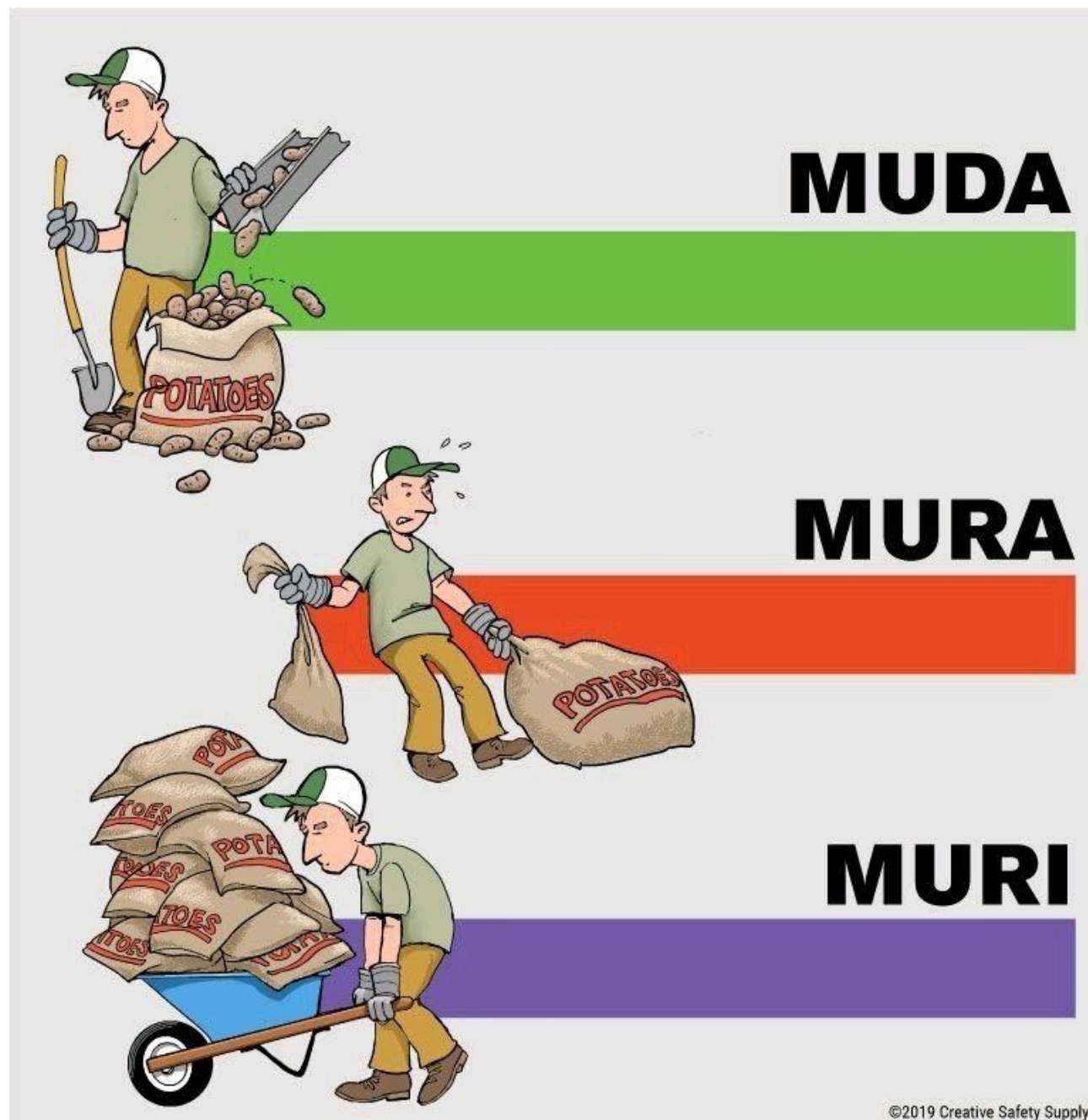
## What are KPIs?

Metrics designed to track and encourage progress towards critical goals of the organization. Strongly promoted KPIs can be extremely powerful drivers of behavior – so it is important to carefully select KPIs that will drive desired behavior.

## How do KPIs help?

The best KPIs:

- Are aligned with top-level strategic goals (thus helping to achieve those goals)
- Are effective at exposing and quantifying waste (OEE is a good example)
- Are readily influenced by plant floor employees (so they can drive results)

