LEAN SOLUTIONS ACADEMY



Lean & Six Sigma Training

# Lean Yellow Belt Certification

*brought to you by:*

PATRICK ADAMS CONSULTING

# Meet Your Instructor

- Background
- Lean Solutions "Train-The-Trainer" Course
- Internationally Certified Trainer




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# CLASS SCHEDULE

## Day 1

- Roles and Responsibilities of Belts
- What is Lean & Six Sigma?
- Lean Principles
- Standard Work
- 8 Wastes
- 5S
- Voice of the Customer (VOC) and CTQs Process
- Jidoka
- Poke Yoke

## Day 2

- Day 1 Review
- PDCA
- Kaizen
- Pull
- Kanban
- Flow
- Visual Management
- SMED
- Total Productive Maintenance
- **YELLOW BELT EXAM**

  **(as Homework )**

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# BODY OF KNOWLEDGE

## Yellow Belt

- The Fundamentals of Lean Six Sigma
- History / Process / Cause & Effect
- Principles of Lean / Six Sigma
- Process Mapping / DMAIC
- PDCA / Kaizen & Kaizen Events
- Kano Analysis
- Voice of Customer, & Business
- Defining a Process / CTQ
- The 8 Elements of Waste / Belt Roles
- 5S / Lean Tools / Visual Management / SMED
- Kanban / Poka-Yoke / Standardized Work
- Lean & Six Sigma Belt Roles
- Total Productive Maintenance
- Value Add & Non Value Add Work

## Lean Green Belt

- Project Management
- Project Charter
- SIPOC
- 7-Quality Tools / Pareto Analysis
- Control Charts
- Control Plans
- Gantt Chart
- Structured Problem Solving
- Fishbone Diagrams / Graphical Analysis
- Lean Metrics & Projects
- FMEA
- Facilitating a Kaizen Event
- Strategy Execution
- Hoshin Kanri
- Change Management

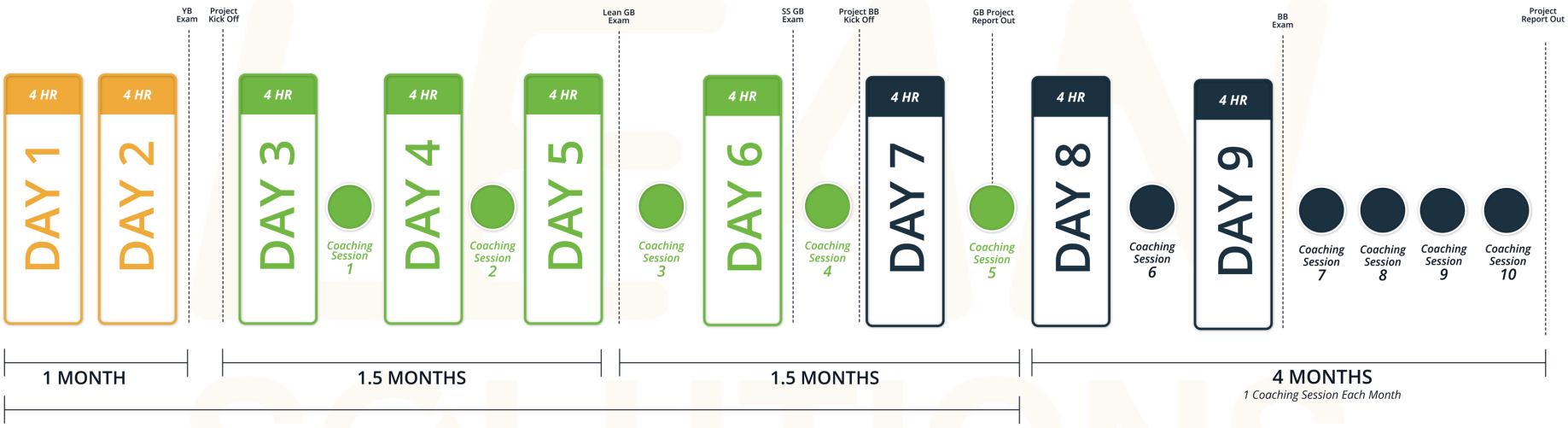
## Six Sigma Geen Belt

- Six Sigma Statistics
- Measurement Systems Analysis
- Process Capability
- Correlation and Regression
- Introduction to DOE
- Hypothesis Testing

## Black Belt

- Mann-Whitney / Kruskal-Wallis
- Friedman Mood's Median / Simple Linear Regression
- 1 Sample Sign / 1 Sample Wilcoxon
- One and Two Sample Proportion
- Chi-Squared (Contingency Tables)
- Correlation / Regression Equations
- Regression Equations / Residuals Analysis
- Non- Linear Regression
- Multiple Linear Regression
- Confidence & Prediction Intervals
- Designed Experiments / OFAT
- Experiment Objectives
- Experimental Methods
- Experiment Design Considerations
- Linear & Quadratic Mathematical Models
- Orthogonal Designs
- Full Factorial Experiments & Designs
- Fit, Diagnose Model and Center Points
- Taguchi Designs Control Phase
- Statistical Process Control (SPC)
- Data Collection for SPC / I-MR Chart
- Xbar-R Chart / U Chart / P Chart
- NP Chart / X-S chart
- CumSum Chart / EWMA Chart
- Binomial Distribution and Calculations
- Poisson Distribution and Calculations
- Design for Six Sigma ( DFSS ) / Hoshin Kanri
- Cost Benefit Analysis / ROI, Payback Period

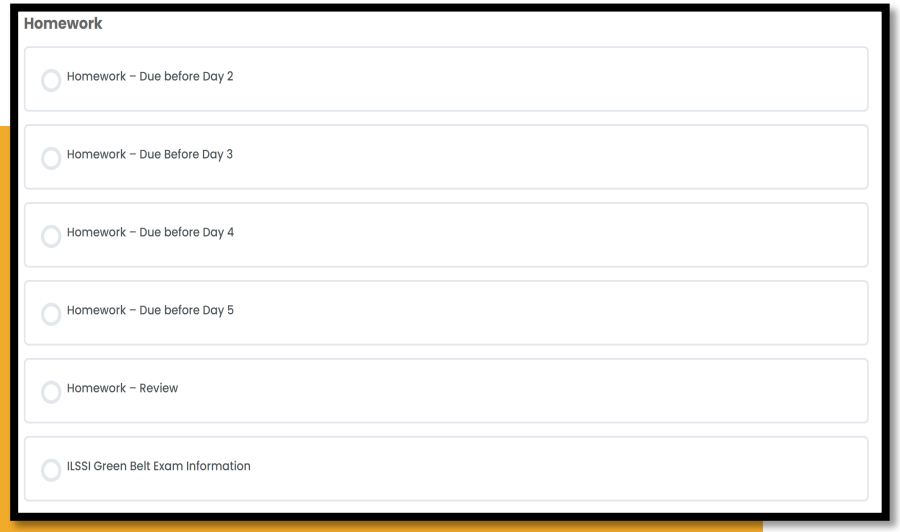
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# 4 MONTHS

*Classes Every Other Week*

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# HOMEWORK

As a Yellow Belt student, you are expected to review and complete the homework for each lesson.

The assignments can be accessed on the student dashboard inside your course.

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# YELLOW BELT
## CERTIFICATION EXAM

- Lifetime certification
- Done online on your student dashboard after training is finished
- Open Book
- 50 Multiple Choice Questions
- Pass mark is 70%
- Result issued immediately
- Retake is available

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# YELLOW BELT
## CERTIFICATION EXAM

Find information on how to access the exam on the student dashboard

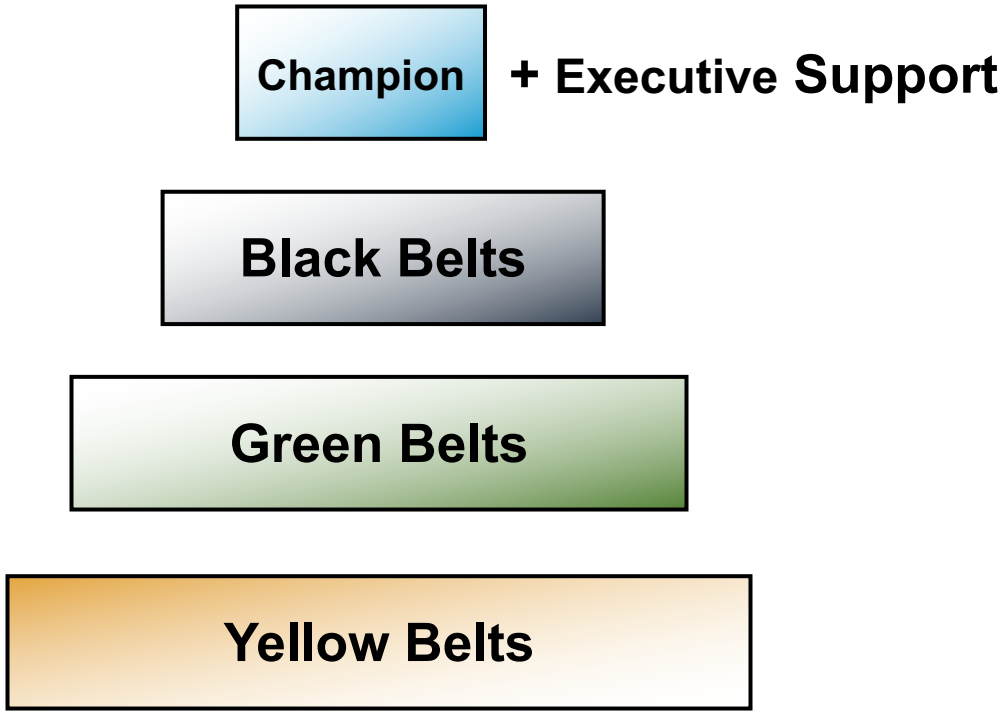



Download the class PowerPoint slides (as a searchable pdf) to help while studying for and taking the exam




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# LEAN SIX SIGMA ROLES & RESPONSIBILITIES



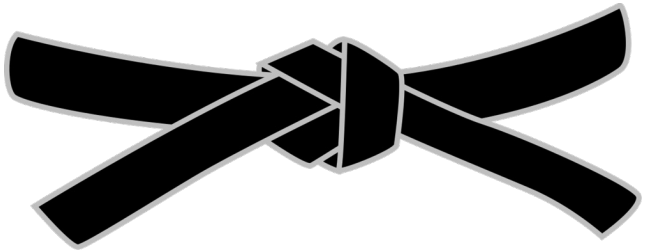

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# CHAMPION/ PROCESS OWNER

***Champions help to identify and select the most important projects to work and break down political barriers / roadblocks for Lean Six Sigma to succeed***

- Assist with Project selection and initiation
- Obtain needed project resources and eliminate roadblocks
- Participate in project review meetings
- Provide Governance /  Ask the right questions
- Set up a training programs

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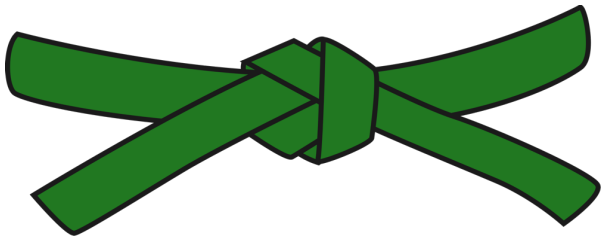


# BLACK BELT

***Black Belts are  Lean Six Sigma process experts, think strategically and lead larger projects within the business.***

- Approx 1 Black Belt every 50 - 100 employees (1%)
- Dedicated to process improvement 100% of time
- Project team leader for larger /  high profile  projects
- Facilitates project teams and helps Green belts
- Thinks strategically and towards Enterprise level goals
- Works cross-functionally

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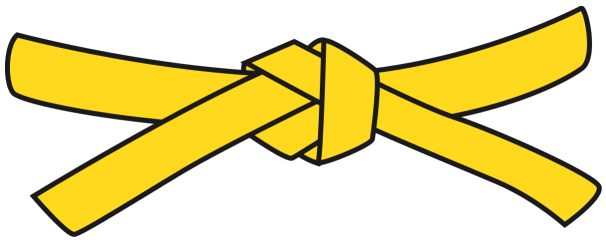


# GREEN BELT

***Green Belts are practitioners of Lean Six Sigma improvement and lead small/medium projects or support larger Black Belt Projects.***

- Approx 1 Green Belt for every 10-30 employees (5%)
- Involved approx 50% time on projects
- Typically works projects within their functional area
- Team members for larger projects
- Team leaders for small / medium projects

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# YELLOW BELT

***Yellow Belts are Workers and Functional Specialists and apply the Lean Six Sigma Methodology to their own work and serve on project teams on a part-time basis.***

- As many as possible (target is 100% of workers)
- Functional workers, Subject Matter Specialists. Team members
- Provide support to Black Belts and Green Belts as needed
- Team members on project teams
    - Supporting projects with process knowledge and data collection

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What is

# Lean & Six Sigma?

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# LEAN & SIX SIGMA TIMELINE




Guinness Brewery



Walter Shewhart Introduces SPC Statistical Process Control



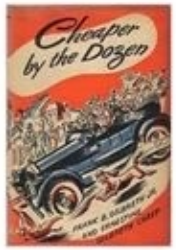
W. Edwards Deming

Joseph Juran

1900 1930 1950




Ford Assembly Line




Gilbreth,
•Management Theory
•Industrial Engineering



Toyota Production System
Taiichi Ohno
Shigeo Shingo
Kaoru Ishikawa

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# LEAN & SIX SIGMA TIMELINE



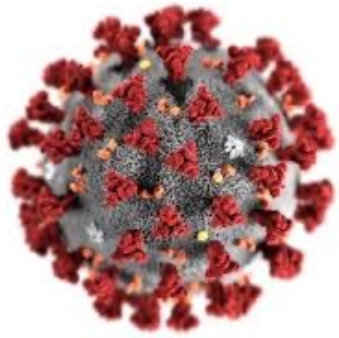

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# LEAN & SIX SIGMA TIMELINE

## Shift in Focus

**2008 Financial Crisis**

**Covid-19**






Cost Cutting
Automation
Down-sizing
'*Do More with Less*'

Survival
Innovation
Adapting
Re-structuring
Re-designing

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# INFLUENTIAL LEADERS

## IN LEAN & SIX SIGMA PRINCIPLES

The evolution of Lean & Six Sigma was heavily influenced by American and Japanese engineers, statisticians and quality control experts 1950-1980.



**Walter Shewhart**
(SPC and Control Charts)



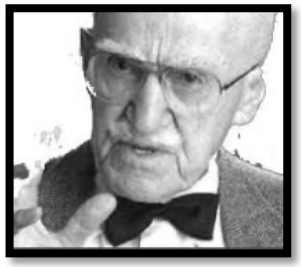
**W. Edwards Deming**
(Quality Management
PDCA Plan, Do, Check, Act )



**Shigeo Shingo**
SMED, Poka Yoke



**Lillian Gilbreth**
Process Flow
Ergonomics



**Joseph Juran**
(Quality Planning, Quality Improvement
Quality Control)



**Taiichi Ohno**
7-Wastes, Gemba-Walk

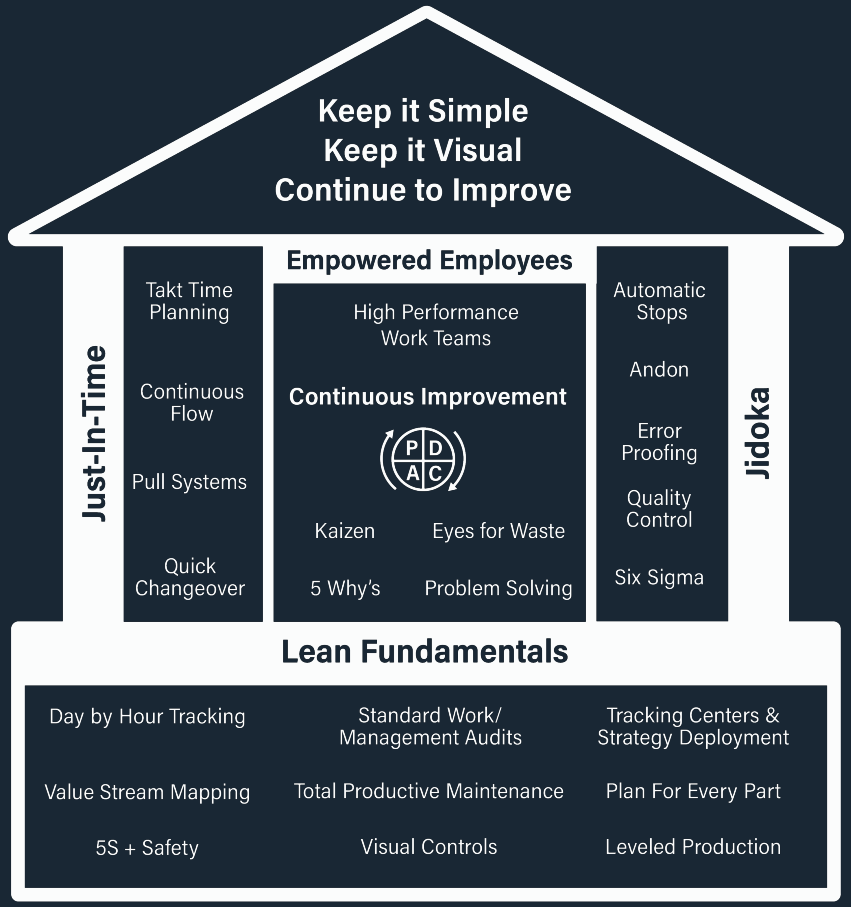


**Kaoru Ishikawa**
7-Quality Tools

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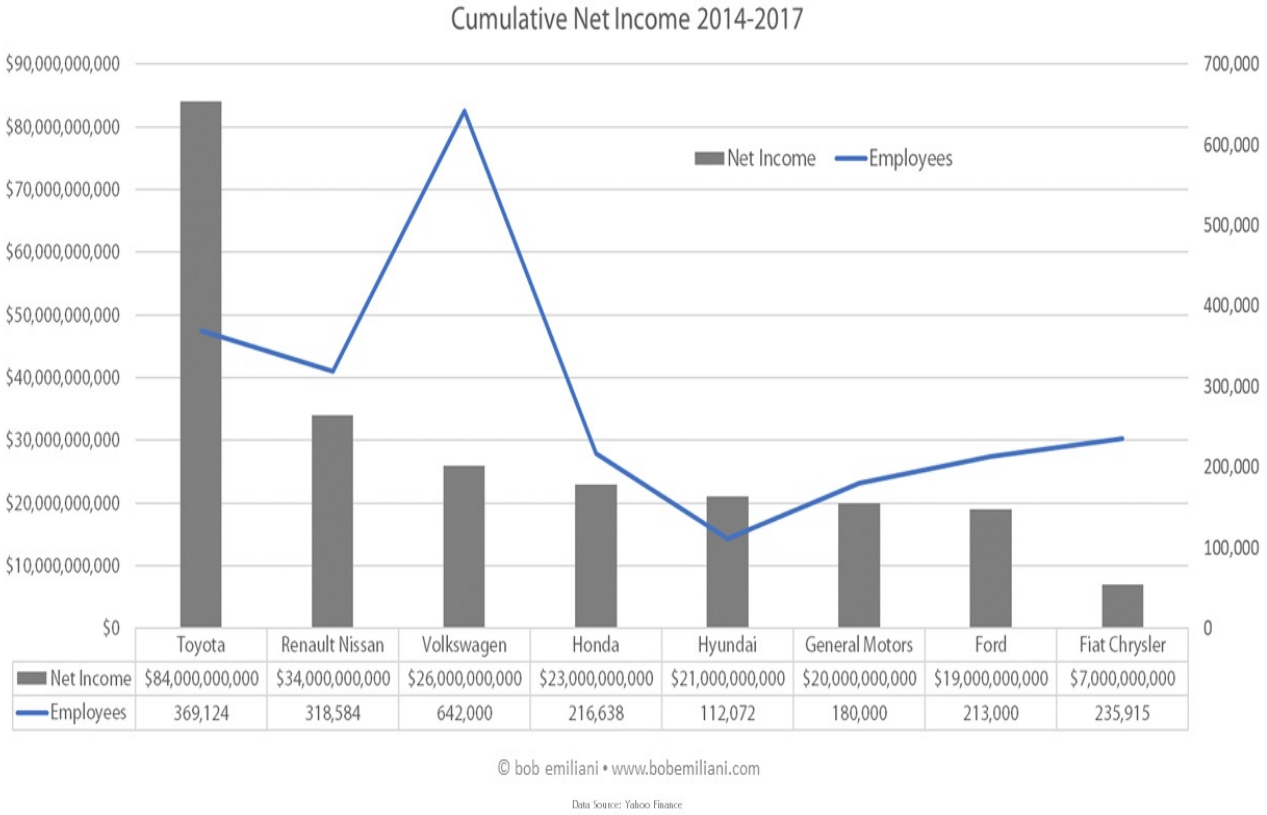
# Toyota Production System (TPS)

## HOUSE OF LEAN




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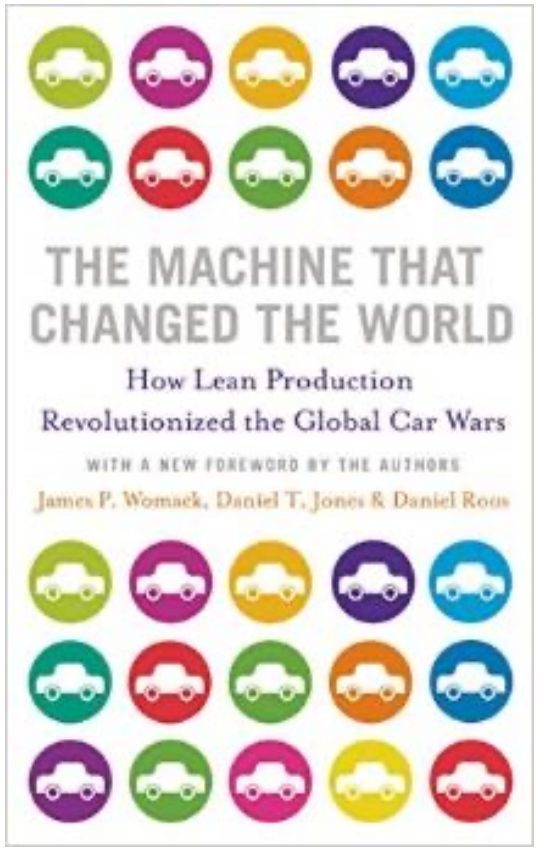
# Superiority of the Toyota Production System

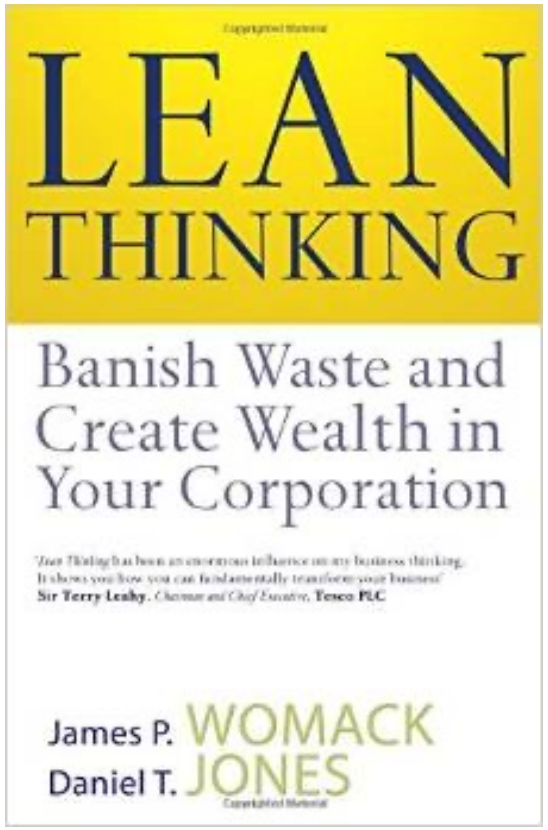



| | Toyota | Renault Nissan | Volkswagen | Honda | Hyundai | General Motors | Ford | Fiat Chrysler |
|---|---|---|---|---|---|---|---|---|
| Net Income | $84,000,000,000 | $34,000,000,000 | $26,000,000,000 | $23,000,000,000 | $21,000,000,000 | $20,000,000,000 | $19,000,000,000 | $7,000,000,000 |
| Employees | 369,124 | 318,584 | 642,000 | 216,638 | 112,072 | 180,000 | 213,000 | 235,915 |

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# “The Machine that Changed the World” 1990




“Lean Thinking” (1993 )

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# Historical Phases in Manufacturing & "Lean Principles" Applied Outside of Toyota

| | When | What | Examples |
|---|---|---|---|
| **Craft** Production | Before 1900s | Individual pieces **made by experts** | Everyone |
| **Mass** Production | 1910 – 1980s | **Large volumes of standard** product made in specialized processes | FORD |
| Lean **Manufacturing** | 1970s – 1990s | **Small batches** with pull, approaching "1-pc flow" | Japanese companies, Intro to US |
| Lean **Operations** | 2000s – Future | **Manufacturing companies and Non-manufacturing companies** improving operations using Lean principles | Banking, Insurance, Manufacturing |
| Lean **Enterprise** | 2000 – Future | Operations, Design Engineering, Marketing, Sales, and support processes fully integrated | Everyone |

TOYOTA

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# ORIGINS OF SIX SIGMA

## MOTOROLA & GENERAL ELECTRIC (GE)

MOTOROLA
intelligence everywhere™

**Bob Galvin: CEO of Motorola 1980's**





1985 Bill Smith coins the term "Six sigma"




1987 Motorola trademarks the term "Six Sigma"

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# ORIGINS OF SIX SIGMA

## MOTOROLA & GENERAL ELECTRIC (GE)



**Jack Welch : CEO of GE 1981-2001**

Jack Welch ( CEO ) made Six Sigma the management and corporate culture of General Electric 1981 – 2001.

- Every manager was trained as at least a Green Belt level.
- During his tenure at GE, the company's value rose 4,000%.

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# WHY IS IT CALLED SIX SIGMA?

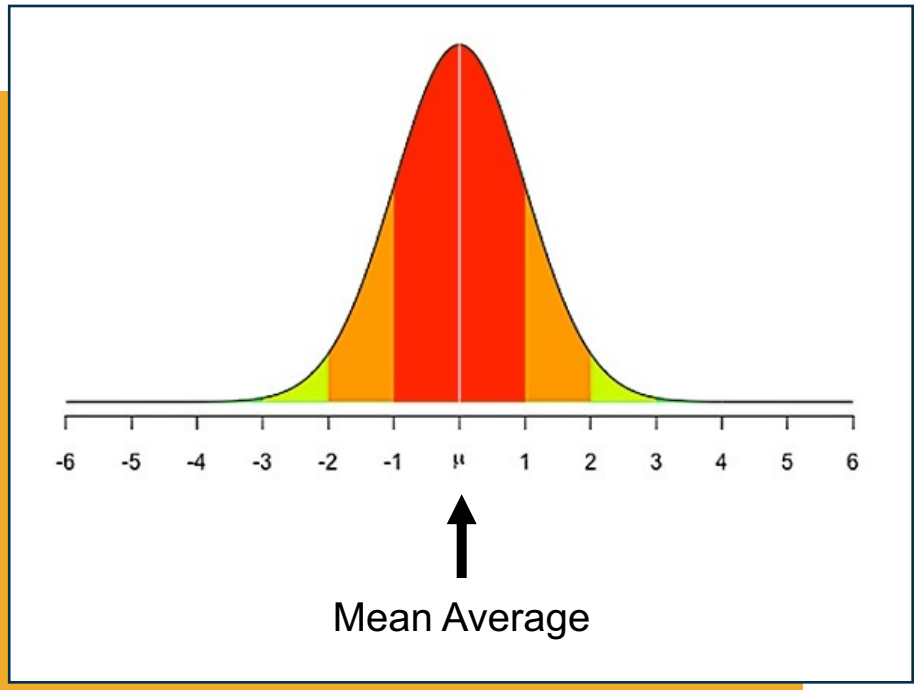
## $\sigma$, *sigma*

'Sigma' is a Greek Symbol to signify the mathematical concept called **Standard Deviation**. This is an important measure of **Variation** in a process.

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N} (X_i - \mu)^2}{N}}$$

You don't need to remember or even understand this equation…Its just 'behind the scenes'!!

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# SIX SIGMA

Six Sigma refers to a process having 6 Standard Deviations (Sigmas) between the mean average of the process (center ) and the closest customer specification limit.

***LSL = Lower Specification Limit**
***USL = Upper Specification Limit**

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# DEFECTS VS PROCESS SIGMA LEVEL

| Process Sigma Level | Defects per Million Opportunities (DPMO ) |
|---|---|
| 1 | 691,500 |
| 2 | 308,500 |
| 3 | 66,800 |
| 4 | 6,200 |
| 5 | 233 |
| 6 | 3.4 |

**DEFINITION :**
**A “Six Sigma Process” is one that produces no more than 3.4 defects per million opportunities for defects**

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# 3.4 DPMO

A “Six Sigma Process” is often described one that produces no more than **3.4 Defects Per Million Opportunities for defects**

**3.4 DPMO (Defects Per Million Opportunities )**

0.00034 % Defects

99.99966 % Correct

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# WHAT DOES A 0.1% DEFECT RATE LOOK LIKE?

What is 99.9% Quality?
**0.1 % Defects**

- 1 unsafe plane landing per day at JFK International Airport
- 100 wrong drug prescriptions per day in US
- 10,000 Houses without electric / day in US
- 100,000 wrong bank transfers per day
- 1 million e-mails sent incorrectly per day

**This is why we need Six Sigma processes !**

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# Lean & Six Sigma
# Complement Each Other

Lean can work alone




Six Sigma can work alone




But…they work really great together!

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# LEAN
## PRINCIPLES

1. Understand the **value** in the product or
2. Identify the **value stream** in each product or service
3. Make the product or service **flow**
4. **Pull** value from the downstream (just in time delivery)
5. Continuous Improvement towards **perfection**
6. Involve workers and **respect workers** opinions

***NOTE:*** *Only the first 5 Lean Principles were taught. Many books and videos still refer to the '5 Lean Principles'*

**Source: Lean Thinking by James P. Womack and Daniel T. Jones*

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# SIX SIGMA

## PRINCIPLES

1. **Reduce Variation** and you will reduce Defects / Errors
2. **Root Cause Analysis of problems** ( RCA )
3. **Use Data** for Decision making ( instead of guessing ! )
4. Use of **Statistical Analysis** tools and charts
5. Process **Optimization** using Designed Experiments and Regression Analysis, Predictive Modelling. Hypothesis Tests
6. Improvement projects using the **DMAIC** Framework

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We Use Lean & Six Sigma For

# Process Improvement

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# Increase Value

## Traditional View of Our Processes

Inputs

Raw Materials
Raw Data
Manpower
Energy

**Operations**

Outputs

Finished Goods
Refined Materials
Information
Services
etc



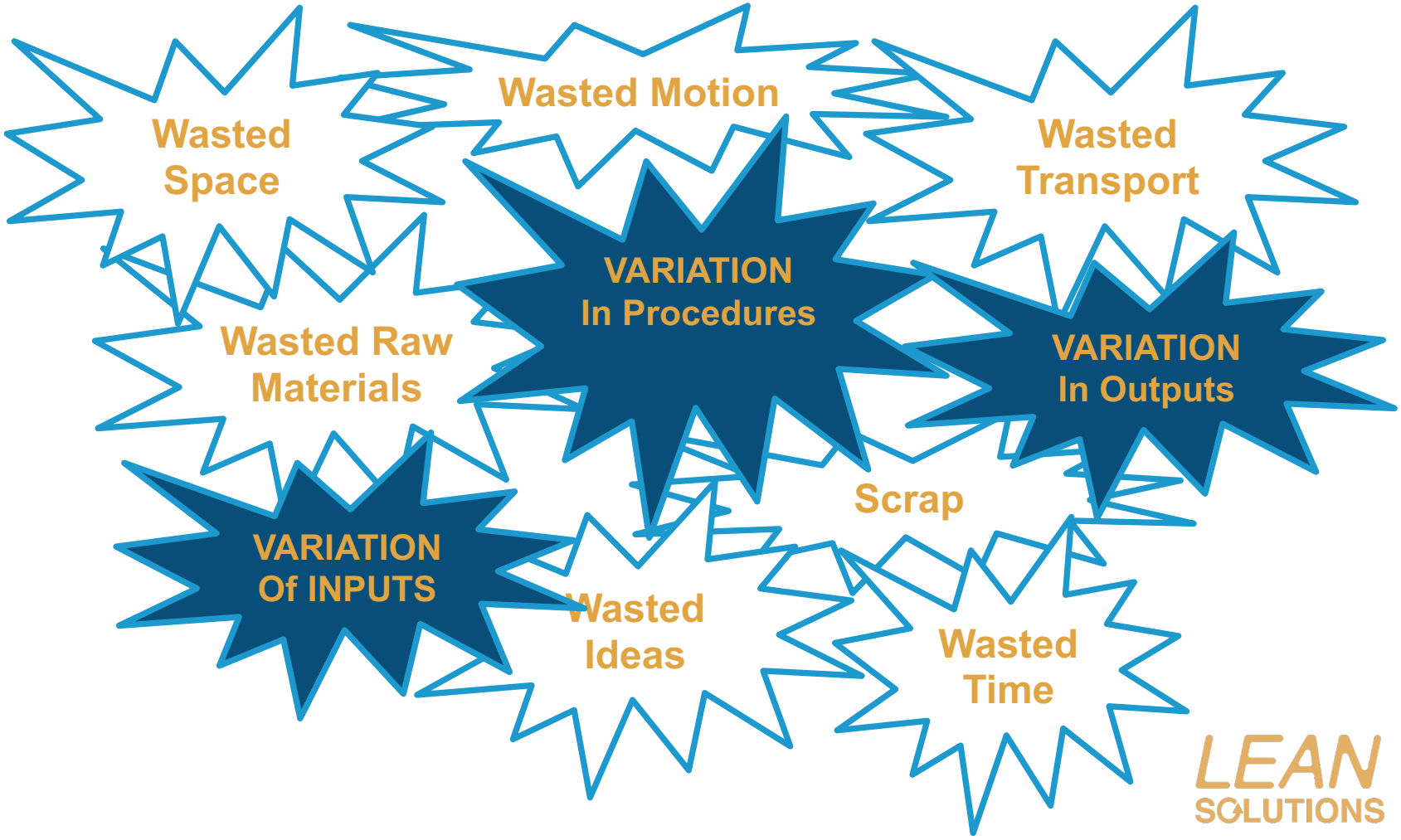
**Customer**

**Lower Value** → **Higher Value**

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# Waste & Variation

## What Our Processes Actually Look Like




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# 3-STAR MANUFACTURING INC.

What are the possible Defects?

- **Shapes**
- **Colors**
- **Size**
- **Concentric**

**What Defect Rate is acceptable?**

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# 3-STAR MANUFACTURING INC.

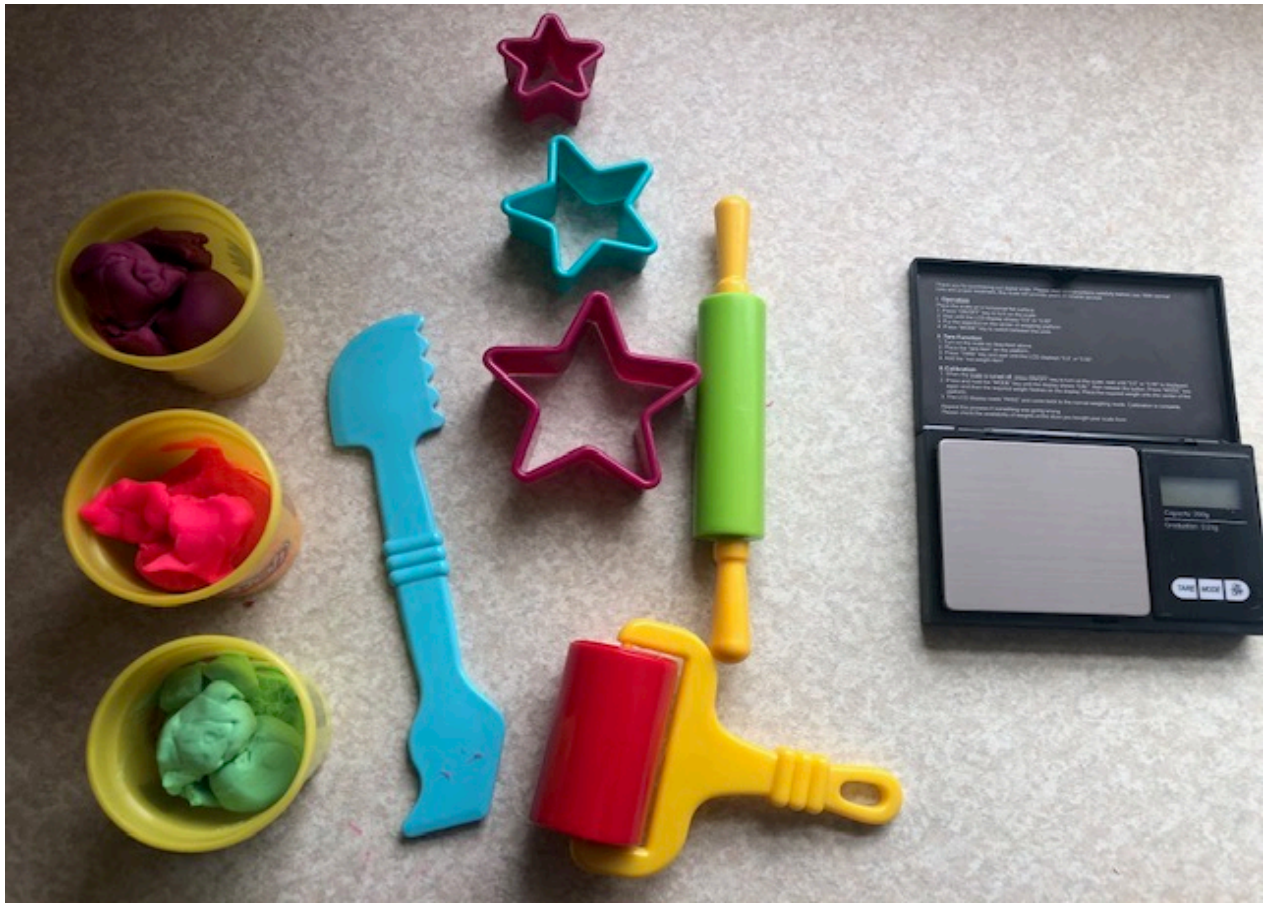
## PERFECT FOR CAKE DECORATIONS

- 3 Star Shapes
- 3 different Colors
- 3 different Size Stars
- Concentric Shapes

- Target Weight = 10 grams
- Upper Specification Limit = 12 grams
- Lower Specification Limit = 8 grams

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# 3-Star Manufacturing Inc.



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# 3-Star Manufacturing Inc.

**ROLL → WEIGH → FLATTEN → CUT → ASSEMBLE → WEIGH**







**<u>Roll Ball</u>**

Small : 8 to 12 grams Target = 10 grams

Medium : 13 to 17 grams Target = 15 grams

Large : 18 to 22 grams Target = 20 grams

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# INPUTS

## What do we need to create Value for Customers ?

Hint : **The '4 M' rule**

**M** A T E R I A L S

**M** A N P O W E R

**M** A C H I N E S

**M** E T H O D

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# INPUTS

## What do we need to create Value?

Examples of Inputs in your work (Which ‘M’ is it ?) :

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

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# OPERATIONS

## Transforming the Inputs into Outputs



Examples of Operations at your company :

1. _____

2. _____

3. _____

4. _____

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# OUTPUTS

## What Your Customer Wants

The **‘TOP 5’** Outputs at your company :

1. _____
2. _____
3. _____
4. _____
5. _____

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# Increase Value

**Lower Value** → **Higher Value**

Inputs → **Our Business Process** → Outputs



**Customer**

- Safer
- Easier
- Better Quality (less defects & rework)
- Faster (on time)
- Lower Cost

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# Shigeo Shingo

'*There are four purposes of improvement:* ***easier, better, faster, and cheaper.*** *These four goals appear in order of priority. Hence the first is to make the work easier for workers while improving the fruits of their labour.'*

*'Intensifying the work should never be undertaken even if the same working hours are maintained.'*

Non-Stock Production : The Shingo System of Continuous Improvement', (1988)

***Shigeo Shingo*** **was a primary architect in the development of the Toyota Production System.**

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# SQCD

1. Easier and **Safer** for workers (S)
2. Produce Better **Quality** Outputs for customers (Q)
3. Lower the **Cost** of Production (C)
4. **Deliver** the Outputs on Time (D)

The **SQCD** model of Production

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# SUMMARY

## At This Point You Should Be Able To…

- Describe the defined roles of Lean & Six Sigma belts
- Describe the goals of our process improvement
- Understand the origins of Lean & Six Sigma
- Describe the principles of Lean
- Describe the principles of  Six Sigma

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# QUIZ 1:

1. What was the name of the first company to use the name 'SIX SIGMA' to describe its Quality Management System?
   - **MOTOROLA**

2. What is the First Principle of Lean production ? What is the most important thing that a Lean process must produce?
   - **VALUE** ( for the customer of the process )

3. Which Japanese company is considered as being the first to use true 'Lean Production "effectively and successfully"?
   - **TOYOTA**

4. A basic principle of Six Sigma is to always find the true original source of a defect or problem. This is called _____?
   - **ROOT CAUSE ANALYSIS**

5. A "Six Sigma Process" is often described one that produces no more than 3.4 DPMO What does DPMO stand for?
   - **DEFECTS PER MILLION OPPORTUNITES FOR DEFECTS**

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# QUIZ 1:

6. What is the role of a Yellow Belt on a Lean Six Sigma project?
    - A YELLOW BELT IS A TEAM MEMBER WHO ASSISTS A GREEN OR BLACK BELT, USING THEIR KNOWLEDGE OF THE PROCESS THAT THEY CURRENTLY ARE WORKING WITHIN.

7. What is the role of a Green Belt in an organisation ?
    - A GREEN BELT IS A PROJECT TEAM LEADER FOR SMALL AND MEDIUM SIZED PROCESS IMPROVEMENT PROJECTS.

8. What is the role of a Black Belt in an organisation ?
    - A BLACK BELT IS A PROJECT TEAM LEADER FOR LARGE PROBLEM SOLVING / IMPROVEMENT PROJECTS or OVERSEES THE WORK OF GREEN BELTS FOR MULTIPLE PROJECTS. A BLACK BELT IS A FULL TIME PROBLEM SOLVER FOR THE ORGANIZATION.

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# STANDARD WORK

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# ONE OF FOUR

## RULES OF TOYOTA

All work shall be highly specified as to content, sequence, timing and outcome.

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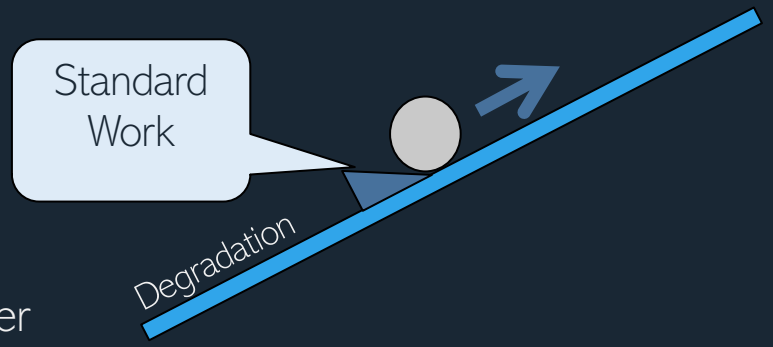
# WHAT IS STANDARD WORK

- Detailed work sequence of the operator
- Provides a routine for consistency of an operation
- Details the best process we currently know
- Is the basis for improvement by defining the normal

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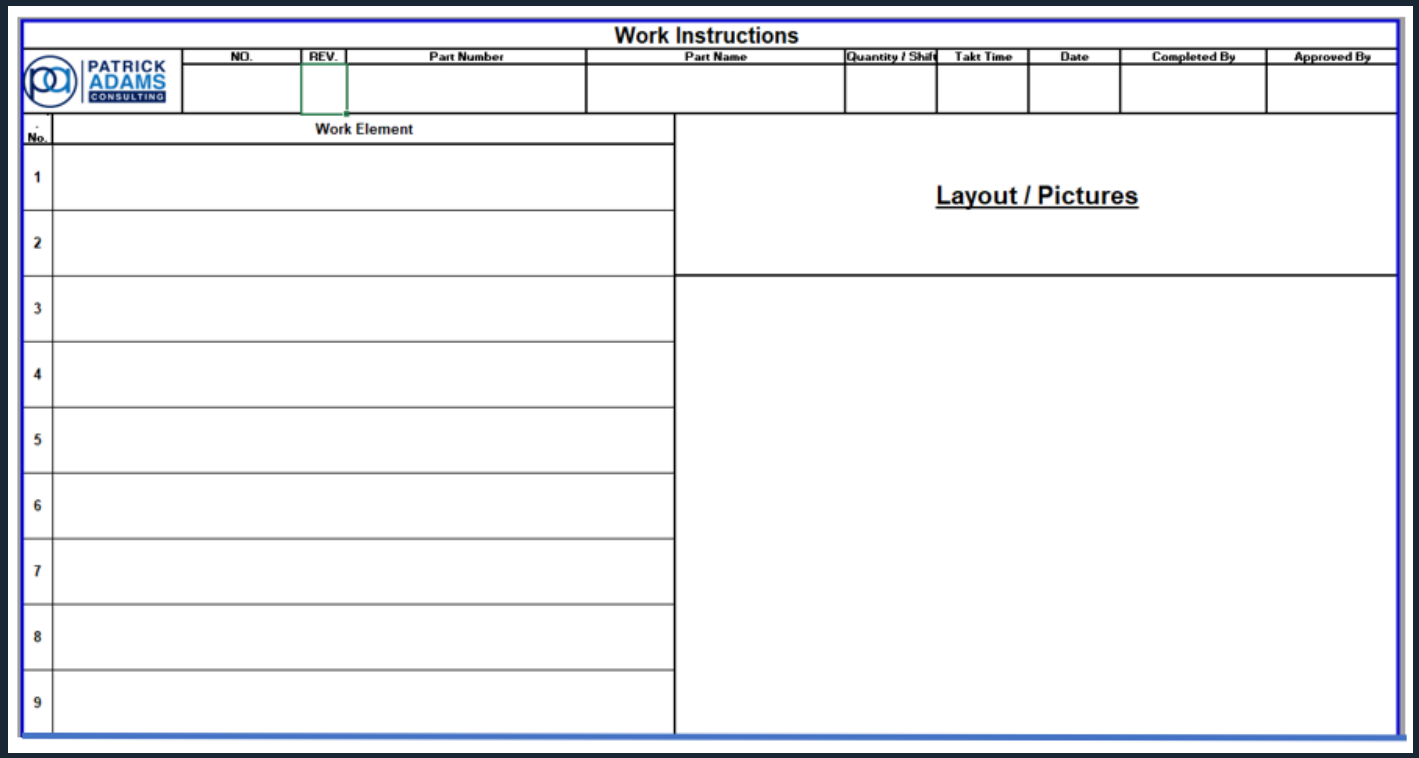
# WHY STANDARD WORK?