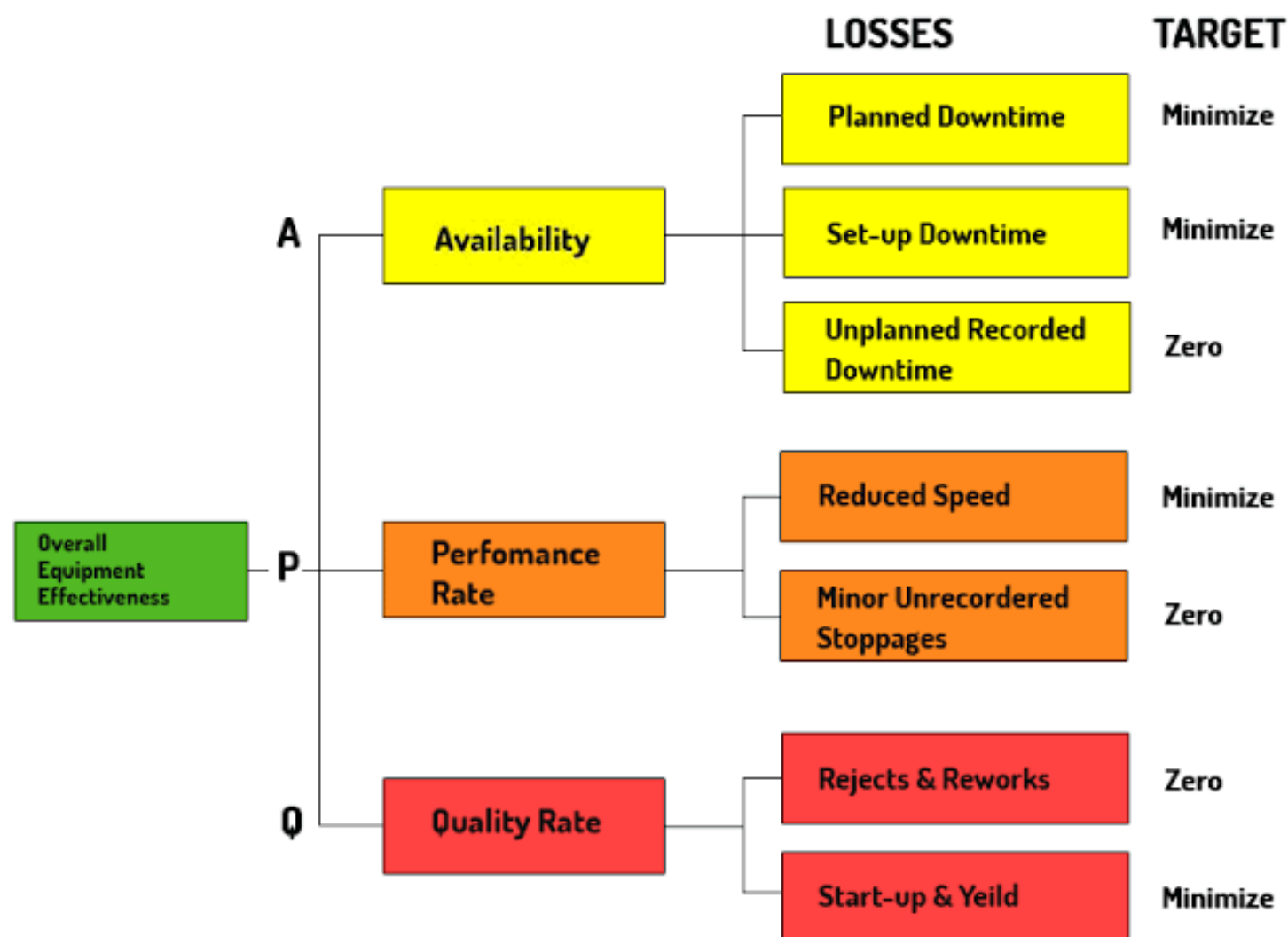


## What is Muda?

Anything in the process that does not add value from the customer's perspective.

### How does Muda help?

It doesn't. Muda means 'waste'. The elimination of muda (waste) is the primary focus of lean management.



## What is Overall Equipment Effectiveness?

Framework for measuring productivity loss for a given process. Three categories of loss are tracked:

- Availability (e.g. down time)
- Performance (e.g. slow cycles)
- Quality (e.g. rejects)

## How does Overall Equipment Effectiveness help?

Provides a benchmark/baseline and a means to track progress in eliminating waste from a process. 100% OEE means perfect production (Producing only good parts, as fast as possible, with no down time).

## Correlation Between The Deming Wheel and The Japanese PDCA Cycle

|                               |                                                                                                                        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>1. Design =&gt; Plan</b>   | Product design corresponds to the planning phase of management.                                                        |
| <b>2. Production =&gt; Do</b> | Production corresponds to doing, making or working on the product that was designed.                                   |
| <b>3. Sales =&gt; Check</b>   | Sales figures confirm whether the customer is satisfied.                                                               |
| <b>4. Research =&gt; Act</b>  | If a complaint is filed, it must be incorporated into the planning phase and action taken in the next round of efforts |

Reference: Foundation and History of the PDCA Cycle By Ronald Moen



Fig- The Deming Wheel (1950)

## What is PDCA?

An iterative methodology for implementing improvements:

- Plan (establish plan and expected results)
- Do (implement plan)
- Check (verify expected results achieved)
- Act (review and assess; do it again)

## How does PDCA help?

Applies a scientific approach to making improvements:

- Plan (develop a hypothesis)
- Do (run experiment)
- Check (evaluate results)
- Act (refine your experiment; try again)

## POKA- YOKE

### Error Proofing

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Poka-Yoke, the Term adopted by Dr. Shigeo Shingo as a part of the Toyota Production System in 1960.

- The initial term was 'baka-yoke', which means 'fool-proofing'.
- A poka-yoke is any mechanism in a process that helps any person to **avoid errors/ mistakes/ defects by preventing, correcting, or drawing attention** to human errors as they occur.

#### COMMON EXAMPLES

- Automated shut-offs on electric coffee pots.
- Spell check in MS Office word processing.



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## What is Poka-Yoke?

Design error detection and prevention into production processes with the goal of achieving zero defects.

### How does Poka-Yoke help?

It is difficult (and expensive) to find all defects through inspection, and correcting defects typically gets significantly more expensive at each stage of production.