- Prevents backsliding
- Makes problems obvious
- Removes ambiguity
- Makes managing schedules/resources easier
- Agree to work together/agree to change together




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# STANDARD WORK DOCUMENT



**Work Instructions**

| PATRICK ADAMS CONSULTING | NO. | REV. | Part Number | Part Name | Quantity / Shift | Takt Time | Date | Completed By | Approved By |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| No. | Work Element | Layout / Pictures |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |
| 9 | | |

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# STANDARD WORK

## AUDIT PURPOSE

- Check understanding of the standard
- Discover individual difficulties
  - Did lack of training lead to the problem
  - Kaizen: to take away difficulty
- Identify waste in process

**Standard Work audits are NOT meant to be punitive**

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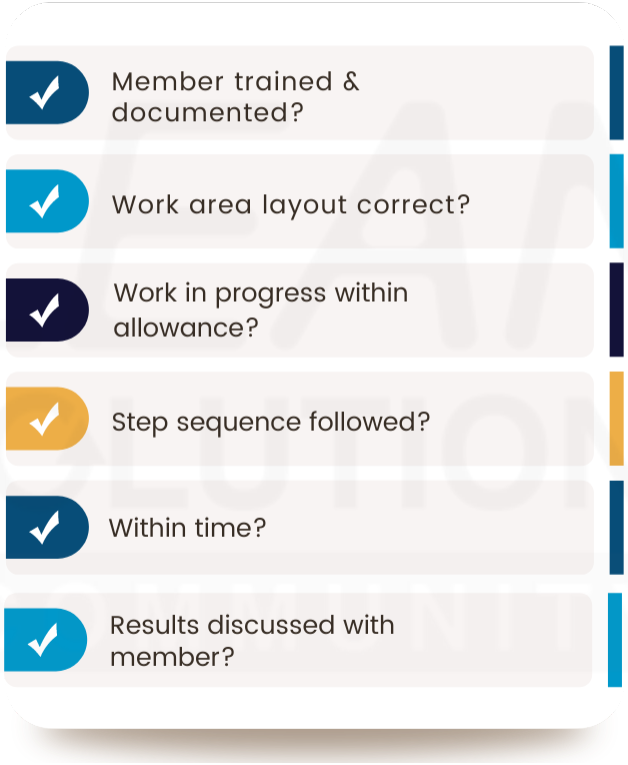
# WHY AUDIT

## STANDARD WORK?

- Go to Gemba
- Establish standards if not in place
- Kaizen day after day, even the small things
- Kaizen creates basis for larger change
- Developing people
- Encourage team work

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# STANDARD WORK
# AUDIT AGENDA




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**What to do if someone is not following the standard?**

## ASK WHY

They're not following the standard

## RESPOND TO

The reason they indicate

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# STANDARD

## WORK SUMMARY

- Every facility must implement and maintain Standard Work
- Applying Standard Work demonstrates how methods to improve quality, increase operational speed, and reduce costs are all interconnected
- Standardized Work establishes the foundation for all productivity, quality, safety, and cost improvements of the future



# STANDARD

## WORK SUMMARY

- Standard Work - The BEST combination of people and machines (assets) while using the minimum amount of materials, equipment and space
- We need to test out possible improvements by changing only one thing at a time.
- Standard work should be developed by those who perform the tasks. The operators that do the work are most likely to know how to do it well and are the experts.



# VALUE & WASTE

*Lean focuses on identifying which activities add value, and which do not...*

**Value Added Activity**

- Transforms or shapes (for the 1st time) material or information to meet customer requirements
- Anything the customer is willing to pay for ONE TIME ONLY

**Non-Value Added Activity (Waste)**

- Anything else that consumes resources or is related to rework or scrap

**Incidental Non-Value**

- Serves you or the company but the customer

doesn't value it

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# WHAT DO YOU
## WANT TO PAY FOR?

If you were the patient, what would you be willing to pay for?

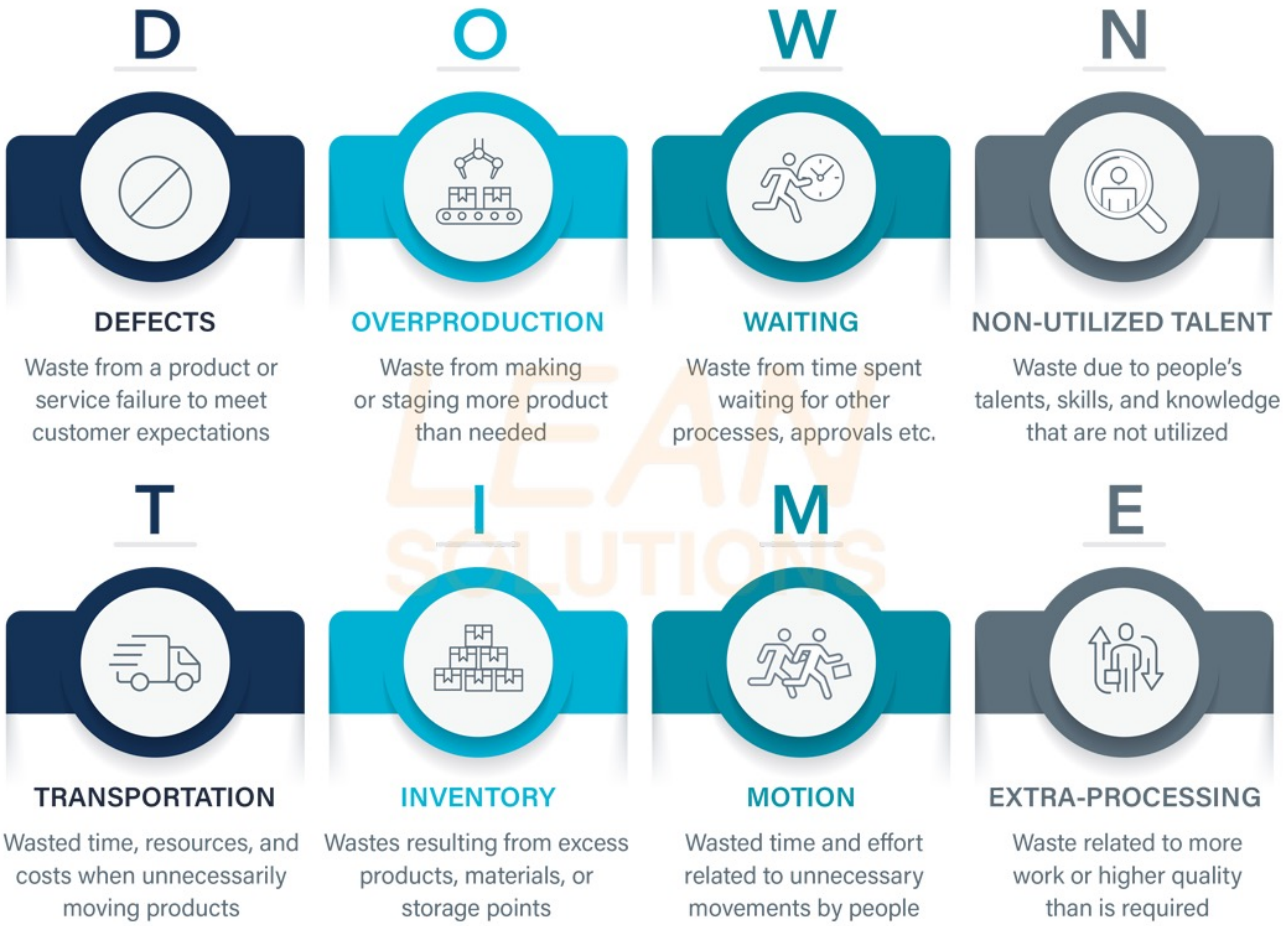
Value Added steps are those the customer is willing to pay for – all else is a form of Non-Value Added or Waste.

| Doctor Visit | |
|---|---|
| Making appointment | 10 min |
| Driving to the doctor's office | 30 min |
| Filling out insurance and health history forms | 10 min |
| Waiting in the reception area | 20 min |
| Walking to the vitals room | 2 min |
| Nurse taking your blood pressure and weight | 4 min |
| Walking to the exam room | 2 min |
| Waiting in the exam room for the doctor | 15 min |
| Exam by doctor | 15 min |
| Checking out at the front desk | 3 min |
| Driving home | 30 min |
| **TOTAL** | **141 min** |

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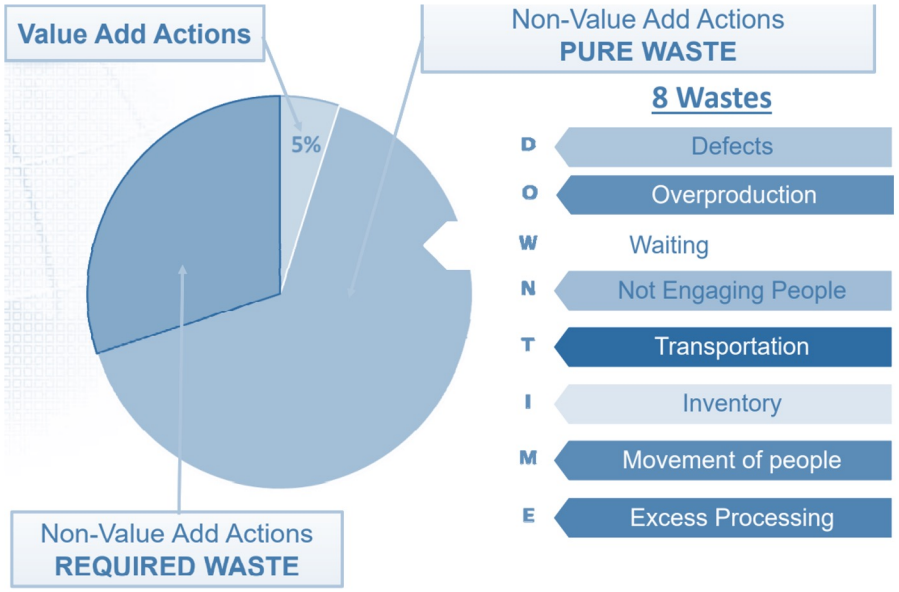
# Recognizing Waste

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# CATEGORIES
## OF ACTION






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# WASTE
## WALK

**A planned visit to where work is being performed to observe what's happening and to note the waste.**

- Explain to the people in the area of observation what you are doing.
- Study the area for 20-30 minutes.
- As you see work that appears to be waste, jot down the example you see.
- Take action immediately if possible or develop a plan to remove waste

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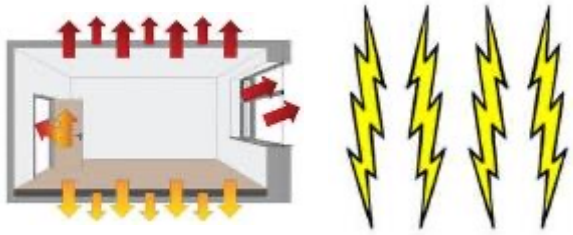
## Waste Walk Form

Date: xx/xx/xx
Location/area: Main Production
Observer: Craig T.

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| Type of Waste | Definition | Observations |
|---|---|---|
| Defect/Rework | Product that does not meet customer requirements | Excessive amount of Hoods in Repair Bay, 4 Racks at 20 per rack |
| OverProduction | Producing more than is required | There are 35 Left Hand Rockers but only 7 Right Hand Rockers. These ship as sets of one each |
| Waiting | Delays in the process, waiting for next step to occur | Paint Line is full of parts waiting to be loaded |
| Non-Utilization of Talent and/or Resources | Not utilizing people's skills properly | Lay up operators are being used to hang parts on the paint line |
| Transportation | Unnecessary movement of material from one location to another | Material Handler is required to move parts From lay-up, To bonding, To sanding, and To paint. |
| Inventory | More supplies/equipment than required to service customer | 275 Hood outer panels are held at bonding |
| Motion | Movement that does not add value to the work being completed | Left and Right Hinges are removed From boxes and put in Totes To be staged at bonding cell |
| Excess-Processing | More work is done than required by the customer, or things are made more complicated than necessary | Hood outer panel is getting sanded in areas that are no longer used To bond To inner panel |

# ‘Non-Traditional’ Categories of Waste



Utility/Energy (Heat/Electrical) Losses




Miscommunications



Over - Communications




Skilled Staff Losses

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# 3-Star Manufacturing Inc.

Where is the **Waste**?

**ROLL → WEIGH → FLATTEN → CUT → ASSEMBLE → WEIGH**







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# QUIZ 2 :

1. All work shall be highly specified as to content, sequence, timing and _____.
   - **OUTCOME**

2. True or False? Standard work provides a routine for consistency of an operation.
   - **TRUE**

3. True or False?  Standard work helps to hide problems.
   - **FALSE**

4. Discussion:  Why is it so important to audit standard work?

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# QUIZ 2 :

1. Which of the traditional 8-Wastes of ‘DOWNTIME is concerned with reducing the complexity of processes and taking out unnecessary steps or activities ?
   - **NON-ESSENTIAL PROCESSING / OVER PROCESSING**

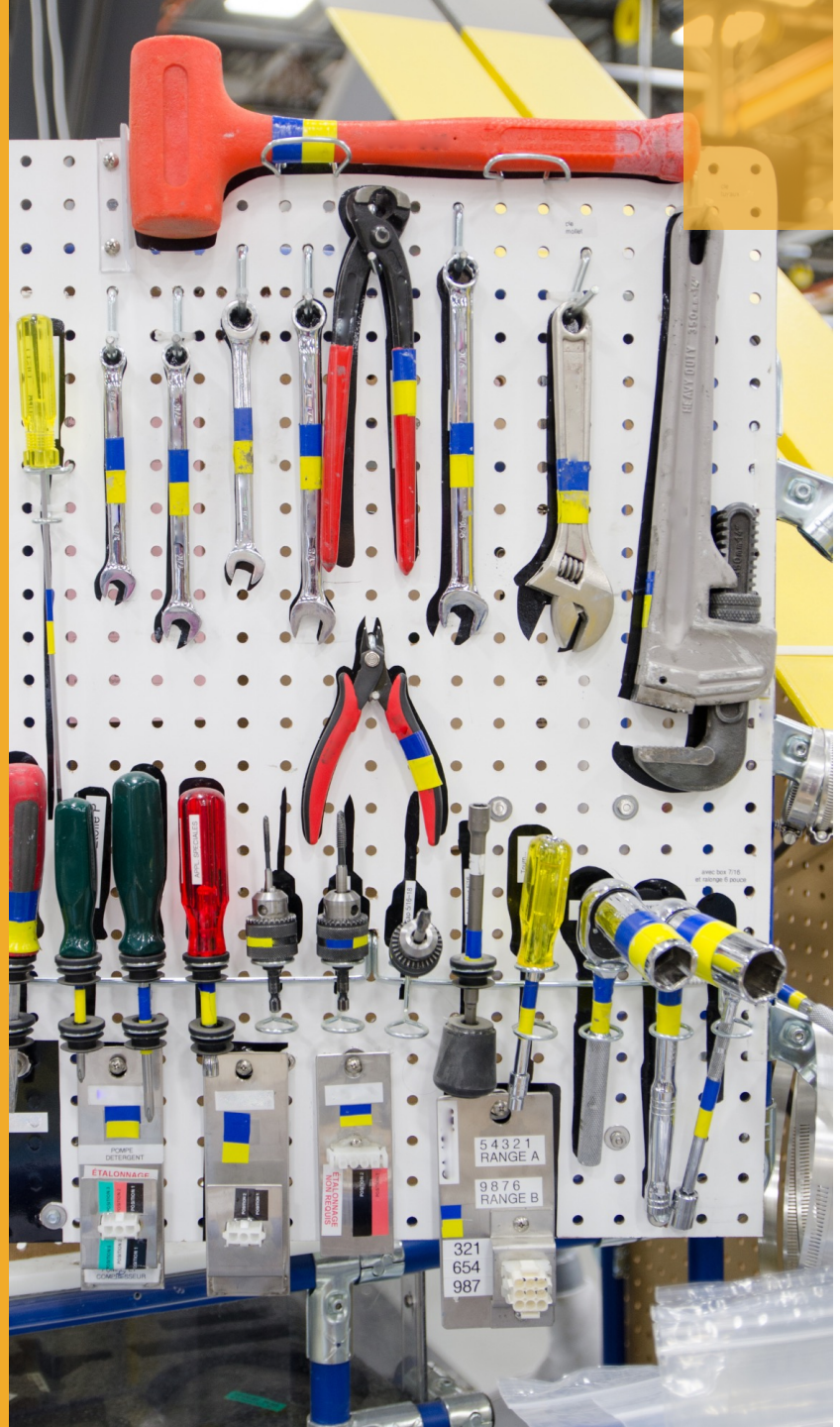
2. What is the name of the Waste of producing more that the customer demand can absorb ?
   - **OVER-PRODUCTION**

3. What is Waste called when an activity or step in process needs to be repeated because it was not done ‘Right-First-Time’ ?
   - **REWORK / DEFECTS**

4. What Waste results in Queues or Backlogs of materials or work ?
   - **WAITING ( DUE TO A BOTTLE-NECK IN THE PROCESS )**

5. What is the Japanese word for ‘Waste’ ?
   - **MUDA**

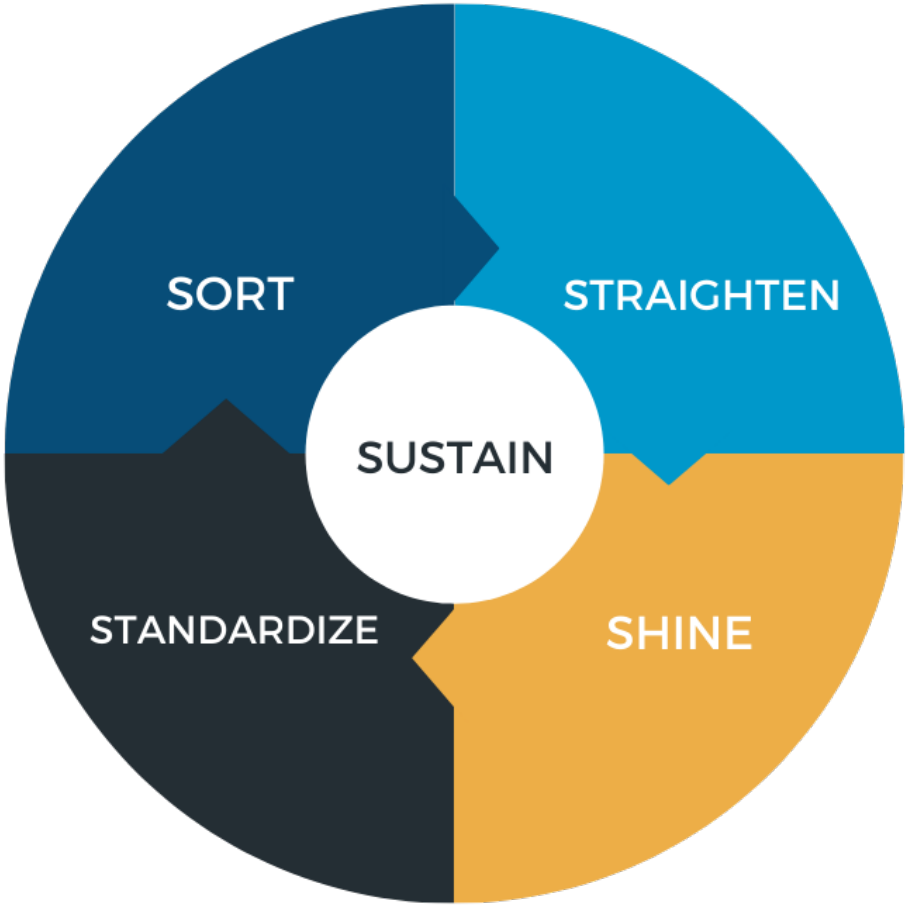
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# 5S

Continuous Improvement
should not be just an event.

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# WHY 5S?