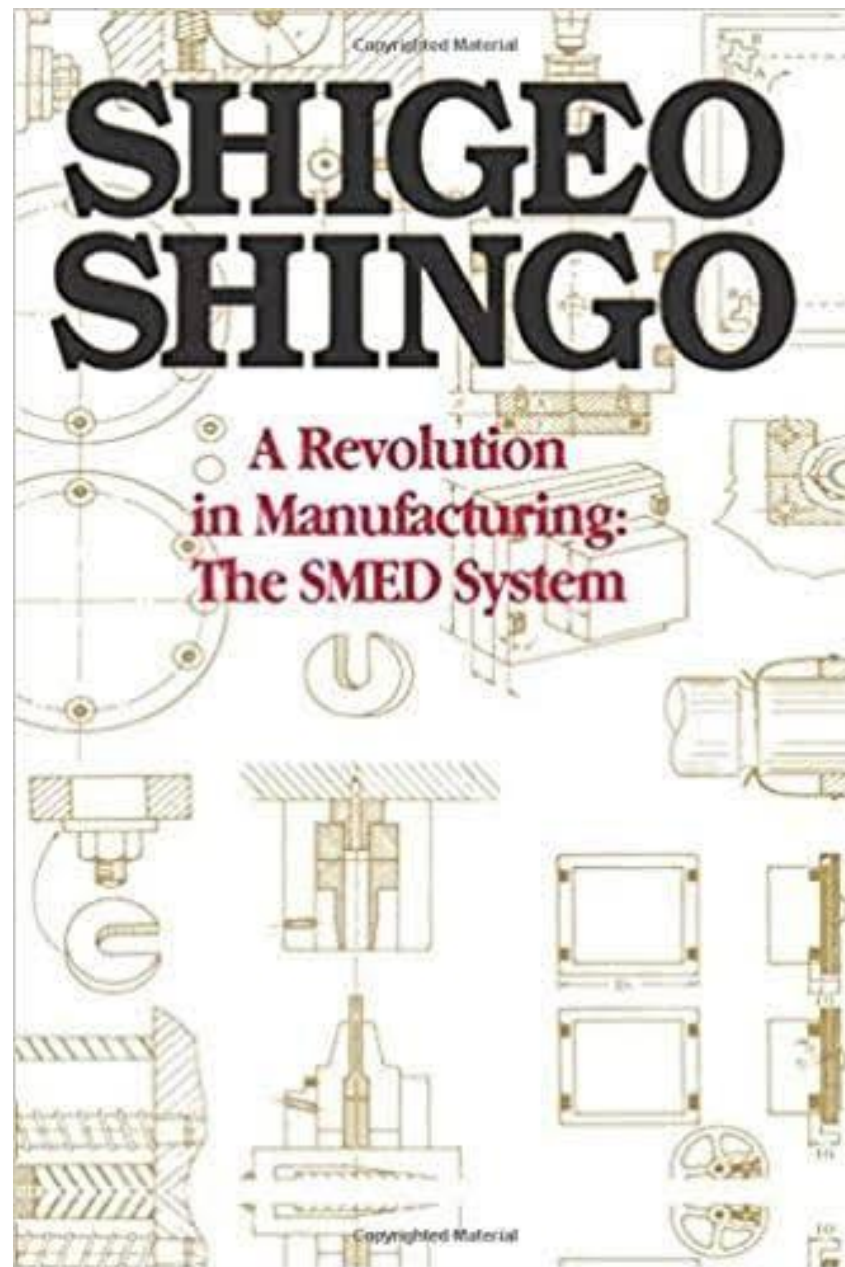
## **What is Root Cause Analysis?**

A problem solving methodology that focuses on resolving the underlying problem instead of applying quick fixes that only treat immediate symptoms of the problem.

A common approach is to ask why five times – each time moving a step closer to discovering the true underlying problem.

## **How does Root Cause Analysis help?**

Helps to ensure that a problem is truly eliminated by applying corrective action to the “root cause” of the problem.



## **What is Single-Minute Exchange of Dies?**

Reduce setup (changeover) time to less than 10 minutes. Techniques include:

- Convert setup steps to be external (performed while the process is running)
- Simplify internal setup (e.g. replace bolts with knobs and levers)
- Eliminate non-essential operations
- Create Standardized Work instructions

## **How does Single-Minute Exchange of Dies help?**

Enables a process in smaller lots, reduces inventory, and improves customer responsiveness.

| Overall Equipment Effectiveness | Recommended Six Big Losses | Traditional Six Big Losses |
|---------------------------------|----------------------------|----------------------------|
| Availability Loss               | Unplanned Stops            | Equipment Failure          |
|                                 | Planned Stops              | Setup and Adjustments      |
| Performance Loss                | Small Stops                | Idling and Minor Stops     |
|                                 | Slow Cycles                | Reduced Speed              |
| Quality Loss                    | Production Rejects         | Process Defects            |
|                                 | Startup Rejects            | Reduced Yield              |
| OEE                             | Fully Productive Time      | Valuable Operating Time    |

## What is Six Big Losses?

Six categories of productivity loss that are almost universally experienced in a process:

- Breakdowns
- Setup/Adjustments
- Small Stops
- Reduced Speed
- Startup Rejects
- Production Rejects

## How does Six Big Losses help?

Provides a framework for attacking the most common causes of waste in the process.



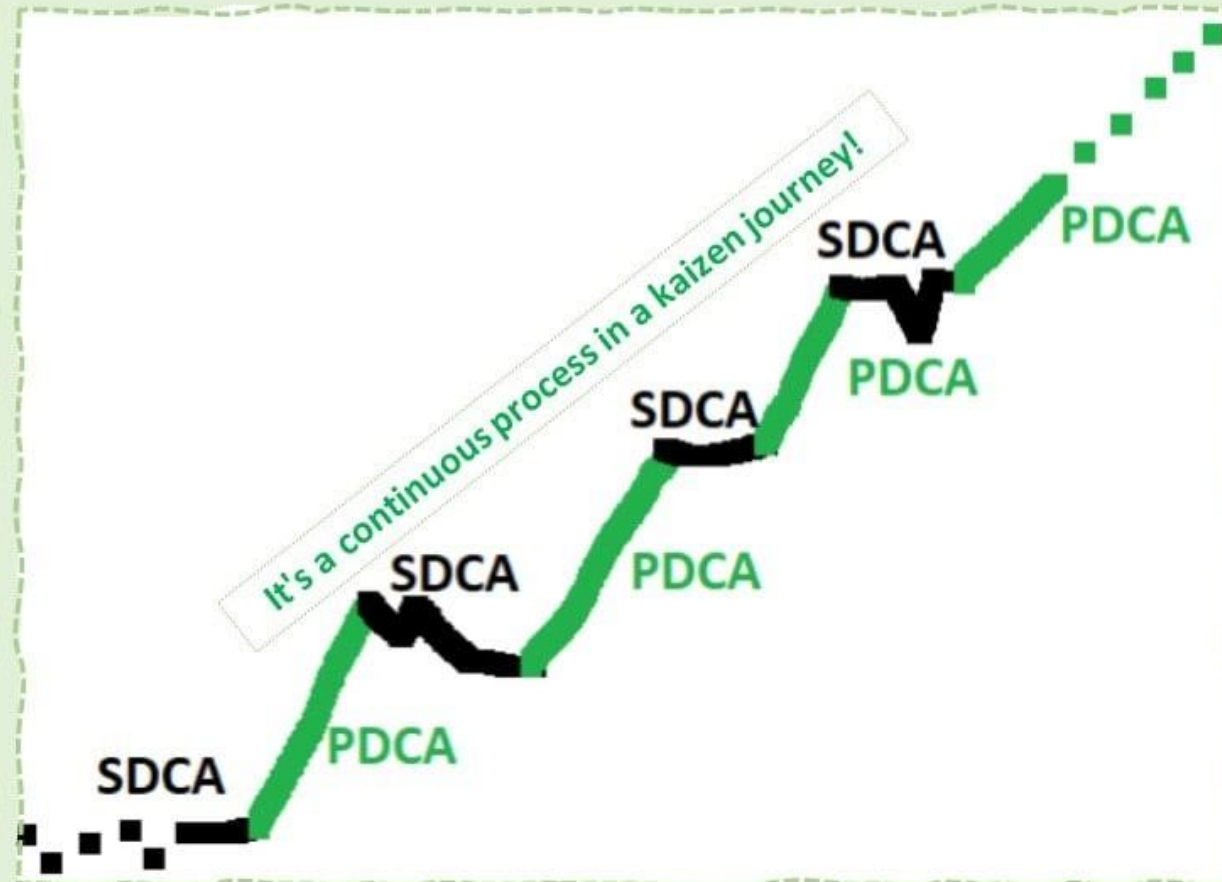
## What are SMART Goals?

Goals that are: Specific, Measurable, Attainable, Relevant, and Time-Specific.

## How do SMART Goals help?

Helps to ensure that goals are effective.

*Strengthen  
your standing  
position first  
through  
SDCA,  
Then jump for  
next  
destination  
through PDCA*



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## What is Standardized Work?

Documented procedures for a process that capture best practices (including the time to complete each task).  
Must be “living” documentation that is easy to change.

## How does Standardized Work help?

Eliminates waste by consistently applying best practices. Forms a baseline for future improvement activities.

## Takt Time

Takt Time =

Working time available

Customer demand

Full shift,  
minus breaks,  
meetings, etc.

450 minutes

50 units

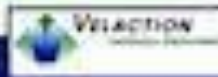
= 9 minutes

Demand for  
that production  
period

Takt time is the required pace of  
production to meet demand.

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### What is Takt Time?

The pace of production (e.g. producing one piece every 34 seconds) that aligns production with customer demand.

Calculated as Planned Production Time / Customer Demand.

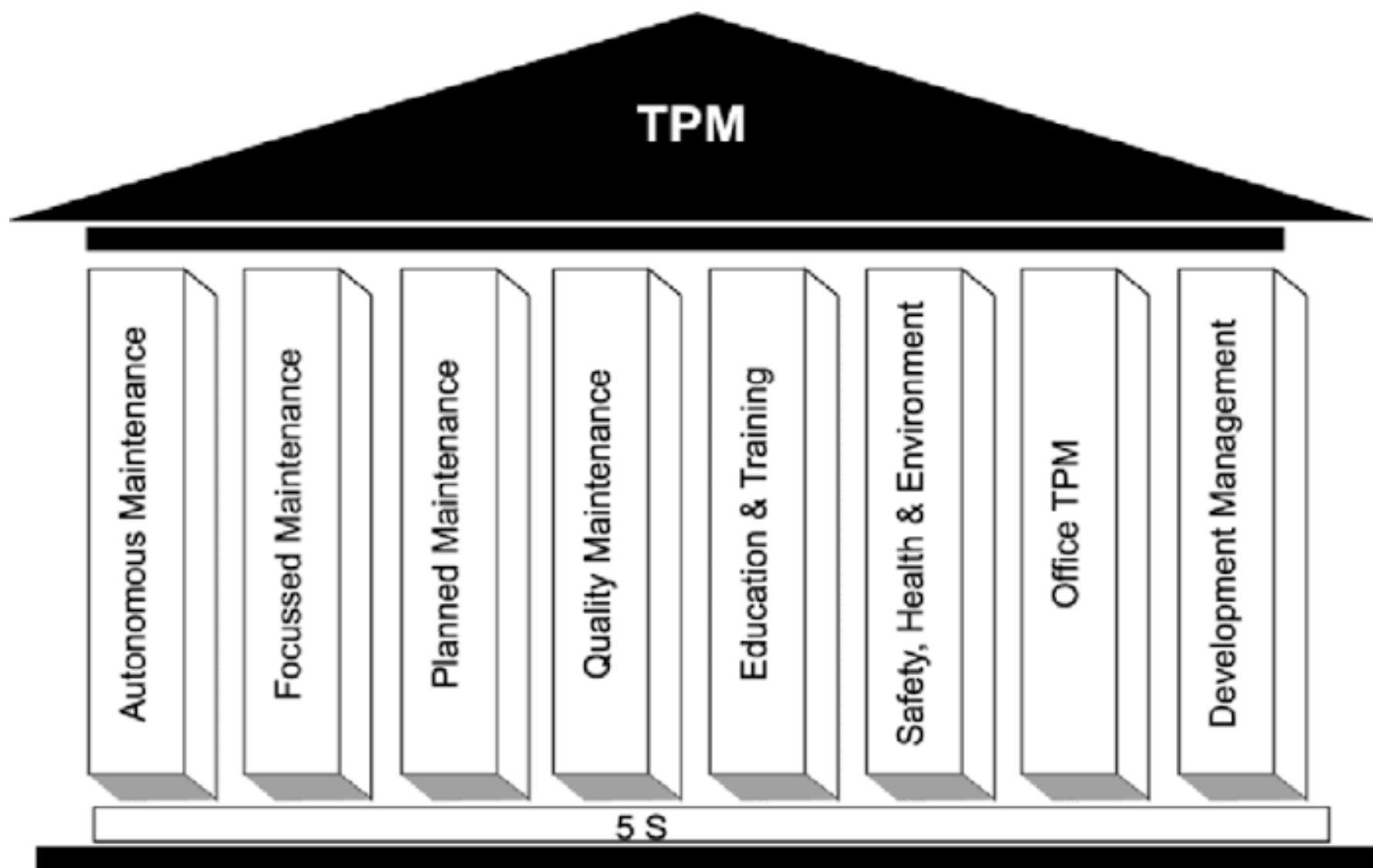
### How does Takt Time help?

Provides a simple, consistent and intuitive method of pacing production.

Is easily extended to provide an efficiency goal for the plant floor (Actual Pieces / Target Pieces).

## 22. Takt Time

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## What is Total Productive Maintenance?