## Workplace Organization and Visual Management Fundamental to Your Facility

- SAFER!
- Problems Become Visible
- Promotes culture

## Result: Improved Safety, Quality and Cost

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# FIND A FLATHEAD SCREWDRIVER



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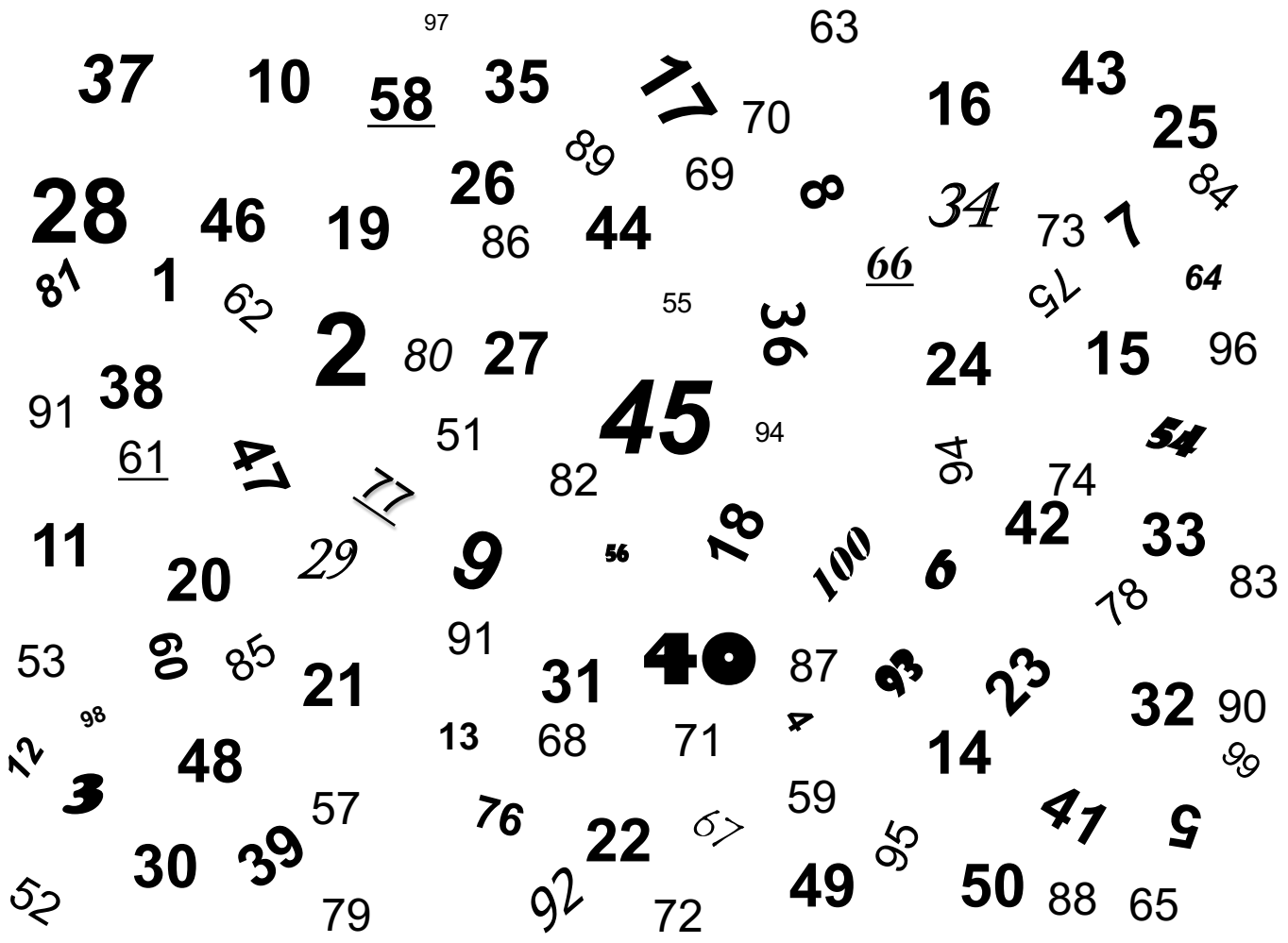
# FIND A FLATHEAD SCREWDRIVER




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# Exercise #1

60




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# SORT

- Critically examine everything
- Red Tag Process
  - Always use-Have a place for it
  - Sometimes use-Tag and Date
  - Never use-Red tag area
- Need a 6mm Hex? Keep only the 6mm Hex, not a whole set
- Members know best what is needed
- Everything in the area should have a purpose

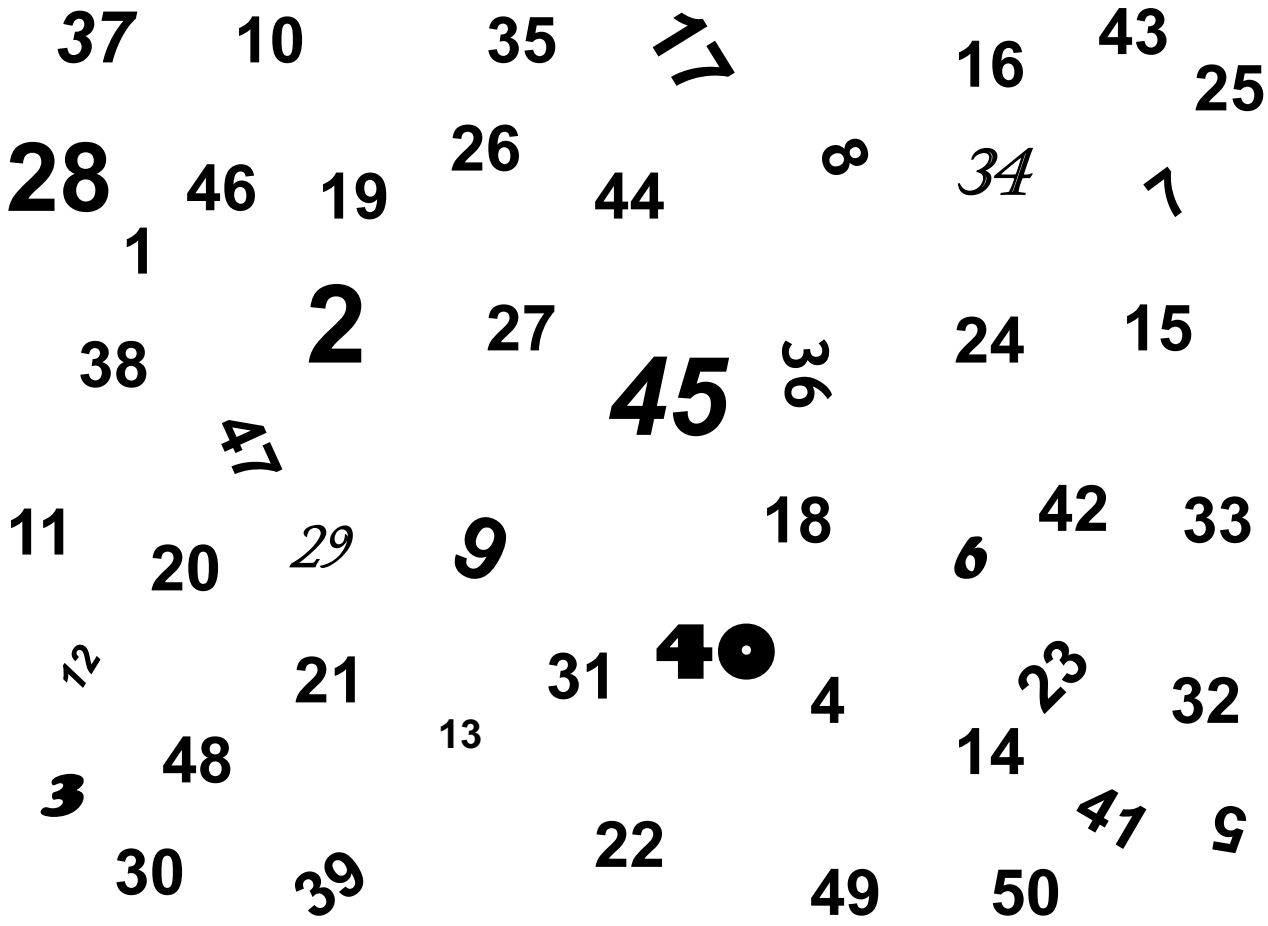





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# Exercise #2

60




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# STRAIGHTEN or SET IN ORDER

- For what's left, where does it go?
- Be mindful of frequency of use and how much is used
- Be Visual
- Arrange so things are easy to find and readily retrieved.
- "A place for everything and everything in it's place."

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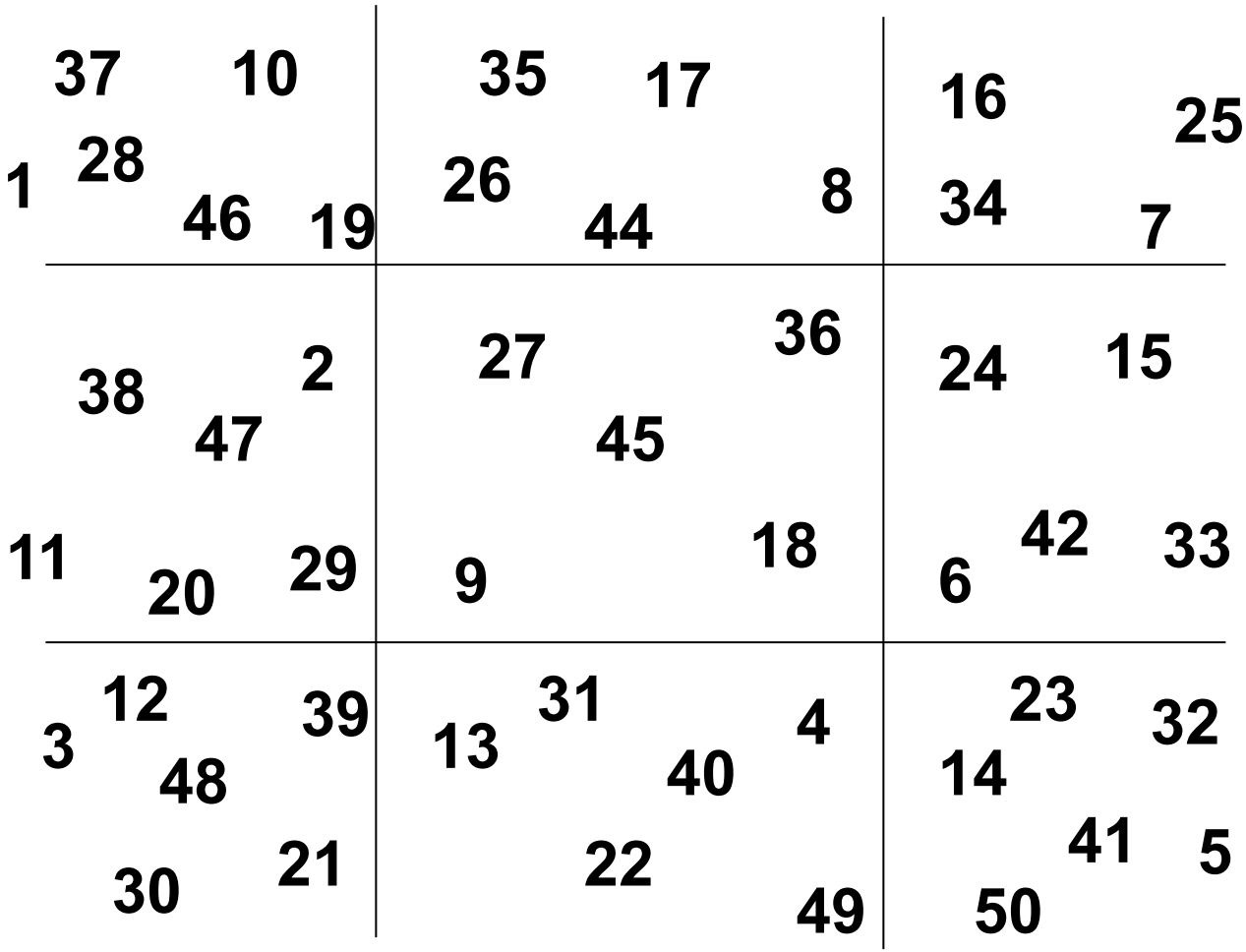

# SHINE

- Clean the area (tools, equipment, lighting, etc.)
- Re-painting may be required
- Implement regular housekeeping so that any dirt or grease is immediately obvious.
- Always use your 5S Color Standards

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# Exercise #3

60




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# STANDARDIZE

- Implement Work Center 5S Board
- Take a picture of the area
- Assign an area owner
- Develop standard work for regular housekeeping
- Implement Daily End of Shift Checks

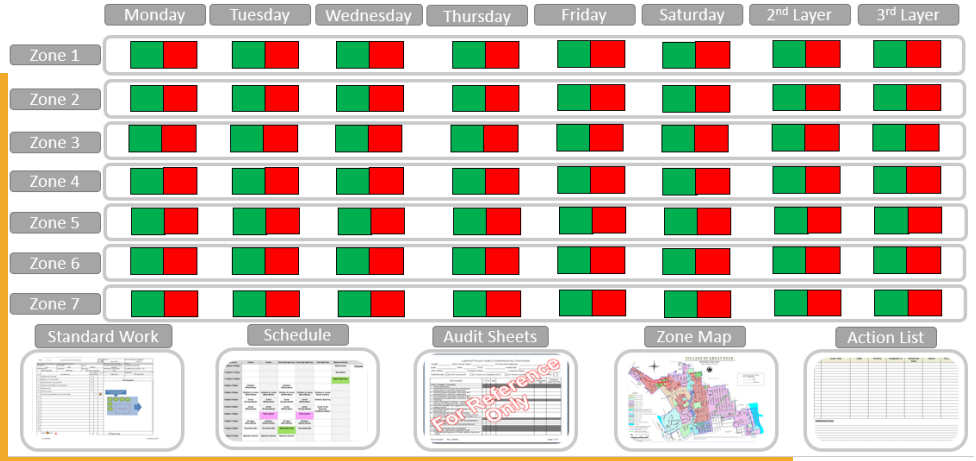
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# Exercise #4

60

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |

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# SUSTAIN

Implement Layered Process Audit

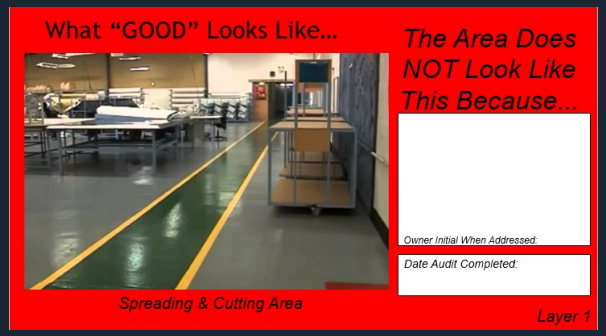
in order to sustain improvements

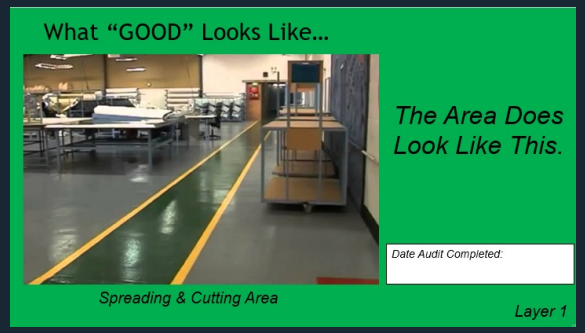
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# SUSTAIN

## LAYER 1 AUDIT

- Layer 1 audits are completed daily by team leaders based on a posted schedule
- Area owner is responsible for any red items on Layer 1.
- Layer 1 checks that the area matches the picture and the work center 5S board is being completed



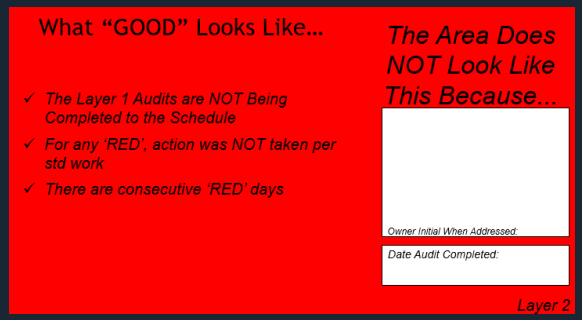




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# SUSTAIN

## LAYER 2 AUDIT

- Layer 2 audits completed by the area Supervisor one time per week.
- The Layer 2 audits are specifically auditing audit completion to schedule.
- The area Supervisor is responsible for any red items in Layer 2.







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# SUSTAIN LAYER 3 AUDIT

Layer 3 audits are completed by the Operations Manager or Plant Manager once per month.

What "Good" Looks Like...

Y N No items present in area without designated location
Y N Aisleways are clear and clean without obstruction
Y N All part racks and containers labeled with proper ID
Y N All surfaces free of dirt and dust, "Hospital Clean" standard
Y N Records of required 5S activities are dated, initialed & current
Y N Team has documented action items on team W3I to improve workplace organization, reduce / eliminate sources of clutter / debris

Y N Layer 2 audits are being completed to schedule

The Area Does NOT Look Like This Because...

1 Action Item To Address:

Owner Initial When Addressed:

Date Audit Completed:

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# 5S Audit & Results

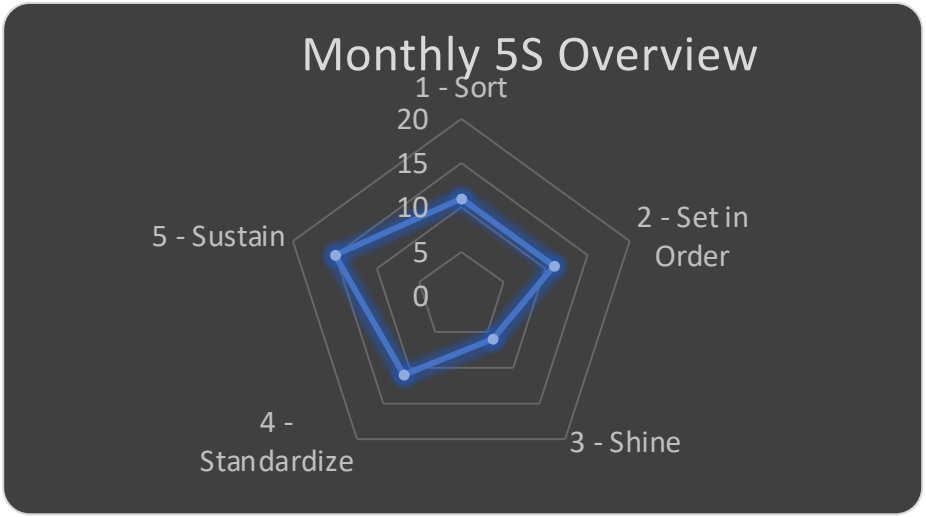
**5S Workplace Scan Checklist**

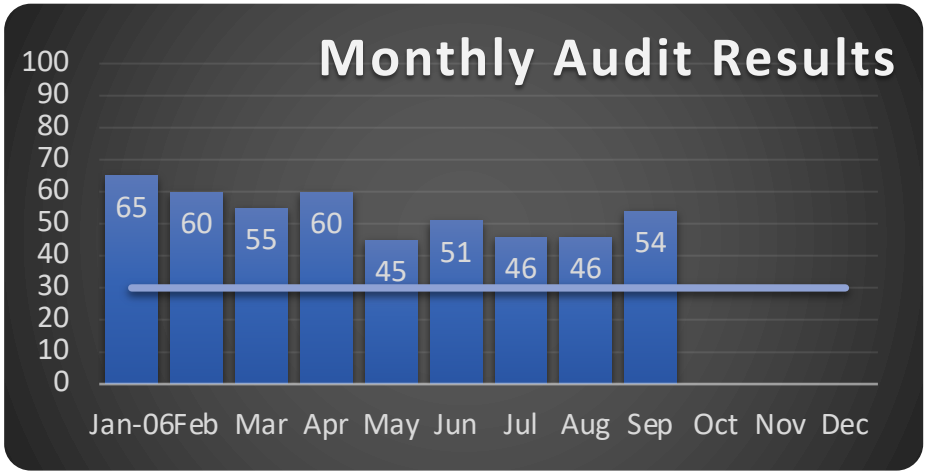
Departme nt:

Date: Scored By:

Place an "x" in the appropriate box based on number of issues observed.

| | | Number of Observations >> | 0 | 1-2 | 3-4 | 5-6 | >6 |
|---|---|---|---|---|---|---|---|
| Sort | | **Distinguish between what is needed and not needed** | | | | | |
| | 1 | Unneeded equipment, tools, furniture, etc. are present | | | x | | |
| | 2 | Unneeded items are on walls, notice boards, etc | | | x | | |
| | 3 | Items are present in walkways, stairways, corners, fire exits etc. | | | | x | |
| | 4 | Unneeded inventory, supplies, parts, or materials are present | | | | x | |
| | 5 | Safety hazards (water, oil, chemical, machines) exist | | x | | | |
| | | **Subtotal >>** | 0 | 1 | 4 | 6 | 0 |
| Set in Order | | **A place for everything and everything in it's place** | | | | | |
| | 1 | Correct places for items are not obvious | | | x | | |
| | 2 | Items are not in their correct places | | | x | | |
| | 3 | Walkways, workstations, equipment locations are not indicated | | | | x | |
| | 4 | Items are not put away immediately after use | | | | x | |
| | 5 | Height and quantity limits are not obvious | | x | | | |
| | | **Subtotal >>** | 0 | 1 | 4 | 6 | 0 |
| Shine | | **cleaning, and looking for ways to keep it clean and organised** | | | | | |
| | 1 | Floors,walls stairs, and surfaces are free of dirt, oil, and grease | | | x | | |
| | 2 | Equipment is not kept clean and free of dirt, oil, and grease | | | x | | |
| | 3 | cleaning materials are not easily accessible | | x | | | |
| | 4 | Lines, labels, signs, etc are not clean and unbroken | x | | | | |
| | 5 | Other cleaning problems of any kind are present | | x | | | |
| | | **Subtotal >>** | 0 | 2 | 4 | 0 | 0 |
| Standardize | | **Maintain and monitor the first three categories** | | | | | |
| | 1 | Necessary information is not visible | | | | x | |
| | 2 | All standards are not known and visible | | | | x | |
| | 3 | Checklist don't exist for all cleaning and maintenance jobs | | | | x | |
| | 4 | All quantities and limits are not easily recognizable | | | | x | |
| | 5 | How many items can't be located in 30 seconds | | x | | | |
| | | **Subtotal >>** | 0 | 1 | 4 | 6 | 0 |
| Sustain | | **Stick to the rules** | | | | | |
| | 1 | How many workers understand the 5s principals | | | | | x |
| | 2 | How many times last week was daily 5s not performed | | | | | x |
| | 3 | Number of times that personal belongings are not neatly stored | | | | x | |
| | 4 | Number of times job aids are not available or up to date | | | | x | |
| | 5 | Number of times last week daily 5s inspection were not performed | | x | | | |
| | | **Subtotal >>** | 0 | 1 | 0 | 6 | 8 |
| | | **Total >>** | 0 | 6 | 16 | 24 | 8 |
| | | **Grand Total 5S Score** | 54 | | | | |




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# 5S Your Computer Hard/Shared Drive

| 5S Principle | Description |
|---|---|
| Sort | • Check all your files and software, and get rid of any that are unnecessary |
| Set In Order | • Organize your files and optimize the use of file folders<br>• Keep in mind how often you need them and how much time you need to store them<br>• Create specific shortcut icons for the most used files or programs |
| Shine | • Eliminate any files under deleted items, sent items and the recycle bin |
| Standardize | • Establish procedures for maintaining your computer 5S system |
| Sustain | • Include hard drives in 5S audits<br>• Focus on how people maintain files and program organization, and the time they spend ding so |

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# 5S 3-Star Manufacturing Inc.



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# 5S IN YOUR COMPANY

## DISCUSSION

- What areas of your work could do with 5S?
- Who do you need to get involved?
- When are you going to try 5S?

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# QUIZ 3 :

1. Which stage of the 5S method is used to ensure that the workers have the good habits and discipline to continue the other 4S tasks?
   - **SUSTAIN**

2. In 5S the action of removing unnecessary tools, equipment and materials from the workspace is called _____.
   - **SORT**

3. Cleaning the workplace of dirt, dust and litter is called what in 5S ?
   - **SHINE**

4. Give one example of a 5S method used for **SET IN ORDER / STRAIGHTEN**
   - **SHADOW BOARDS**
   - **RACKS**
   - **COLORED LABELS**
   - **FLOOR MARKING etc**

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# Lean Principles & Tools

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# 6 FUNDAMENTALS OF LEAN

- Value
- Value Stream
- Flow
- Pull
- Perfection

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# WHO IS YOUR CUSTOMER?

## IN LEAN SIX SIGMA…

- Value is always viewed “Through the eyes of the Customer”
  - Who is our customer ?
  - What is The Voice of our Customer ( VOC ) ?
  - What is Critical to Quality (CTQ ) to our Customer ?