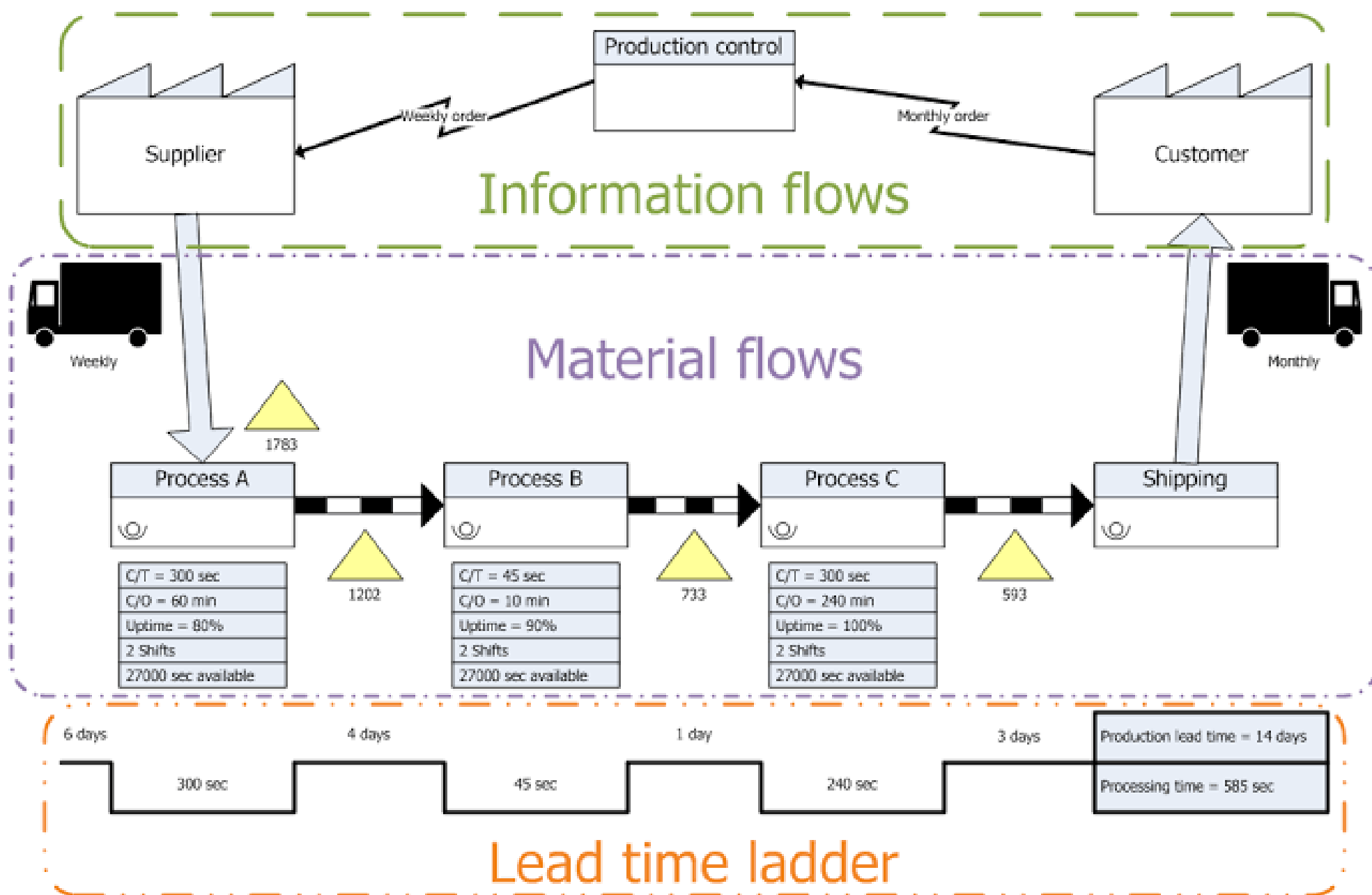
A holistic approach to maintenance that focuses on proactive and preventative maintenance to maximize the operational time of equipment.

TPM blurs the distinction between maintenance and production by placing a strong emphasis on empowering operators to help maintain their equipment.

## How does Total Productive Maintenance help?

Creates a shared responsibility for equipment that encourages greater involvement by plant floor workers.

In the right environment this can be very effective in improving productivity (increasing up time, reducing cycle times, and eliminating defects).

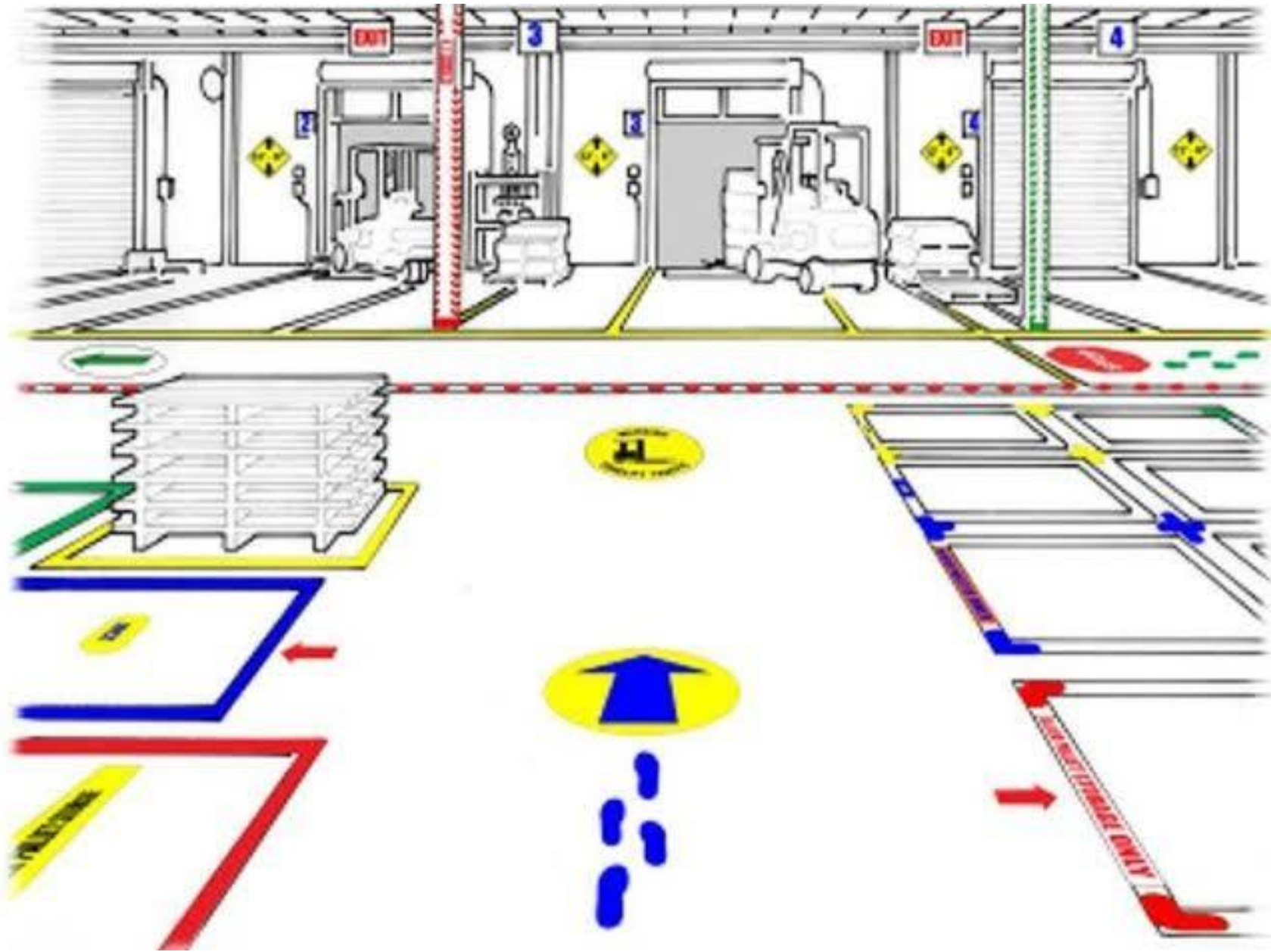


## What is Value Stream Mapping?

A tool used to visually map the flow of production. Shows the current and future state of processes in a way that highlights opportunities for improvement.

## How does Value Stream Mapping help?

Exposes waste in the current processes and provides a roadmap for improvement through the future state.



## What is Visual Factory?

Visual indicators, displays and controls used throughout a plants to improve communication of information.

### How does Visual Factory help?

Makes the state and condition of processes easily accessible.

These terms recommended, endorsed or referred by **Toyota** as their own?

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### The Term "Lean"

born in 1988 through MIT's SLOAN but arguably it's said that the term "Lean" born in 1990 through the book "THE MACHINE THAT CHANGED THE WORLD".

### "14 Management Principles"

described in "The Toyota Way" written by Dr. Jeffrey Liker published in 2003

1988

1997

2003

### "The 5 Lean Principles"

first described in 1997 by James P. Womack and Daniel T. Jones

**The term "Lean" had not been originated from Toyota/ Japan/ Japanese Organization or Author !**

# The Term “Lean” originated from America not Japan!



The Term “**Lean**” coined by an American John Krafcik in his 1988 article, it’s not a Japanese/ Toyota’s term.



The famous book “**The Toyota Way**, Second Edition: 14 Management Principles from the World's Greatest Manufacturer” authored by Jeffrey Liker.

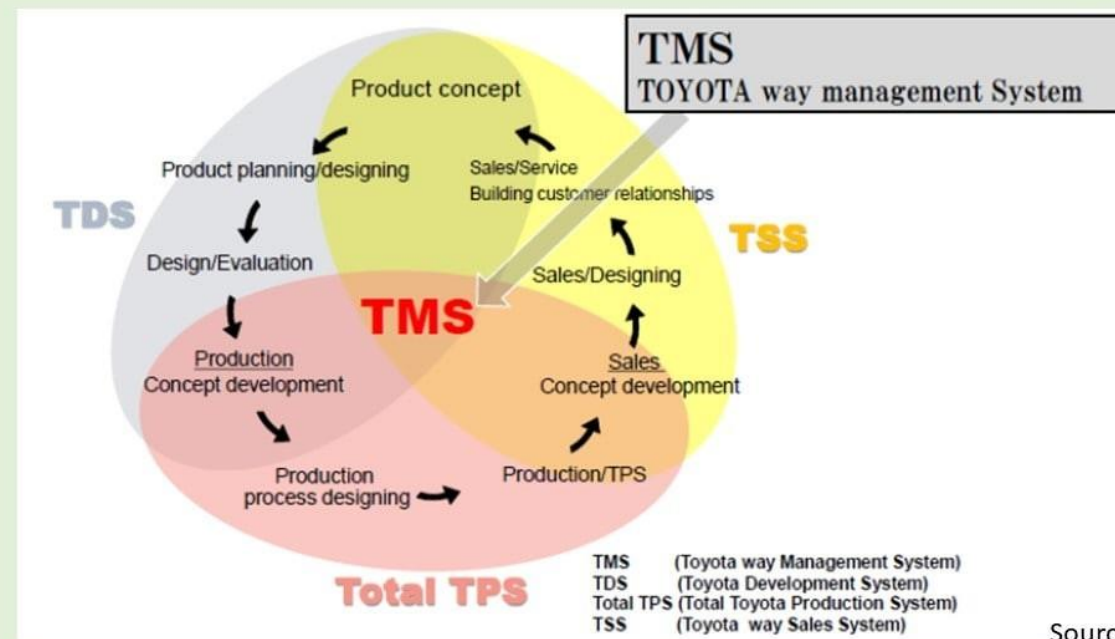


“**5 Principles of Lean**” described/ proposed by James Womack & Daniel Jones in their book “Lean Thinking”

## Toyota way Management System (TMS)

TDS, Total TPS, TSS

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Source: AOTS Japan

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## TOYOTA's TQM Structure

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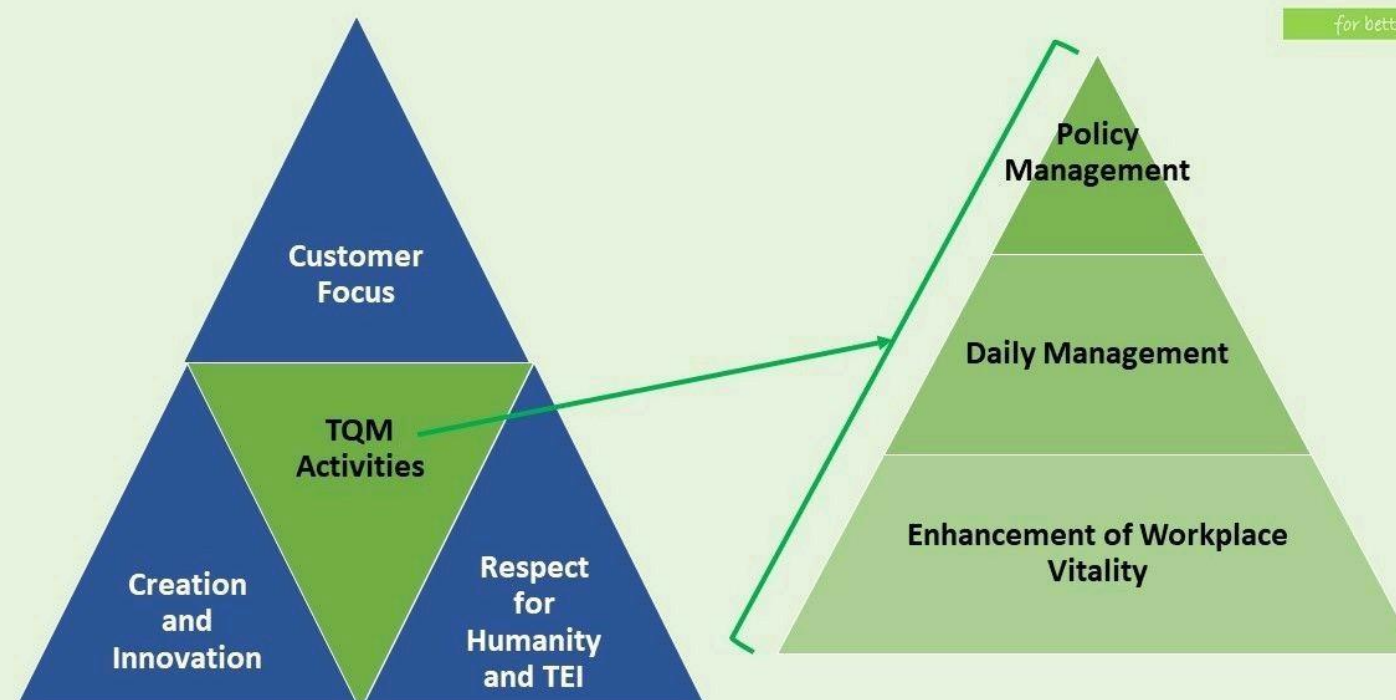