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# WHO IS YOUR CUSTOMER?

## 'Internal Customers' VS 'External Customers'

- An internal Customer could be a different department or operation. It could be the next downstream operation in the process.

- Can you name some different types of 'Internal/External Customers'?

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# WHAT IS A CTQ?

**Critical to Quality** (CTQ's) are measures we use to capture VOC properly.

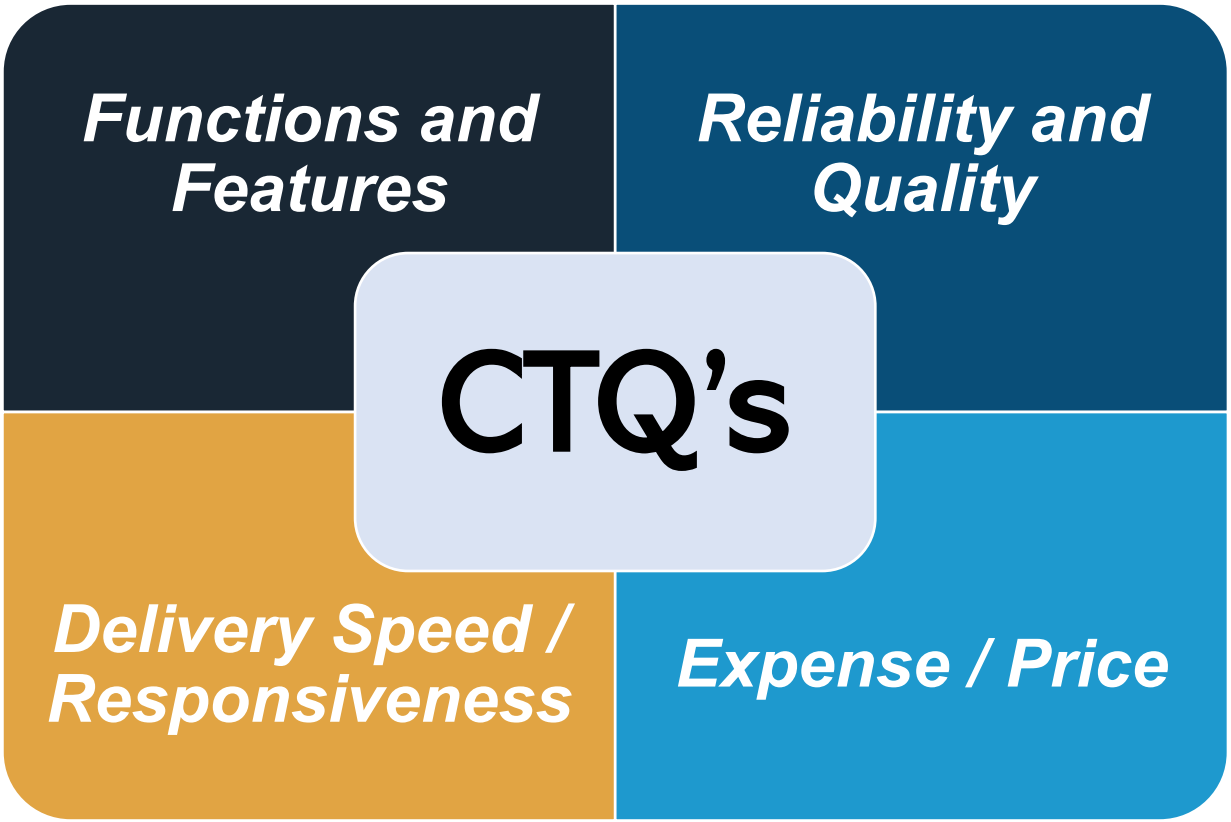
- Also referred to in some literature as :
  - CTC's – Critical to Customer
  - CTS's – Critical to Satisfaction
  - CTQC - Critical to Quality Characteristics

- CTQ's are a tool to help to break down VOC into well defined and measurable terms.

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# DEFINING CTQ'S

Customer CTQs usually fall into one of 4 categories :




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# DEVELOPING CTQ'S

1. IDENTIFY YOUR CUSTOMERS
2. CAPTURE VOC
3. DEVELOP CTQ'S

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# SPECIFICATION LIMITS

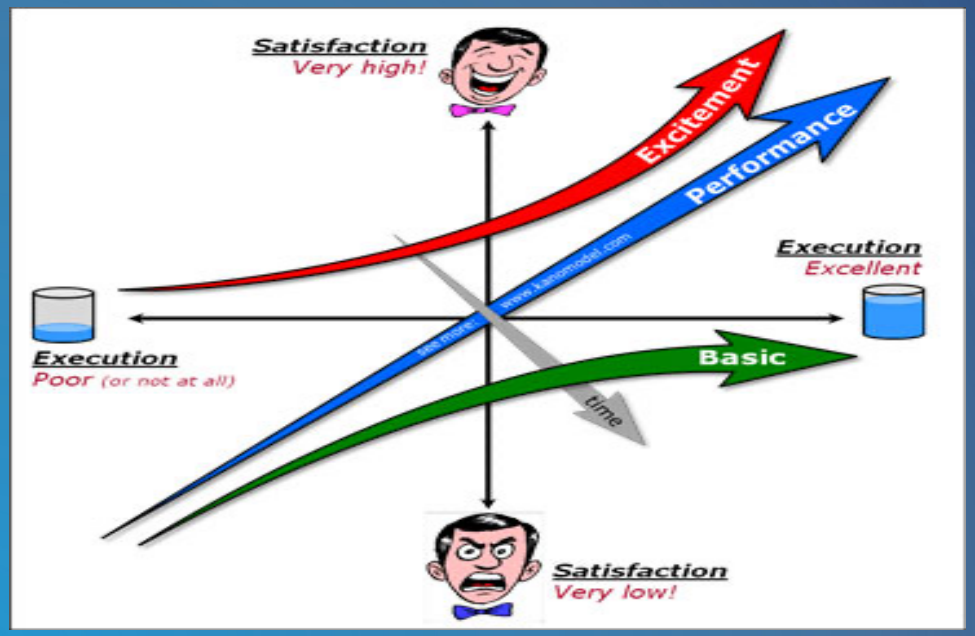
"Specification Limits" are Lean Six Sigma's way of defining your customer expectations

**USL = Upper Specification Limit**

**LSL = Lower Specification Limit**

Also called 'Tolerance limits' in some businesses

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3. Delighters

2. Performers

1. “Must Haves”

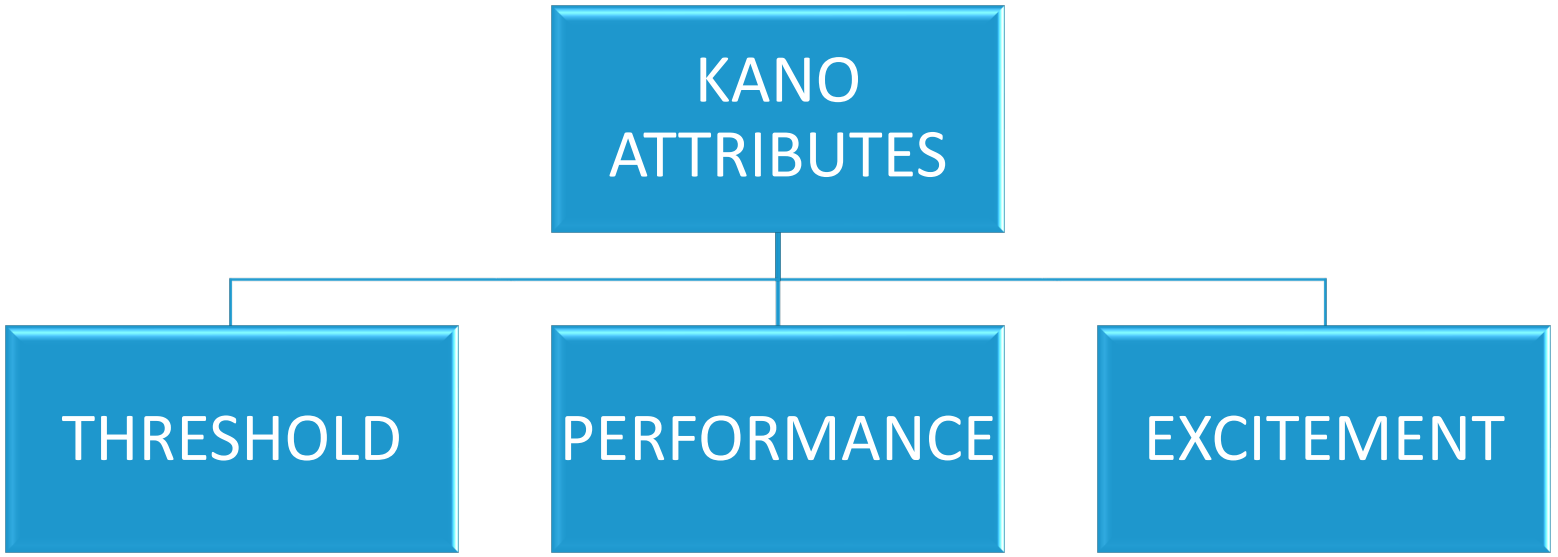
# **KANO** ANALYSIS

Developed in the 1980s by Professor Noriaki **Kano**, which classifies customer preferences into three main categories

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# KANO ANALYSIS

The Kano Model has three main categories of attributes:




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# CTQ's & KANO

## Consider a 3-Star Manufacturing

- What are the CTQs for the process ?
- What at the Basic Requirements ?
- What are Performers ?
- What at Delighters ?

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# 3-Star Manufacturing Inc.

CTQS: _____

_____

_____

- Basic Requirements

_____

- Performers

_____

- Delighters

_____

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# Poka Yoke & Jidoka

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# POKA YOKE & JIDOKA

## PREVENT DEFECTS

- Create no defects / errors
- Accept no defects / errors
- Pass no defects / errors

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# JIDOKA

- **Work** stops immediately when a problem first is detected.
- The **Root Cause** of the defect is discovered and corrected before work continues
- This prevents defects being passed on downstream
- This short term disruption to FLOW will improve both FLOW and QUALITY in the long term




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# POKA YOKE

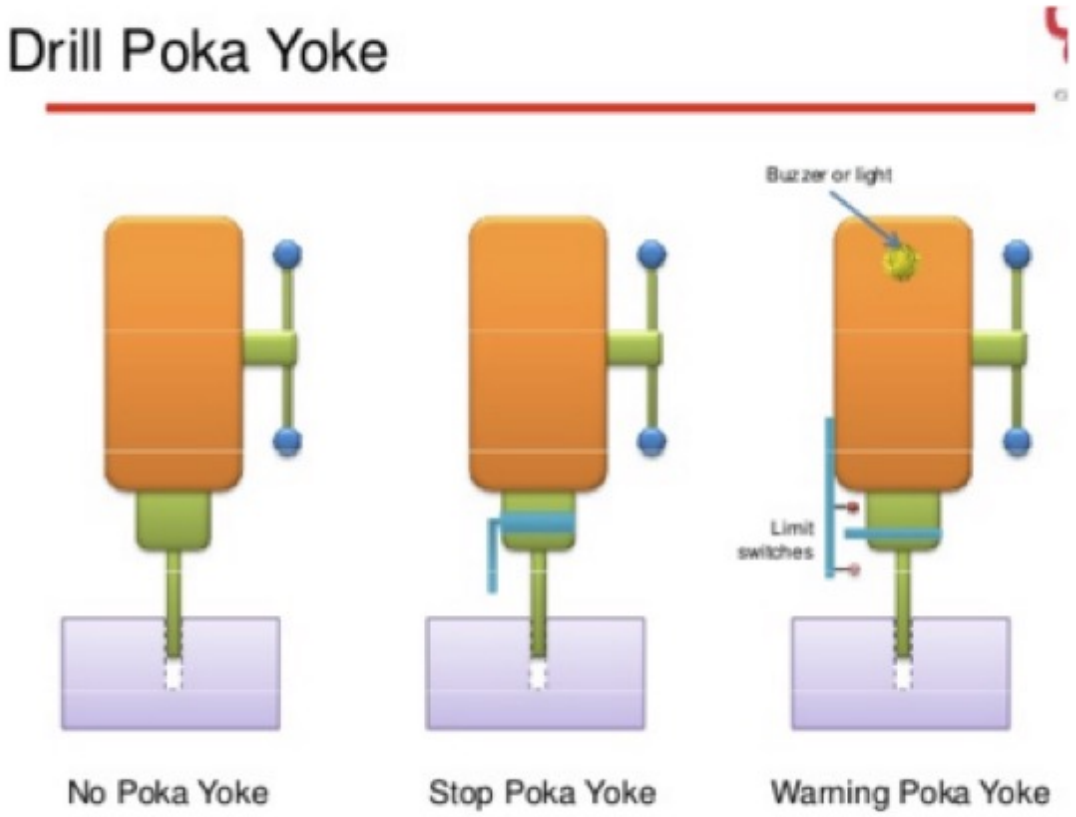
Originally called Baka Yoke (Idiot Proofing) it was changed to Poka Yoke (mistake proofing) by Toyota in 1960's so as not to dishonor anyone to be labeled as an "Idiot".

**Poka Yoke = Mistake Proofing**

*Prevent mistakes rather than correct mistakes*
*Prevent defects rather than correct defects*

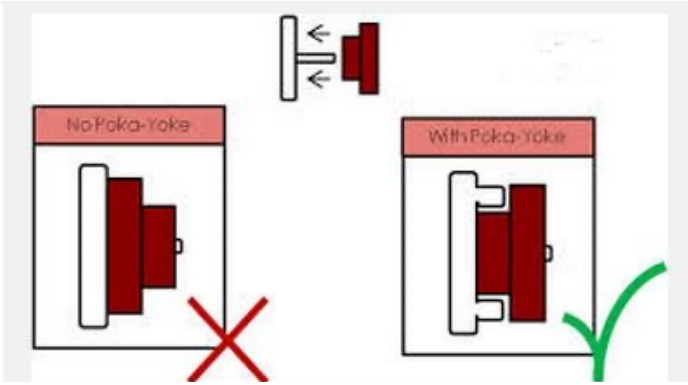
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# POKA YOKE EXAMPLES

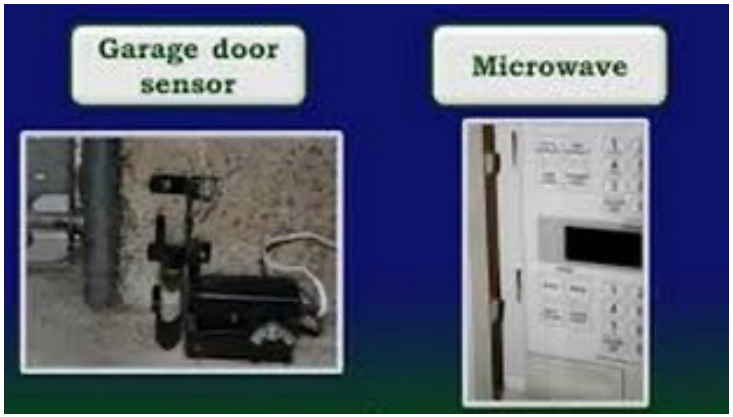



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# POKA YOKE EXAMPLES





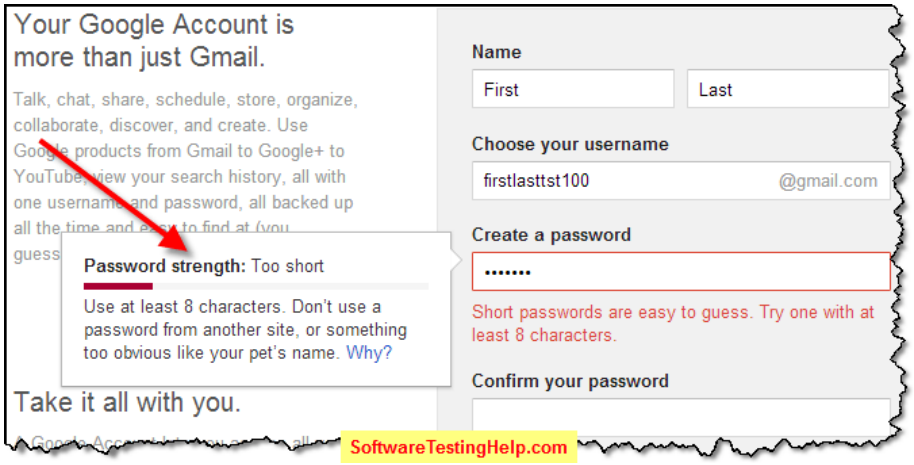







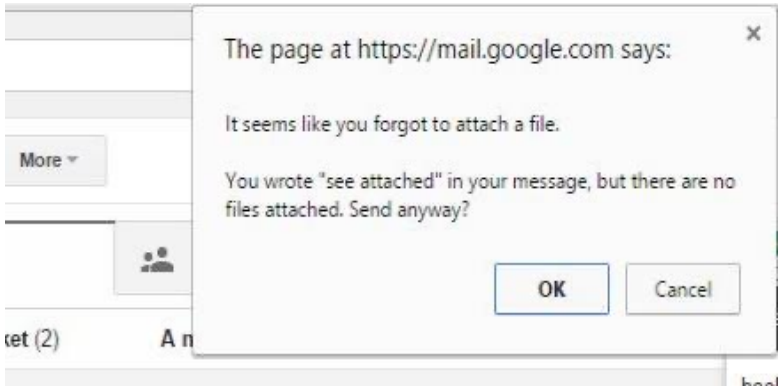
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# POKA YOKE OFFICE EXAMPLES










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# QUALITY AT SOURCE

## (UPSTREAM QUALITY)

- Quality means meeting requirements of the customer (or next step in the process) and not creating defects.
- We can use tools such as **poka yoke** (mistake-proofing) and **visual control** to prevent errors

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# POKA YOKE

## EXAMPLES IN THE OFFICE

**What are some of the common mistake proofing devices on automobiles?**

**What are the current mistake proofing devices at your company?**

**Where might you be able to implement mistake proofing at your company?**

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# QUIZ 4 :

1. What Tool is used to understand what is Critical to Quality ( CTQ ) by Forming 3 categories: *threshold, performance,* and *excitement*?
   - **KANO ANALYSIS**

2. Splitting Customers into groups according to different needs or behaviours is called _____.
   - **SEGMENTING**

3. CTQs are also sometimes called CTCs or CTSs. What does CTS stand for?
   - **CRITICAL TO SATISFACTION**

4. Give one example of a method used to understand the **Voice of the Customer**?
   - **SURVEYS**
   - **FEEDBACK**
   - **FOCUS GROUPS**
   - **REPEAT SALE METRICS, etc**

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# HOMEWORK REVIEW

**(Open Computers and Log into your Portal)**

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# End of Day 1

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LEAN SOLUTIONS ACADEMY



Lean & Six Sigma Training

# Lean Yellow Belt Certification

# CLASS SCHEDULE

## Day 1

- Roles and Responsibilities of Belts
- What is Lean & Six Sigma?
- Lean Principles
- Standard Work
- 8 Wastes
- 5S
- Voice of the Customer (VOC) and CTQs Process
- Jidoka
- Poke Yoke

## Day 2

- Day 1 Review
- PDCA
- Kaizen
- Pull
- Kanban
- Flow
- Visual Management
- SMED
- Total Productive Maintenance
- **YELLOW BELT EXAM (as Homework )**

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# QUIZ 1 REVIEW:

1. What was the name of the first company to use the name 'SIX SIGMA' to describe its Quality Management System?
   - **MOTOROLA**

2. What is the First Principle of Lean production ? What is the most important thing that a Lean process must produce?
   - **VALUE** ( for the customer of the process )

3. Which Japanese company is considered as being the first to use true 'Lean Production "effectively and successfully"?
   - **TOYOTA**

4. A basic principle of Six Sigma is to always find the true original source of a defect or problem. This is called _____?
   - **ROOT CAUSE ANALYSIS**

5. A "Six Sigma Process" is often described one that produces no more than 3.4 DPMO What does DPMO stand for?
   - **DEFECTS PER MILLION OPPORTUNITES FOR DEFECTS**

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# QUIZ 1 REVIEW:

6. What is the role of a Yellow Belt on a Lean Six Sigma project?
    - A YELLOW BELT IS A TEAM MEMBER WHO ASSISTS A GREEN OR BLACK BELT, USING THEIR KNOWLEDGE OF THE PROCESS THAT THEY CURRENTLY ARE WORKING WITHIN.

7. What is the role of a Green Belt in an organisation ?
    - A GREEN BELT IS A PROJECT TEAM LEADER FOR SMALL AND MEDIUM SIZED PROCESS IMPROVEMENT PROJECTS.

8. What is the role of a Black Belt in an organisation ?
    - A BLACK BELT IS A PROJECT TEAM LEADER FOR LARGE PROBLEM SOLVING / IMPROVEMENT PROJECTS or OVERSEES THE WORK OF GREEN BELTS FOR MULTIPLE PROJECTS. A BLACK BELT IS A FULL TIME PROBLEM SOLVER FOR THE ORGANISATION.

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# QUIZ 2 REVIEW:

1. All work shall be highly specified as to content, sequence, timing and _____.
   - **OUTCOME**

2. True or False? Standard work provides a routine for consistency of an operation.
   - **TRUE**

3. True or False?  Standard work helps to hide problems.
   - **FALSE**

4. Discussion:  Why is it so important to audit standard work?

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# QUIZ 2 :

1. Which of the traditional 8-Wastes of ‘DOWNTIME is concerned with reducing the complexity of processes and taking out unnecessary steps or activities ?
   - **NON-ESSENTIAL PROCESSING / OVER PROCESSING**

2. What is the name of the Waste of producing more that the customer demand can absorb ?
   - **OVER-PRODUCTION**

3. What is Waste called when an activity or step in process needs to be repeated because it was not done ‘Right-First-Time’ ?
   - **REWORK / DEFECTS**

4. What Waste results in Queues or Backlogs of materials or work ?
   - **WAITING ( DUE TO A BOTTLE-NECK IN THE PROCESS )**

5. What is the Japanese word for ‘Waste’ ?
   - **MUDA**

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# QUIZ 3 REVIEW:

1. Which stage of the 5S method is used to ensure that the workers have the good habits and discipline to continue the other 4S tasks?
   - **SUSTAIN**

2. In 5S the action of removing unnecessary tools, equipment and materials from the workspace is called _____.
   - **SORT**

3. Cleaning the workplace of dirt, dust and litter is called what in 5S ?
   - **SHINE**

4. Give one example of a 5S method used for **SET IN ORDER / STRAIGHTEN**
   - **SHADOW BOARDS**
   - **RACKS**
   - **COLORED LABELS**
   - **FLOOR MARKING etc**

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# QUIZ 4 REVIEW:

1. What Tool is used to understand what is Critical to Quality ( CTQ ) by Forming 3 categories: *threshold, performance,* and *excitement*?
   - **KANO ANALYSIS**

2. Splitting Customers into groups according to different needs or behaviours is called _____.
   - **SEGMENTING**

3. CTQs are also sometimes called CTCs or CTSs. What does CTS stand for?
   - **CRITICAL TO SATISFACTION**

4. Give one example of a method used to understand the **Voice of the Customer**?
   - **SURVEYS**
   - **FEEDBACK**
   - **FOCUS GROUPS**
   - **REPEAT SALE METRICS, etc**

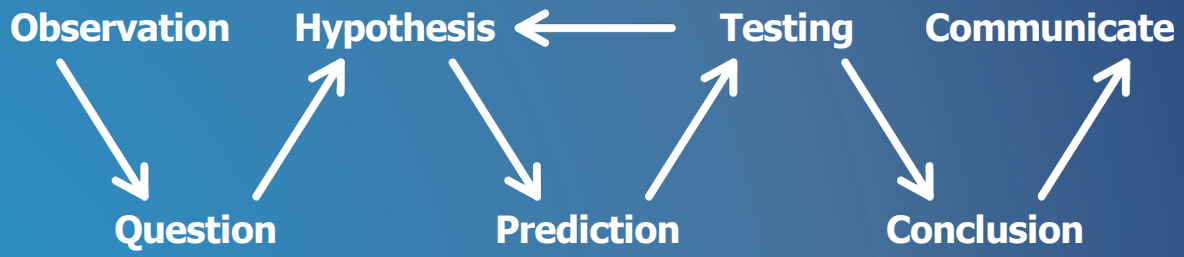
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# PDCA

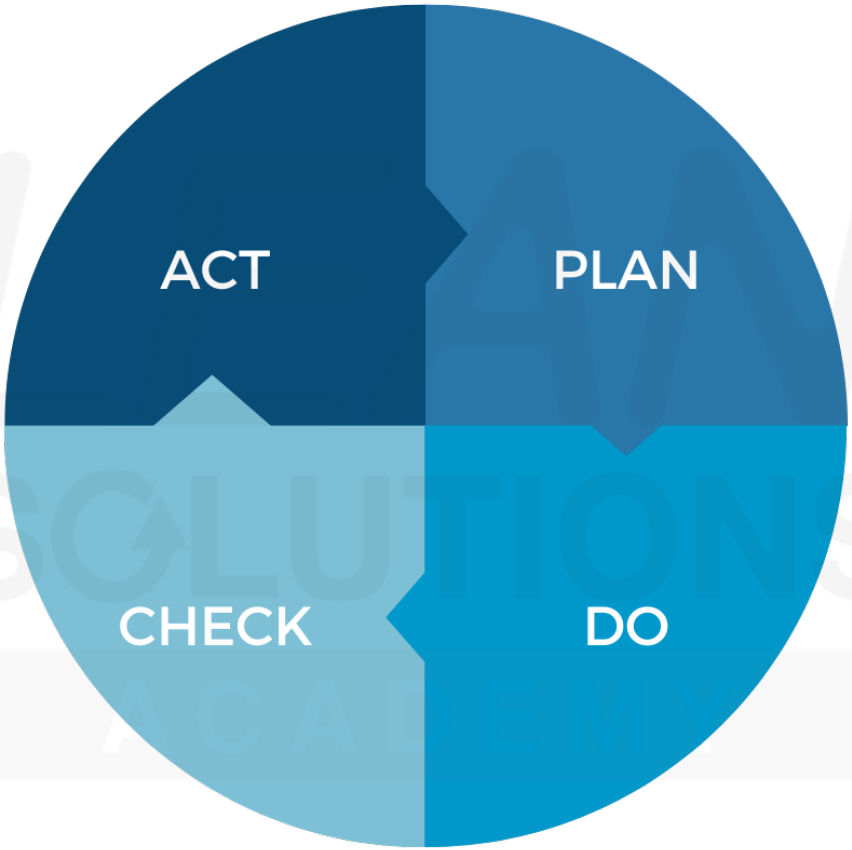
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# SCIENTIFIC METHOD




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# BALL TOSS EXERCISE




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# KAIZEN &

## CONTINUOUS IMPROVEMENT

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# WHAT IS KAIZEN?

- Kaizen is a Japanese word made up of two distinct characters:
- Small changes for the better = Continuous Improvement
- Managing daily improvement (part of Lean Management System)
- Continuous Improvement Projects

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# WHAT IS A KAIZEN EVENT?

A Kaizen Event (different than Kaizen as a mindset) is a focused team activity with a specific, aggressive breakthrough objective aimed toward solving a well-defined problem.

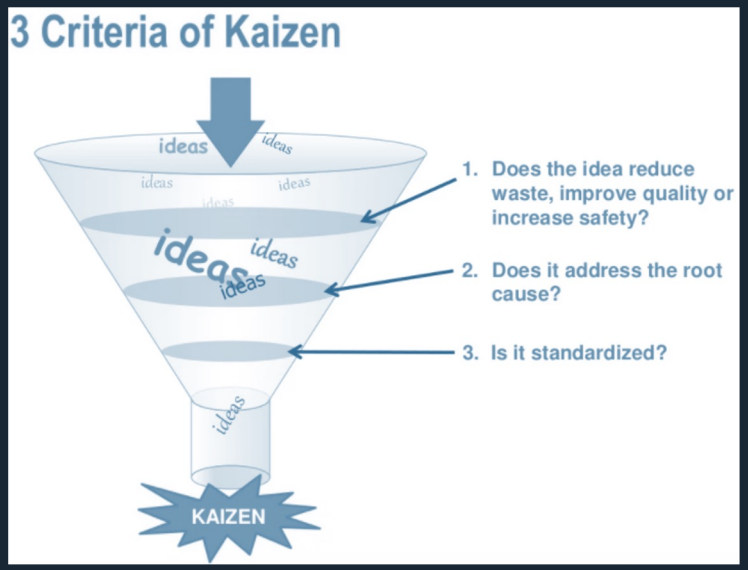
You can expect to accomplish huge results in a very short time frame (usually 2-5 days).

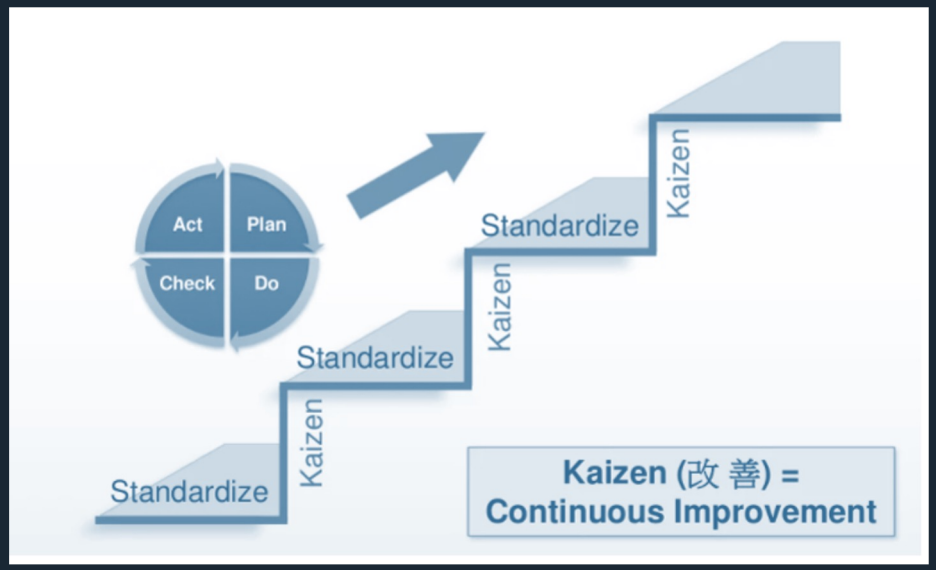



Huge results
In a
Short time
frame

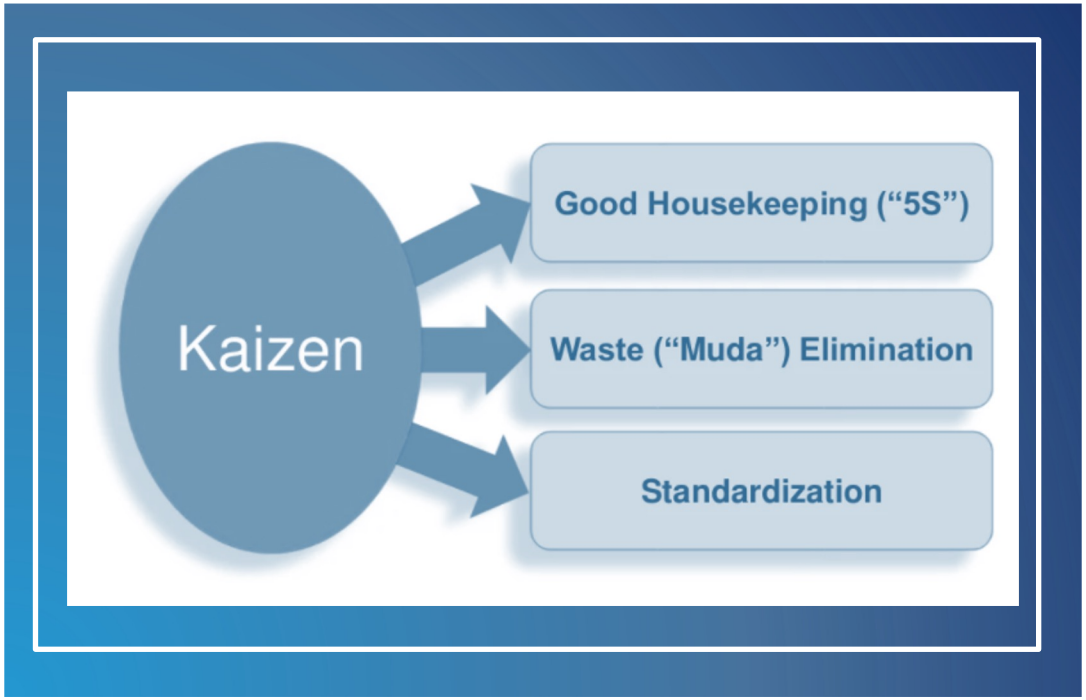
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# KAIZEN IS A CONTINUOUS PROCESS




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# VARIETIES OF KAIZEN METHODS

Individual (1-2 people) Versus Teamed (5-9)

Day-to-Day (2 second- improvements) Versus Special Event

Limit the hours spent on the project
The project scope must be considered when limiting available time

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| Kaizen | Innovation |
| --- | --- |
| Un-dramatic | Dramatic |
| Low Cost | High Cost |
| Low Risk | High Risk |
| Human Effort | Technology |
| No Brainer | More Thought |

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# BENEFITS
## OF KAIZEN

- Empowers employees, enriches the work experience & brings out the best in everyone
- Promotes the growth of the Employee & the Company
- Improves quality, safety, cost structures, delivery, environments, throughput & customer service/ satisfaction
- Provides guidance from employees & serves as a barometer for leadership



# TRADITIONAL KAIZEN

One Week Commitment

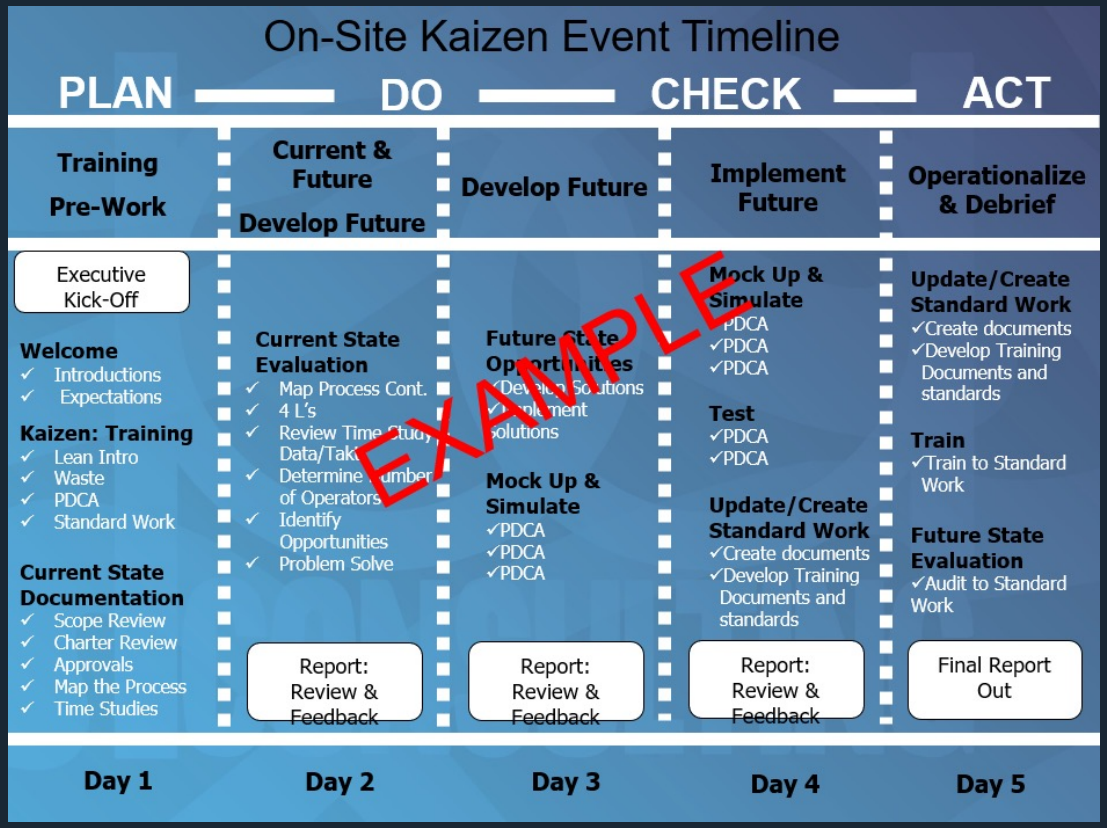
Lots Of Prep Work

Lots Of Ideas & Actions




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# WHAT'S IN A WEEK – A LOT




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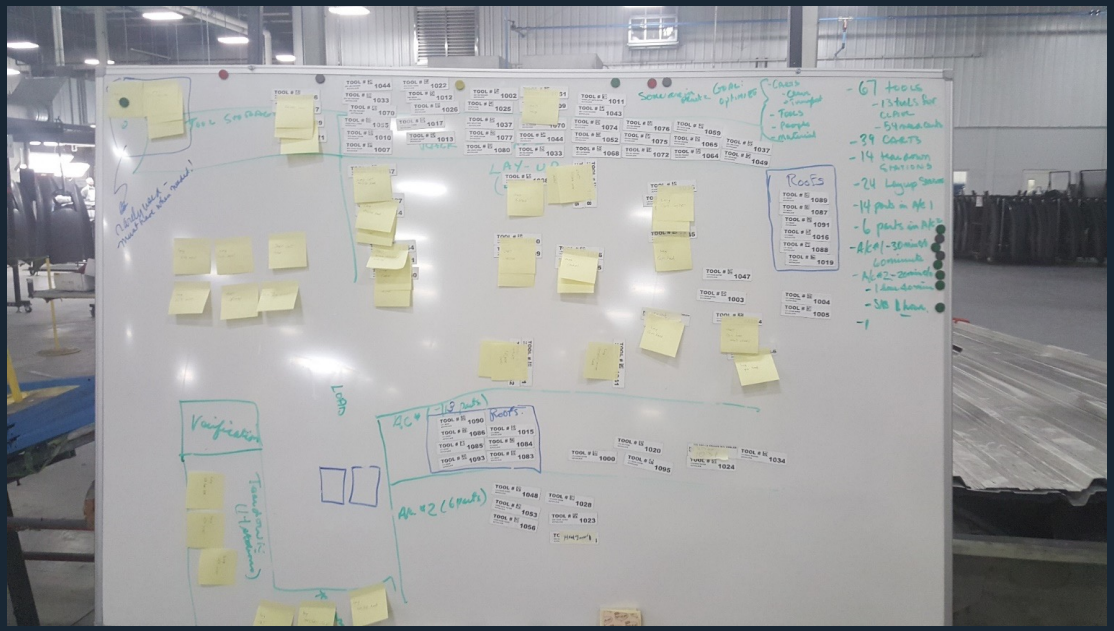
# WHAT'S

## Different About The Kaizens At Plasan?

- The weeklong 5-Day Kaizens have been swapped
- Four, quick, 5 hour Kaizens were held in the month of January.
- Involved in the Kaizens were representatives from Maintenance, Engineering, Quality, Supervisors, Team Leads, and the experts, the operators.

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# AUTO CLAVE QUICK KAIZEN




## DEPLOYMENT CHAMPION - SUPERVISOR

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# TOOL CART STORAGE
## LOCATED BY TEAR DOWN

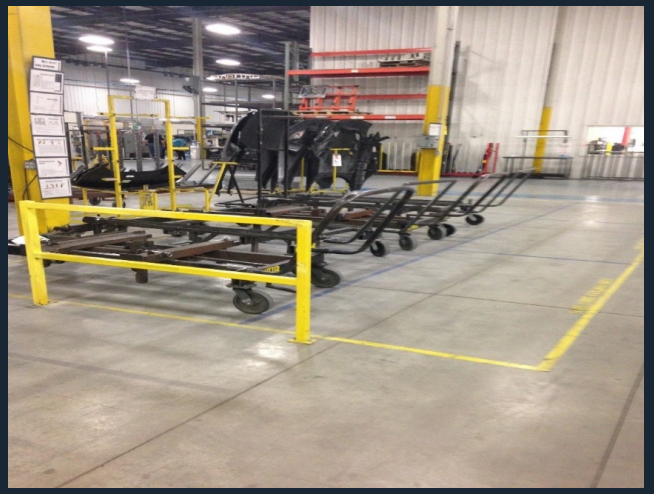



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# GUARD RAIL WAS ADDED

## TO PREVENT OVERFLOW INTO CART PARKING

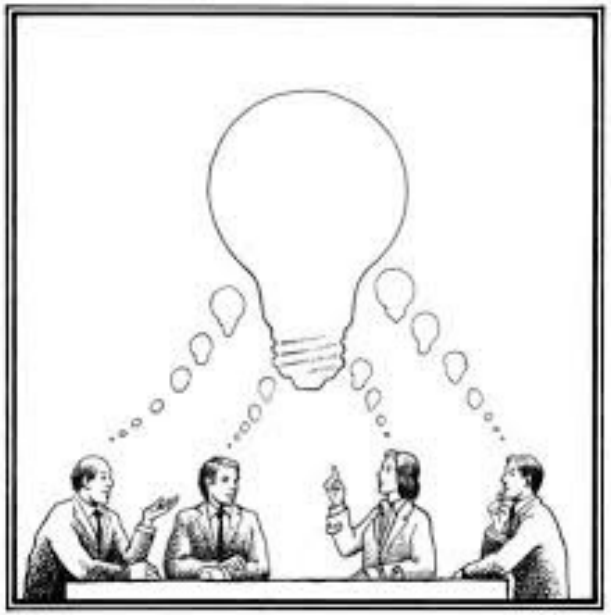


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# WHAT CAN WE DO DIFFERENTLY?



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# SUGGESTED
## KAIZEN PROCESS

1. Employee identifies a problem, waste/loss, or an opportunity for improvement and writes it down.
2. Employee develops an improvement idea and discusses it with his or her supervisor.
3. Supervisor reviews the idea within 24 hours and encourages immediate action.
4. Employee implements the idea. If a larger improvement idea is approved, the employee should take leadership to implement the idea.
5. Idea is written up on a simple form in less than three minutes.
6. Supervisor posts the form to share with and stimulate others and recognizes the accomplishment.

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# CAPTURE THE IDEAS

**Continuous Improvement Idea**

Name: Shift: Dp #: 3016- Date:

**Which of the seven wastes does this idea reduce? (Circle One)**

Over-Production Transportation Motion Waiting Inventory Defects Over-Processing

**Which measure does this impact on the team board? (Circle One)**

Safety Quality Schedule Cost Culture Environment

**Continuous Improvement Idea** ***(Attach additional information, as required.)***

**Improvement Results** ***(Attach additional information, as required.)***

| Reviewed | Accepted | Not Accepted | Implemented | Complete | Implemented = Completed by mbr<br>Complete = Recognized by mgmt | Award given/amount:<br>Date: |
|---|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | | |

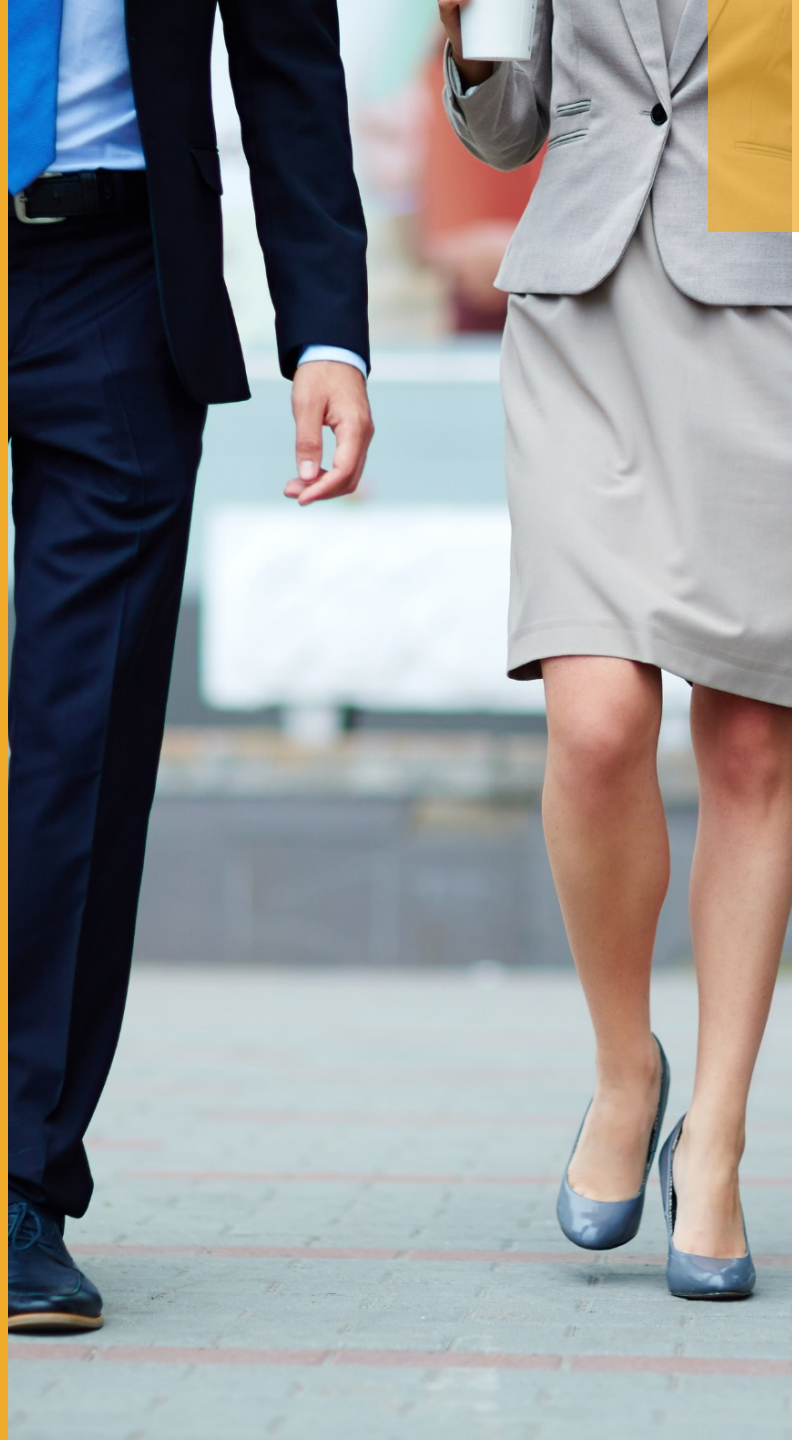
:pe 02/11/2019 WHITE: HMS YELLOW: Team Leader/Supv PINK: Member

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# GEMBA WALKS

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# WHAT IS A GEMBA WALK?