Fig-A: Toyota's TQM Concept

Fig-B: Toyota's TQM Activities

# Toyota's TQM History and Structure

## TOYOTA's TQM Structure

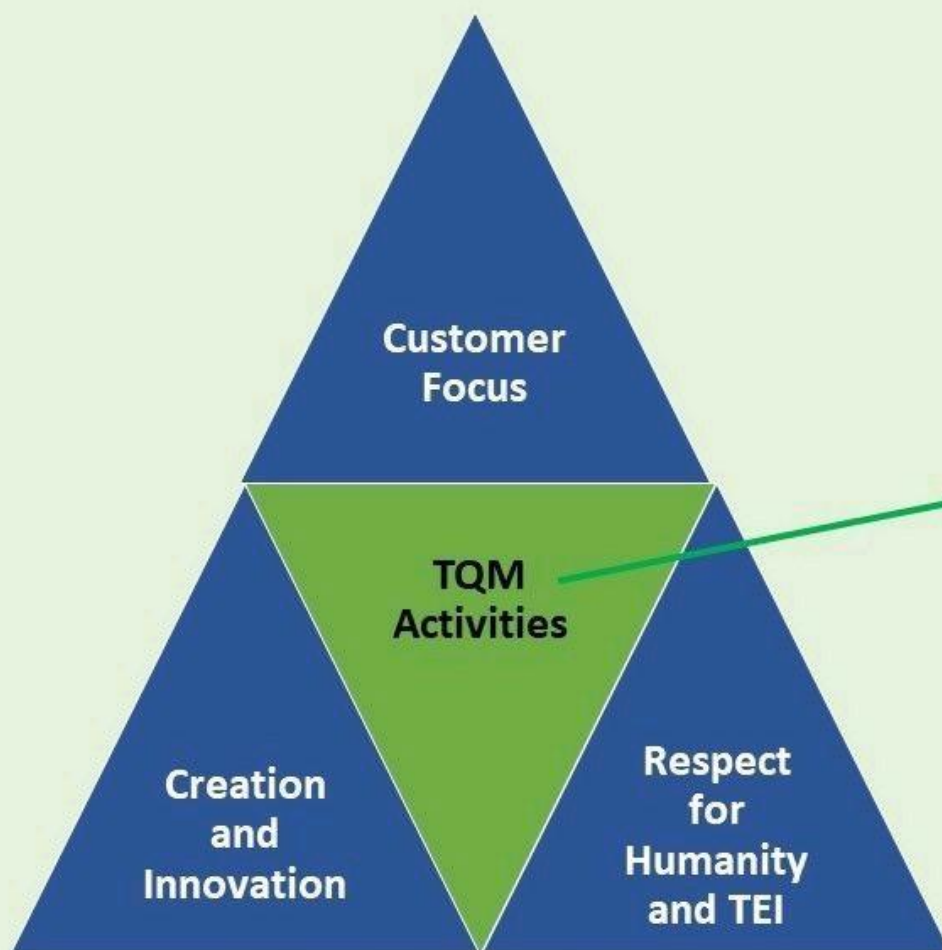


Fig-A: Toyota's TQM Concept

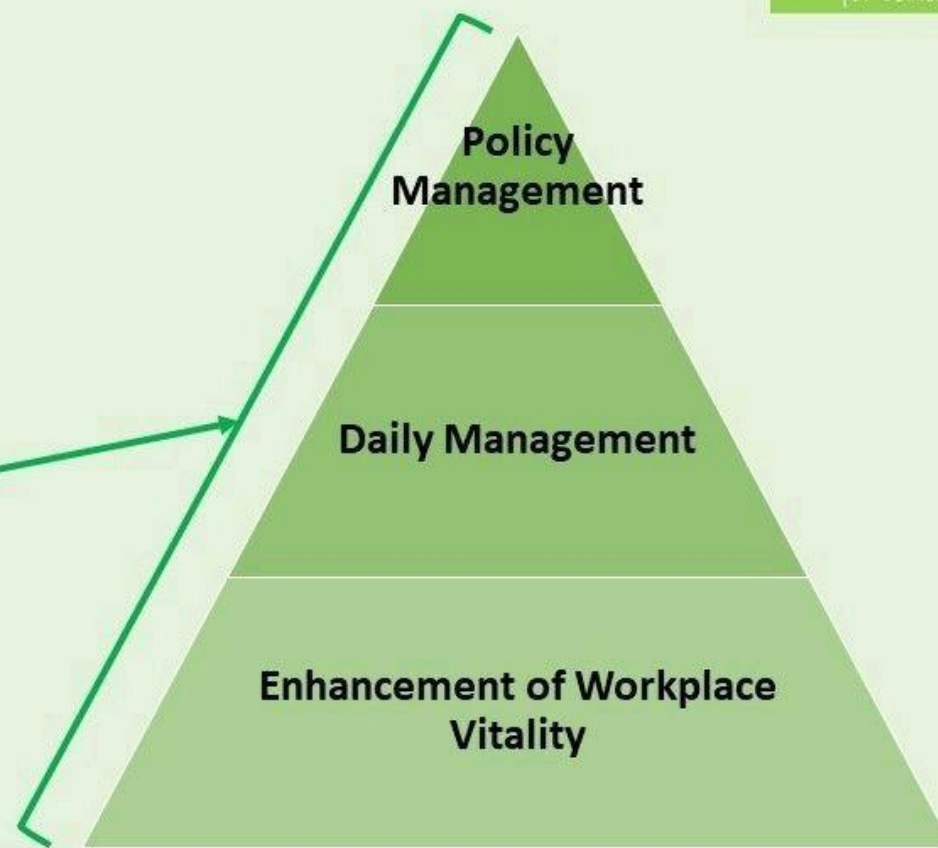


Fig-B: Toyota's TQM Activities

Based on the corporate philosophy of 'customer first' and 'quality first' since its founding, **Toyota Motor Co., Ltd. won the Deming Application Prize in 1965** and the Japan Quality Control Award in 1970, following the introduction of **statistical quality control (SQC)** in 1949, and has conducted **Total Quality Management (TQM)** based on the unchanging principles of 'customer first', kaizen (continuous improvement), and 'total participation'.

[https://www.toyota-global.com/company/history\\_of\\_toyota/75years/data/company\\_information/management\\_and\\_finances/management/tqm/change.html](https://www.toyota-global.com/company/history_of_toyota/75years/data/company_information/management_and_finances/management/tqm/change.html)

# Few Popular Terms of Lean and Their Origin.

## The Term “Lean”

=> The term coined by John Krafcik through his paper Triumph of the Lean Production System, published by MIT Sloan Management Review in 1988.

Reference:

<https://lnkd.in/g8ry8pGi>

## #5S

⇒ Toyota recommend 4S instead of 5S

The term 5S popularized by Hirano and Osada by their separate two books.

Reference:

<https://lnkd.in/gQPkRsFH>,  
<https://lnkd.in/dRRiM2Nq>;  
[https://lnkd.in/g\\_kmG9JY](https://lnkd.in/g_kmG9JY)

## #A3

=> Toyota practices QC Circle (Toyota's website: <https://lnkd.in/gDkDFbt>), but Mr. John Shock coined/popularized that concept through a new term "A3" !

Reference:

[https://lnkd.in/gNk\\_gFK6](https://lnkd.in/gNk_gFK6);  
<https://lnkd.in/eTqbC92>

## #VSM:

Toyota Japan doesn't use the term Value Stream Mapping!

Mr. Jim and Dan coined the term "value stream" and "value-stream mapping".

Reference:

<https://lnkd.in/gmnG-AVD>

# 3Mu and Muda!



7 wastes are not limited to the number “7”.

Taiichi Ohno Sensei said, “I Never Said There Were 7 Types of Waste”

<https://lnkd.in/gvMazvM>



TPS doesn't refer only to wastes reduction!

TPS refers "3M Reduction"

(Muda: Waste, Mura: Variation, Muri: Overburden)!

# Toyota Business Practices (TBP)

Vs

## A3 Problem Solving

**A3 Problem Solving Can be referred as copied version of Japanese QC Circle or Toyota's 8 Steps TBP.**

### 8 Steps TBP

Due to globalization of Toyota's operations, they had introduced 8 Steps TBP (English Version) as below-

1. Clarify the problem.
2. Break down the problem.
3. Set a target to be achieved.
4. Analyze the root cause.
5. Develop countermeasures.
6. See countermeasures through.
7. Evaluate both results and process.
8. Standardize successful processes.

Reference: Gemba Kaizen by Masaaki Imai (Page-59)

### A3 Problem Solving

Mr. John Shock recommended following steps for A3 (Problem Solving) Report through MIT Sloan Magazine (2009)-

1. Establish the business context and importance
2. Describe the current conditions of the problem;