**The Gemba walk is an essential part of the Lean management philosophy.**

- Its purpose is to allow managers and leaders to observe the actual work process, engage with employees, gain knowledge about the work process and explore opportunities for continuous improvement.
- A Gemba Walk is also an opportunity for managers and leaders to coach and receive coaching.

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# GEMBA WALKS
## ARE NOT DONE ALONE

Gemba walks are meant to be coaching opportunities.

**Step 1:** Use your LSW to establish a day/time and stick to your schedule. Make it routine!

**Traditional Management Style: "Do It My Way"**



**Lean Leadership Style: "Follow Me, and We'll Figure This Out Together"**



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# DEFINE
# THE PURPOSE

Define ‘purpose’ for walk – why doing it?

Define scope for walk – where headed?

**Coach appropriate behaviors to participants:**

- One conversation at a time.
- Show respect. Listen more than you talk.
- Make no on the spot judgements, seek to understand.

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# TYPES OF GEMBA WALKS

- Safety
- 5S
- Waste – Waste Walk
- Process Focus – Never Focus on Individuals
- Walk the Value Stream of a Product





# WHAT TO DO

## ON A GEMBA WALK

- If with another leader, ask to SEE their leader standard work
- Review Hr x Hr and Tier Boards
- Review corrective actions / plans for top issues
- Discuss team board problem solving process
- Review training matrix and ensure plans are in place
- Pay attention to lean waste and review plans

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# TIPS & POINTS
## TO REMEMBER

### Step 1: Create a Theme

Before a walk begins, managers should pick a theme to guide the entire Gemba walk. This narrows the focus of the Gemba walk and yields better results, as attention is not spread amongst different themes and objectives. Once a theme has been chosen it's easier to tailor your Gemba walk questions to the theme you chose, and ask quality questions.

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# TIPS & POINTS
## TO REMEMBER

### Step 2: Prepare the Team

Inform the team by explaining what a Gemba walk is and what to expect from a routine Gemba walk. Share this in your Tier Meetings. Consider sharing your checklist, too.

This lowers a team's anxiety as the Gemba walk will not be perceived as an evaluation, but rather, a collaboration between participants. Getting buy-in from the team beforehand will also raise questions that could have been missed.

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# TIPS & POINTS
## TO REMEMBER

### Step 3: Focus on the Process

Stick to the evaluation of the process and how things are done. Here, a checklist can help. By writing questions that force you to assess the process, not the person, you can avoid the most common Gemba walk mistakes: **blaming.**

Remember: **You are there to identify opportunities of improvement in the process and barriers on the shop floor hindering productivity.**

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# TIPS & POINTS
## TO REMEMBER

### Step 4: Keep the Value Stream Front & Center

Make sure your checklist traces the whole value stream. By sketching these questions out beforehand, you can ensure you don't miss any crucial stations or processes.

Focusing the bulk of your Gemba walk on the value chain is more effective in identifying bottlenecks and potential pockets of waste. Removing such bottlenecks will improve overall performance across the value chain.

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# TIPS & POINTS
## TO REMEMBER

### Step 5: Record Your Observations

**Record everything.** Record every data point you encounter on your Gemba walk. Don't make assumptions or recommendations before journaling everything you find on the Gemba walk. Here, checklists are helpful. You can record your observations as answers to the questions you know you need answered. You can also just take notes or record and document your findings via video.

Regardless of method: **record, record, record!**

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# TIPS & POINTS
## TO REMEMBER

### Step 6: Get a Second Vantage Point

Once the Gemba walk has concluded and all relevant information has been recorded, seek a second opinion. Better yet, have another team member write their own checklist. **Having a fresh set of eyes review your findings could yield important insights.**

Comparing checklists can help you locate any gaps in your own thinking. This second perspective could be someone far removed from the operations or an experienced operator who did not take part in the Gemba walk. Feedback reveals overlooked information.

# TIPS & POINTS
## TO REMEMBER

### Step 7: Solicit Feedback

Present your findings to the team regardless of outcome. Whether your findings were insignificant and no changes need to be made to the operations or vice versa. This brings the collaboration between stakeholders full circle and negates any feelings of being watched by the team during the Gemba walk.

If changes need to be made, include them in your presentation tying back to your findings. This brings buy-in from all stakeholders and increases probability of success once the change to operations occurs.

### Conclusion

Gemba walks are a crucial observational method for assessing a manufacturing operation. Checklists are an easy, quick tool for adding structure to your observations, and for getting more out of the gemba walks you schedule. Use a checklist and stick to your plan.

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# QUESTIONS
## TO ASK

**Simple 3 Question Summary:**

1. What is Working?
2. What Is NOT Working?
3. Given That, What Will You Do Differently Going Forward?

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# GEMBA CHECKLIST




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# QUIZ 5:

1. What does kaizen stand for?
    - **SMALL CHANGE FOR THE BETTER / CONTINUOUS IMPROVEMENT**

2. What are the three criteria of kaizen?
    - **DOES THE IDEA REDUCE WASTE, IMPROVE QUALITY, AND/OR INCREASE SAFETY?**
    - **DOES THE IDEA ADDRESS THE ROOT CAUSE?**
    - **IS IT STANDARDIZED?**

3. What are the different types of Gemba walks?
    - **SAFETY, 5S, WASTE, VALUE STREAM WALK**

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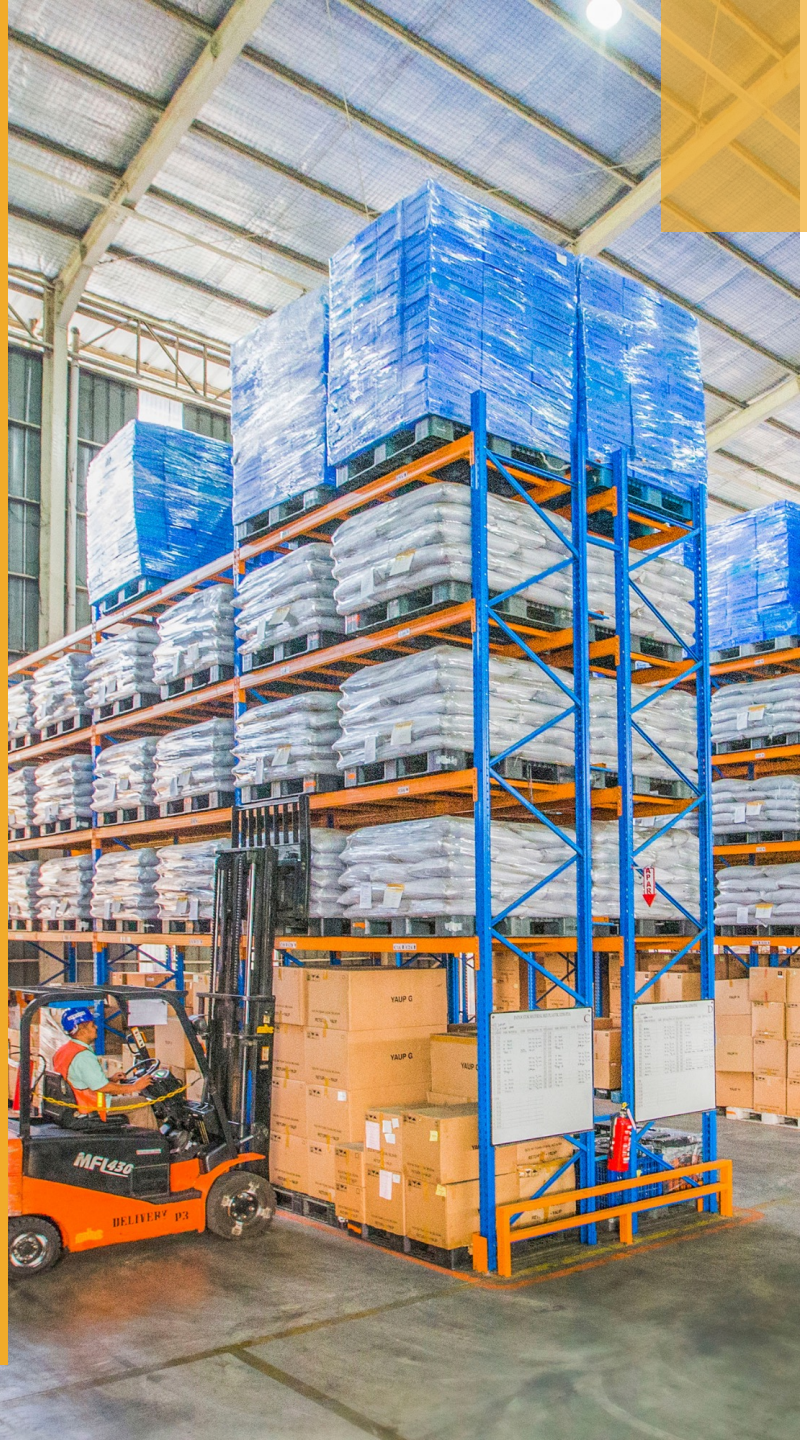


# Changeover Reduction

# SMED

*brought to you by:*

PATRICK ADAMS CONSULTING




# WHAT IS

## QUICK CHANGEOVER?

A process for *dramatically* reducing setup time changeover time

Also Known as:

- Single Minute Exchange of Dies (SMED)
- Setup Reduction

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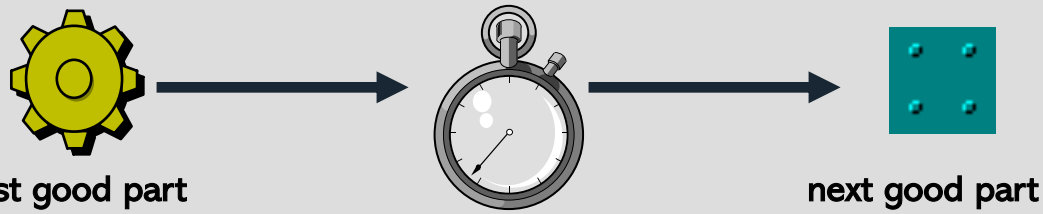


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# SET UP DEFINITION

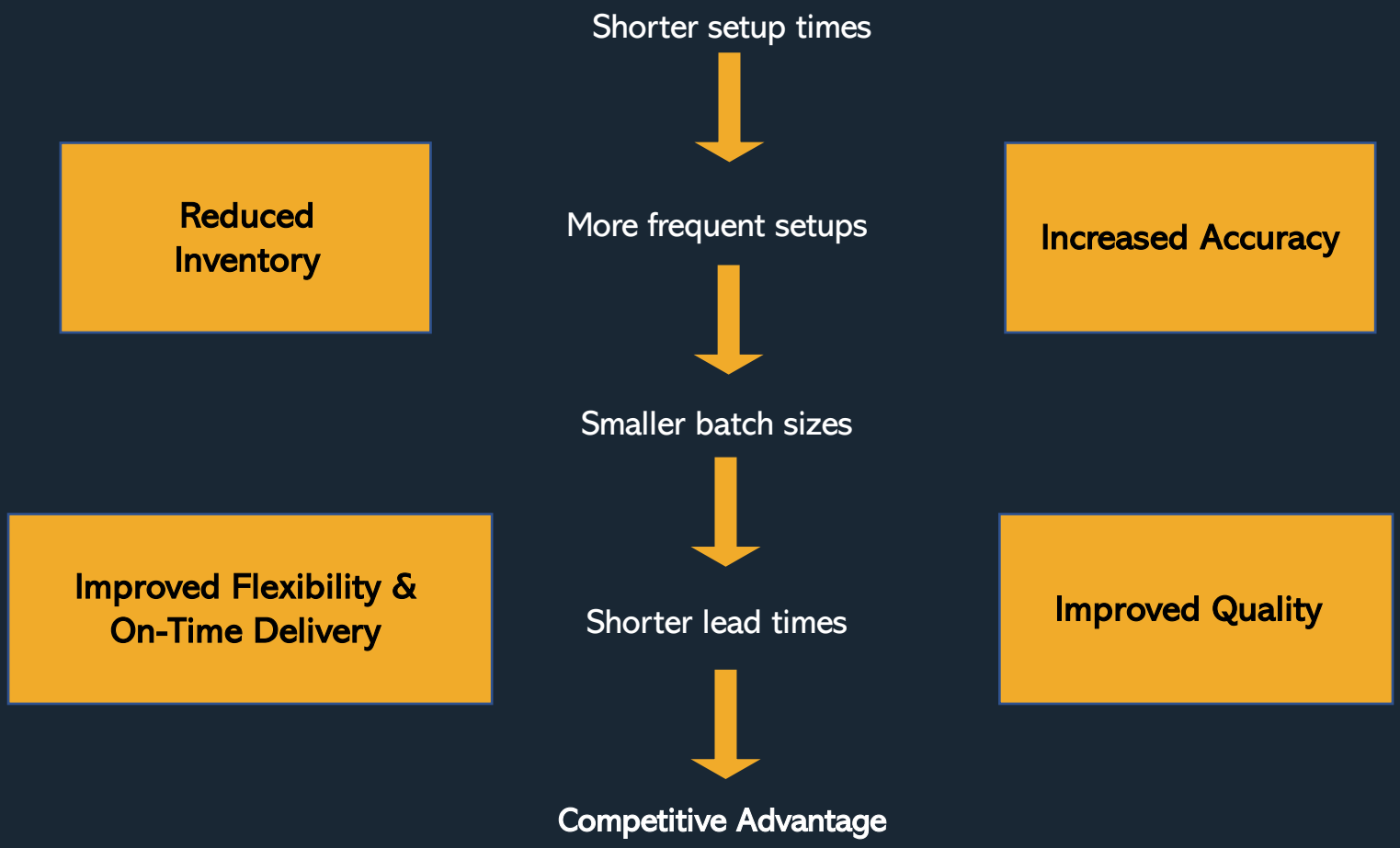
*During this time the equipment is idle and not producing parts.*

The length of time it takes to changeover a machine from the last good part of a production run to the first good part of the next production run.

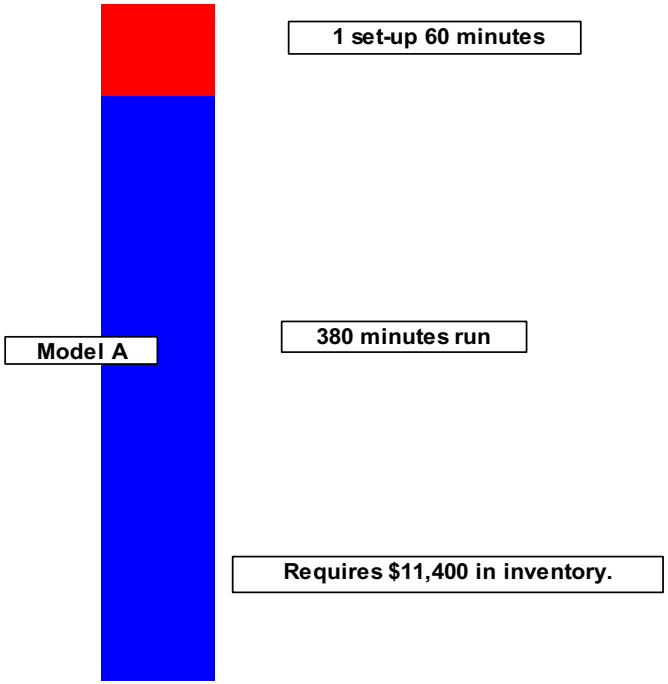


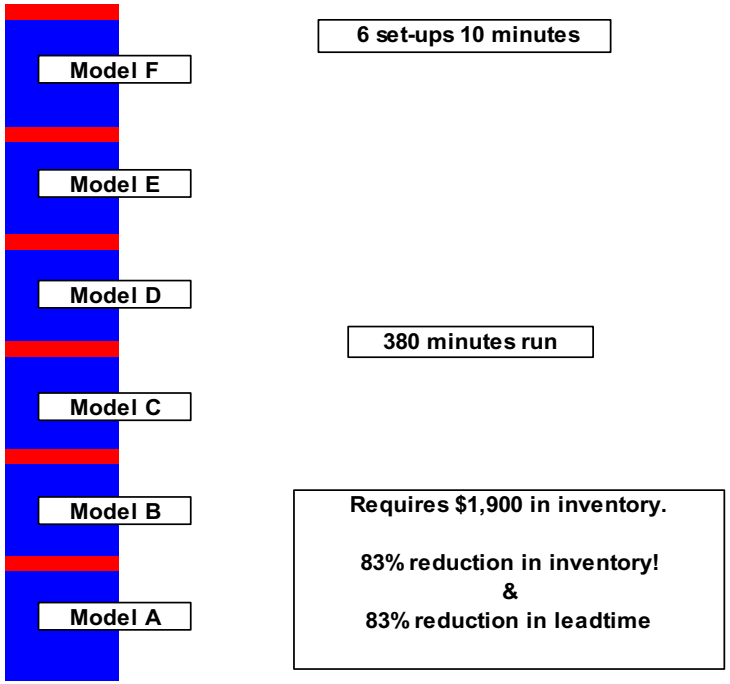

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# WHY IMPLEMENT
## QUICK CHANGEOVER




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6 different models produced.
1900 parts required per day.
Cycle Time = 12 seconds
1900 parts /12 seconds each =
380 minutes required per day.

It will take 6 days to cycle thru all models requiring inventory of at least 6 days of each model. That is 11,400 pieces total,if each costs $1 there is $11,400 because of set-up.

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# QUICK CHANGEOVER: DEFINITION

## Internal Set-Up Activities

- An activity or task that can only be performed while the machine is stopped. (Stopping the machine to change a tool)

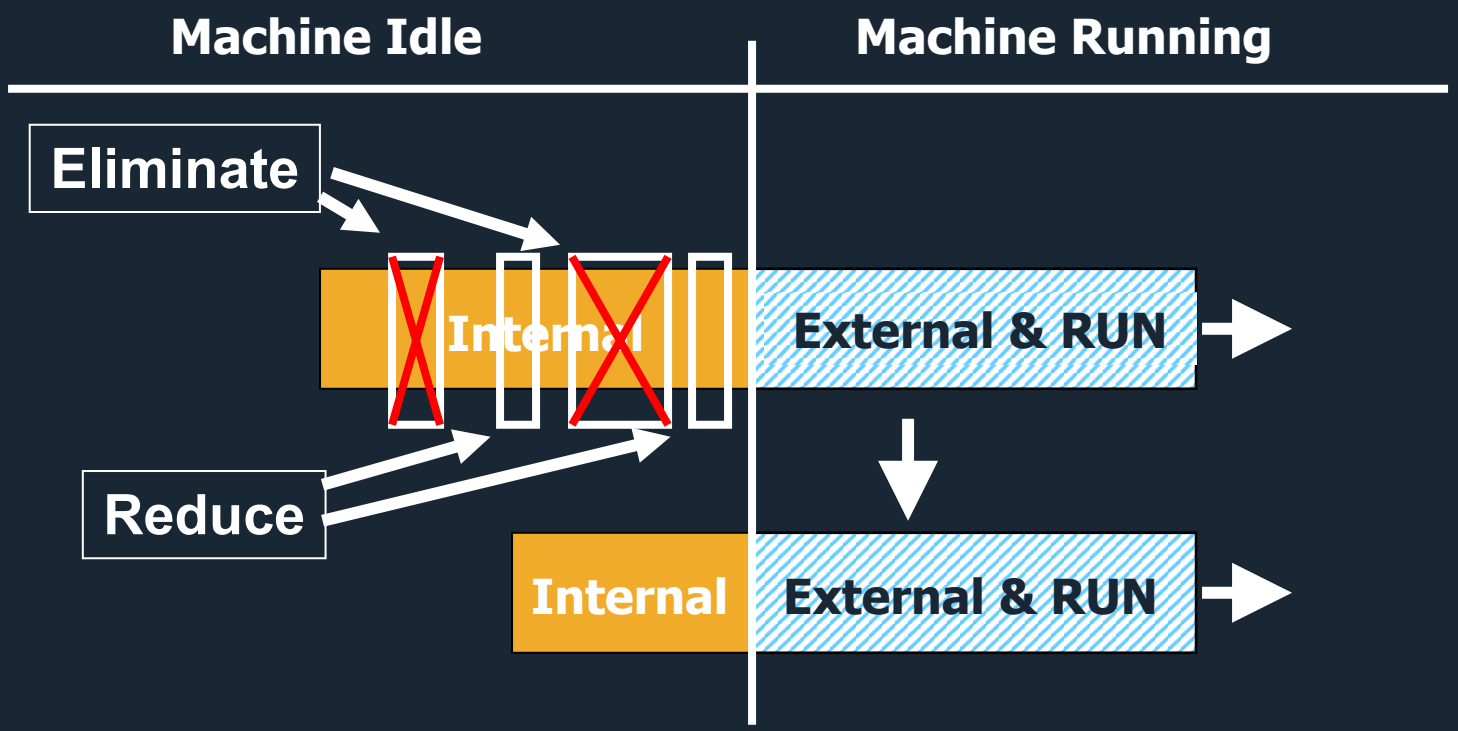
## External Set-Up Activities

- An activity or task that can be performed while the machine is running (Prepare tools, tooling, and required paperwork, while the machine is running)

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| Steps | Pre-Work | |
|---|---|---|
| 1. Measure total changeover time, study current conditions. "Document Reality." (Video) | | 60 Minutes |
| 2. Identify internal vs. external steps and calculate individual times. | | 5 5 3 5 3 8 6 11 3 11<br>E I E I E I E I E I |
| 3. Strip out external steps and pull them forward before previous part run ends. | 20 Min. E | I |
| 4. Reduce and eliminate the internal setup, adjustments, etc. | 20 Min. E | I 20 Minutes |
| 5. Reduce the external elements. | 10 Minutes E | I 20 Minutes |
| 6. Identify parallel tasks. Two people working in harmony with one another, rather than one. | 10 Minutes E | I 10 Minutes |
| 7. Practicing the new and improved changeover method | 8 Minutes E | I 8 Minutes |
| 8. Standardize and improve the new changeover procedure over time. | 8 Minutes E | I 8 Minutes |

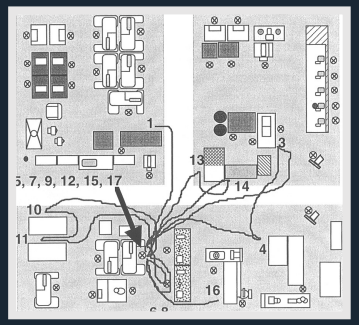
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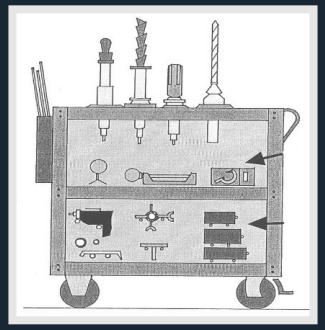