3. Identify the desired outcome;
4. Analyze the situation to establish causality;
5. Propose countermeasures;
6. Prescribe an action plan for getting it done; and
7. Map out the follow-up process.

Reference:  
<https://sloanreview.mit.edu/article/toyotas-secret-the-a3-report/>

# What is QC Circle?

Project Based Kaizen and Breakthrough initiatives

## Quality Control Circle

Quality Control Circle (QCC) is a concept of employee engagement and empowerment by which a small group of employees solve their work-related vital problems by themselves through a systematic and scientific approach.

The group of people from the same area, coming together voluntarily to identify, analyze the work area problems, and find effective solutions.

The QC Circle (QCC) members present the solutions to management and implement them after approval. Review and follow-up of implementation are also the responsibility of the QCC members.

Dr. Kaoru Ishikawa known as “Father of QC Circle” for his role in starting QC Circles in Japan in the 1960s to improve Quality, Productivity, and the work environment.

# Quality Control Circle

#ProblemSolving #Kaizen #TPS #TQM

## Why QCC?

1. Workforce knows best about the work area
2. With proper support, most of their problems will be solved by themselves
3. QCC raises morale and team spirit
4. Work becomes safer and easier
5. Improve quality and efficiency of work

## Structure of QCC:

1. Steering committee
2. Facilitator
3. Leader
4. Members

## Problem Solving Steps, QCC Story-PDCA

### Plan Phase (P):

1. Identifying a list of problems
2. Selecting a single problem to be solved
3. Defining and analyzing the problem
4. Developing solution

### Do Phase (D):

5. Present to management the full proposal
6. Implementing action plans on trial basis

### Check Phase (C):

7. Checking the results

### Act Phase (A):

8. Regular implementation and proper standardization

# Quality Control Circle

#ProblemSolving #Kaizen #TPS #TQM

## Commonly used Tools and Techniques

1. 7 QC Tools:
  - Check Sheet
  - Stratification
  - Histogram
  - Cause and Effect Diagram
  - Pareto Chart
  - Scatter Diagram
  - Control Chart
2. Brainstorming Techniques
3. 7 Management and Planning Tools (7 QC Tools)
4. Project Charter
5. Process Mapping Tools
6. Why-Why Analysis
7. 5W1H Analysis
8. Gantt Chart
9. Run Chart/ Graphs

## Guidelines for QCC Success:

1. Once the Quality Circles are initiated in any organization, it is the responsibility of the top management to nurture them and pay attention to all relevant aspects related to QC project.
2. The QC member should attend the meeting regularly, punctually
3. Circle members should participate actively
4. Training on 7 QC tools and kaizen must be given to all circle members
5. The circle must select the leader from within its own members
6. A circle must have one facilitator and QC administrator who guide and support QC projects
7. QC Circle team must maintain record book for their meetings and progressing of their works

*Thank  
you!*

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