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# REDUCE/ELIMINATE INTERNAL STEPS

- Implement good 5S
- Standardize spacer & fixture heights
- Pre-set stops, gauges, limit switches, and tools
- Add center lines and reference planes
- Use of Changeover Carts
- Preset locations to eliminate measurement



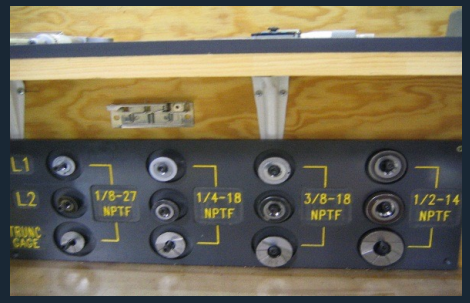


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# REDUCE/ELIMINATE INTERNAL STEPS

- Numerical Settings vs. “feel”
- Gauges used so that adjustment can be preset without producing any defective parts
- Color-coding setup locations per part numbers
- V-notch and pin locators for dies
- Quick Release Clamps (one-turn / one-motion)



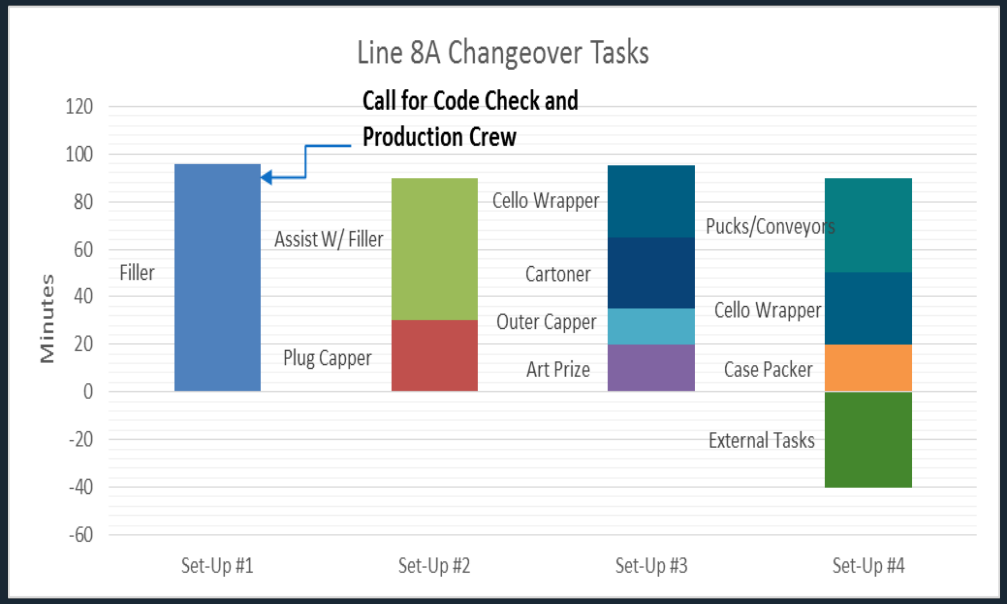





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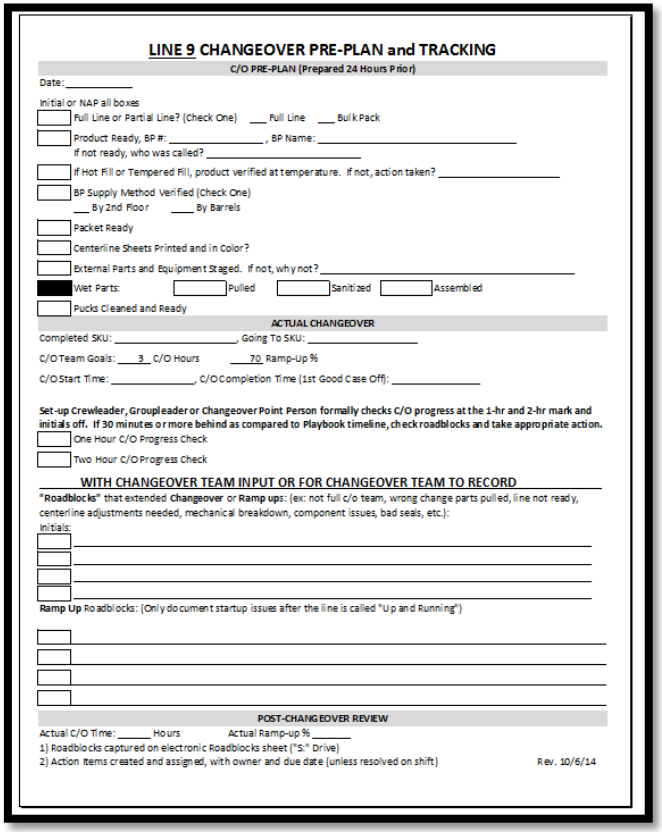
# REDUCE/ELIMINATE INTERNAL STEPS

- Develop changeover sequencing (playbook)
- Develop standardized work chard (create a checklist)




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# REDUCE/ELIMINATE INTERNAL STEPS



**LINE 9 CHANGEOVER PRE-PLAN and TRACKING**

**C/O PRE-PLAN (Prepared 24 Hours Prior)**

Date: _____

Initial or NAP all boxes

☐ Full Line or Partial Line? (Check One) ___ Full Line ___ Bulk Pack

☐ Product Ready, BP #: _____, BP Name: _____
If not ready, who was called? _____

☐ If Hot Fill or Tempered Fill, product verified at temperature. If not, action taken? _____

☐ BP Supply Method Verified (Check One)
___ By 2nd Floor ___ By Barrels

☐ Packet Ready

☐ Centerline Sheets Printed and in Color?

☐ External Parts and Equipment Staged. If not, why not? _____

■ Wet Parts: ☐ Pulled ☐ Sanitized ☐ Assembled

☐ Pucks Cleaned and Ready

**ACTUAL CHANGEOVER**

Completed SKU: _____, Going To SKU: _____

C/O Team Goals: ___3___ C/O Hours ___70___ Ramp-Up %

C/O Start Time: _____, C/O Completion Time (1st Good Case Off): _____

**Set-up Crewleader, Groupleader or Changeover Point Person formally checks C/O progress at the 1-hr and 2-hr mark and initials off. If 30 minutes or more behind as compared to Playbook timeline, check roadblocks and take appropriate action.**

☐ One Hour C/O Progress Check

☐ Two Hour C/O Progress Check

**WITH CHANGEOVER TEAM INPUT OR FOR CHANGEOVER TEAM TO RECORD**

**"Roadblocks"** that extended **Changeover** or **Ramp ups**: (ex: not full c/o team, wrong change parts pulled, line not ready, centerline adjustments needed, mechanical breakdown, component issues, bad seals, etc.):

Initials:

☐ _____
☐ _____
☐ _____
☐ _____

**Ramp Up** Roadblocks: (Only document startup issues after the line is called "Up and Running")

☐ _____
☐ _____
☐ _____
☐ _____

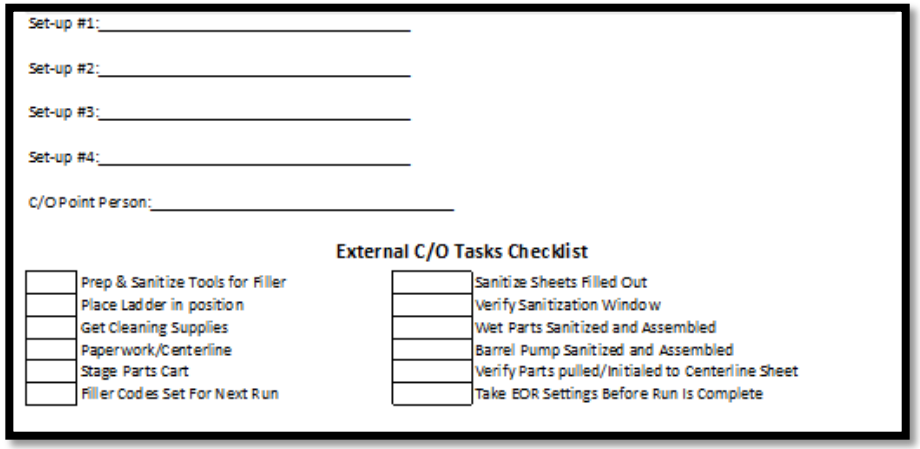
**POST-CHANGEOVER REVIEW**

Actual C/O Time: _____ Hours Actual Ramp-up % _____

1) Roadblocks captured on electronic Roadblocks sheet ("S:" Drive)
2) Action Items created and assigned, with owner and due date (unless resolved on shift)

Rev. 10/6/14

## Pre-Plan Meeting & Checklist



Set-up #1: _____

Set-up #2: _____

Set-up #3: _____

Set-up #4: _____

C/O Point Person: _____

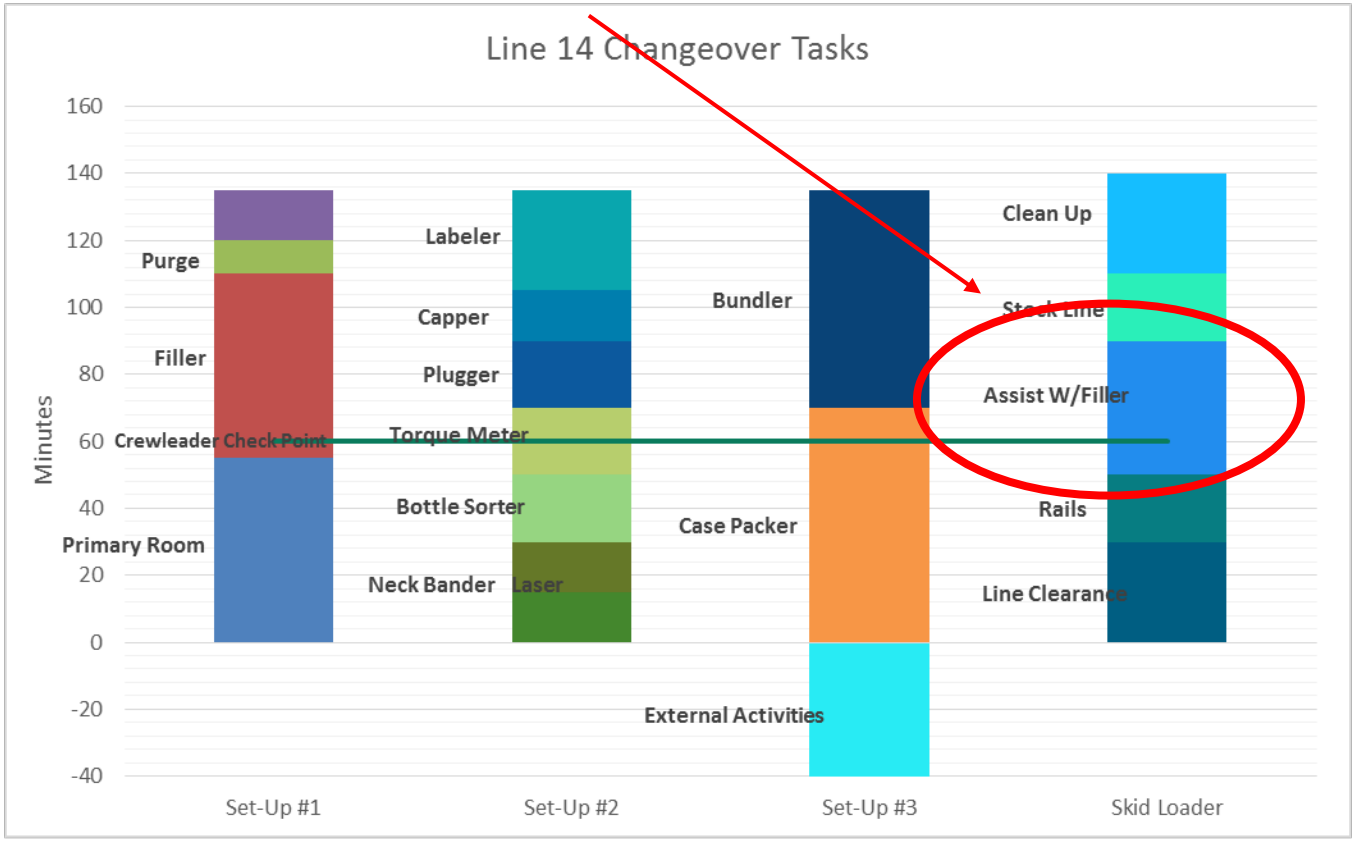
**External C/O Tasks Checklist**

| | |
|---|---|
| ☐ Prep & Sanitize Tools for Filler | ☐ Sanitize Sheets Filled Out |
| ☐ Place Ladder in position | ☐ Verify Sanitization Window |
| ☐ Get Cleaning Supplies | ☐ Wet Parts Sanitized and Assembled |
| ☐ Paperwork/Centerline | ☐ Barrel Pump Sanitized and Assembled |
| ☐ Stage Parts Cart | ☐ Verify Parts pulled/Initialed to Centerline Sheet |
| ☐ Filler Codes Set For Next Run | ☐ Take EOR Settings Before Run Is Complete |

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# PARALLEL TASKS

Identify areas where two or more people can work together.




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# STANDARDIZE/IMPROVE THE PROCEDURE OVER TIME

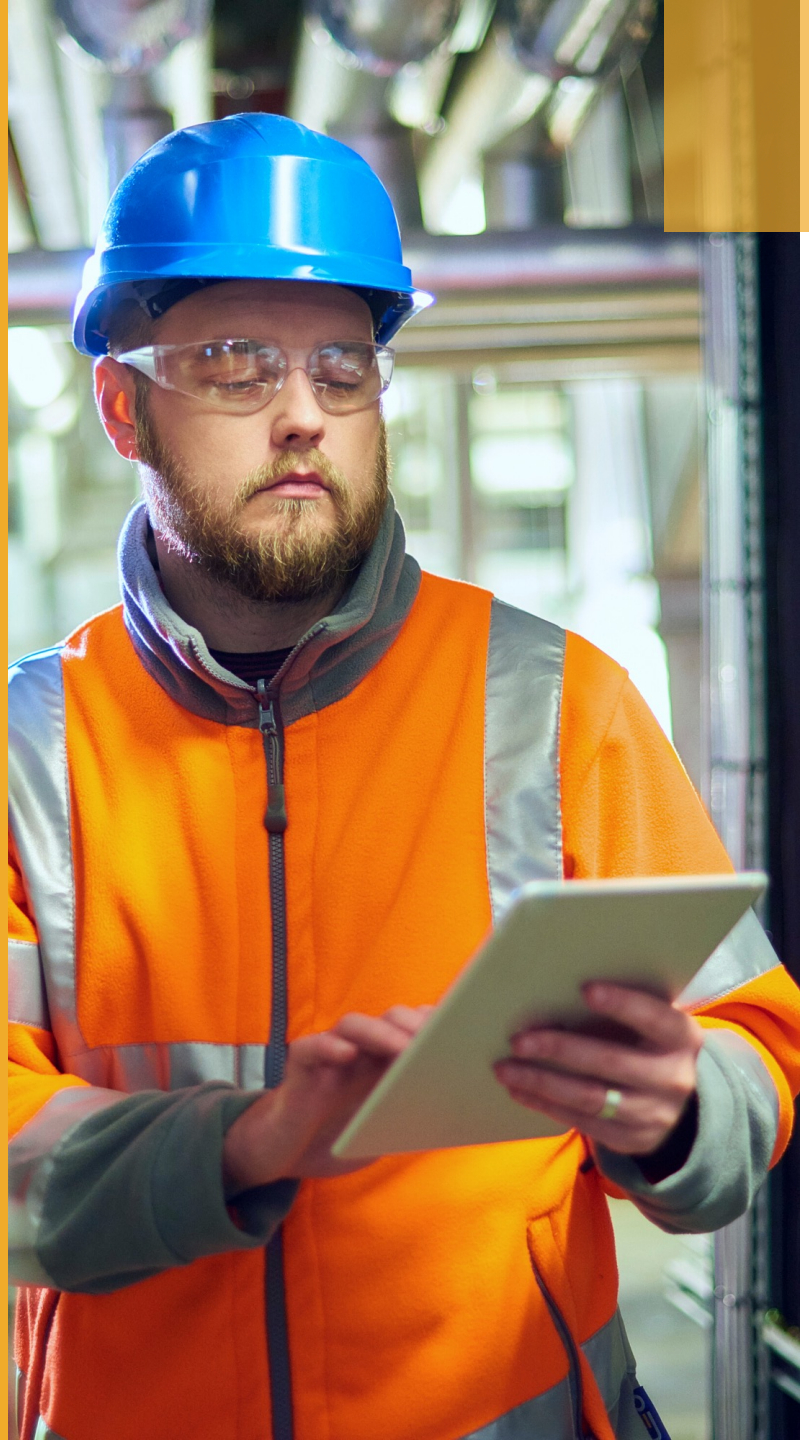









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# TOTAL PRODUCTIVE MAINTENANCE

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# WHAT IS

## TOTAL PRODUCTIVE MAINTENANCE?

A set of techniques which ensures that each and every machine in the production process is always able to perform its required task

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# WHAT IS

## TOTAL PRODUCTIVE MAINTENANCE?

- The approach needs to be Total; It requires the participation of all employees. Production operators are trained to handle routine maintenance activities such as lubricating, cleaning, tightening and inspecting equipment on a regular basis
- It blurs the distinction between the roles of production and maintenance by placing a strong emphasis on empowering operators to help maintain their equipment.

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# WHY IMPLEMENT
## TOTAL PRODUCTIVE MAINTENANCE?

**TPM increases stability by…**

- Reducing unscheduled downtime
- Determining abnormal / normal conditions at a glance
- Improving knowledge on equipment operation and maintenance
- Equipment performs as expected
- Equipment is ready when needed

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# TPM APPROACH

A shared responsibility for the equipment;

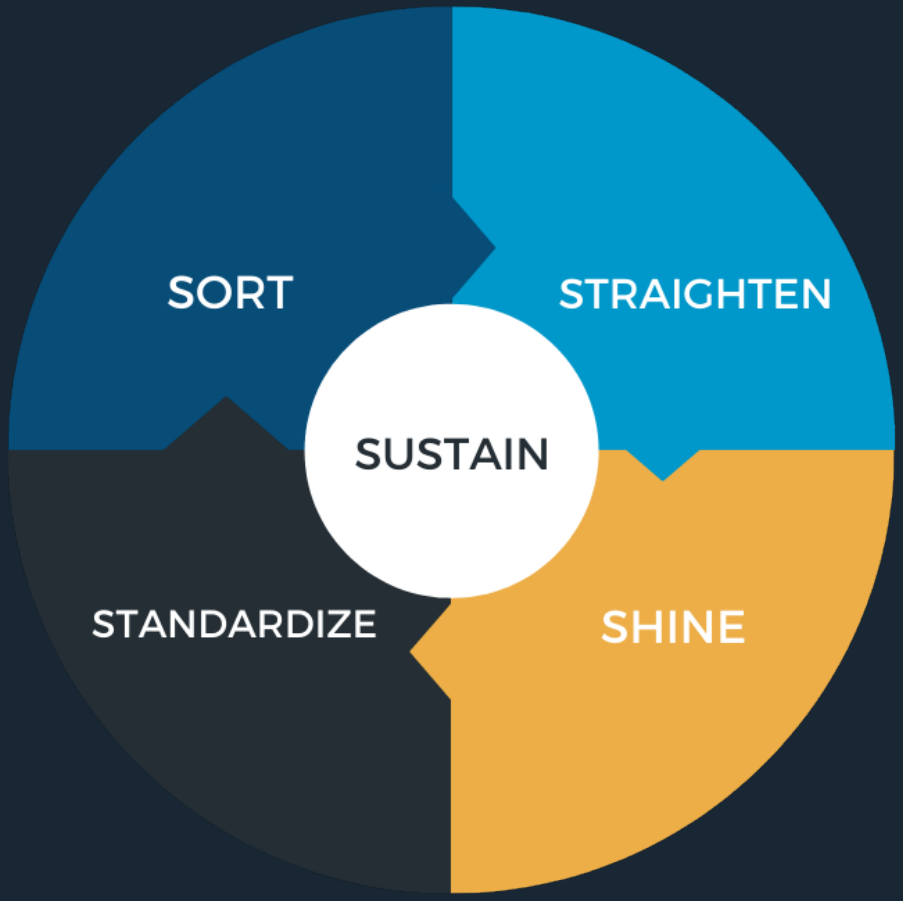
- It gives operators a chance to take ownership of their equipment
- Frees up the resources needed to fix problems caused by lack of maintenance
- Operators work together with maintenance

It seeks the total productivity of all the equipment;

- Achieved by focusing on the elements which account for the usual major losses, or downtime that occur to equipment

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# RESTORE TO ORIGINAL CONDITION




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# DOES THE MACHINE HAVE AN OIL LEAK?



# DOES THE MACHINE HAVE AN OIL LEAK?





# MEASURE OEE

OEE stands for “Overall Equipment Effectiveness”.

OEE is a metric that identifies the percentage of planned production time that is truly productive. It was developed to support TPM initiatives by accurately tracking progress towards achieving “perfect production”.

**Simply put – it identifies the percentage of manufacturing time that is truly productive.**

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# DEVELOP

## THE ROUTINE & SCHEDULE

- Research equipment-maker's recommendations
- Add "experience-based" things to be done
- Utilize all your resources when determining tasks
- Use Preventative Maintenance System already in place

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# TRAIN PERSONNEL
## ON RESPONSIBILITIES

### Operating equipment correctly and safely

- Do operators know how to start-up, shut-down and operate the equipment?
- Can operators run the equipment safely?
- Can operators changeover the equipment safely and in the targeted time?

### Knowing recommended equipment maintenance

- Do operators have the required level of knowledge on the equipment?
- Do operators understand how to perform the required Preventative Maintenance routine, and scheduled tasks?

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# OUR ROLES & RESPONSIBILITIES

## Operators perform routine maintenance

- Think of them as the car owner
  - Goal is to keep the car at optimal performance
    - Learn to properly operate car
    - Check and refill fluids
    - Keep automobile clean
    - Provide feedback to mechanic when problems occur

## Maintenance delivers specialized service

- Think of them as the Mechanics
  - The goal is a well running automobile
- Provide pre-scheduled maintenance
- Diagnose problems when car not performing to expectations
- Trained to handle more complex repair
- Provide feedback to car owner

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# MONITOR

## TO IMPROVE

- Visual card systems are effective to monitor the TPM Systems
- TPM Tasks are listed on colored cards; Red/Incomplete and Green/Completed
- Tasks are broken up into Daily, Weekly, and Monthly Requirements
- When a TPM task is complete the card is turned from red to green
- Cards are flipped back to red depending on the frequency of the TPM task i.e., the beginning of the week, or month
- The TPM system is monitored using Layered Process Audits

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# TPM FOUNDATION:
## DAILY DATA

**Hour by Hour can be used to identify the losses that are occurring**

There are five main categories of losses:

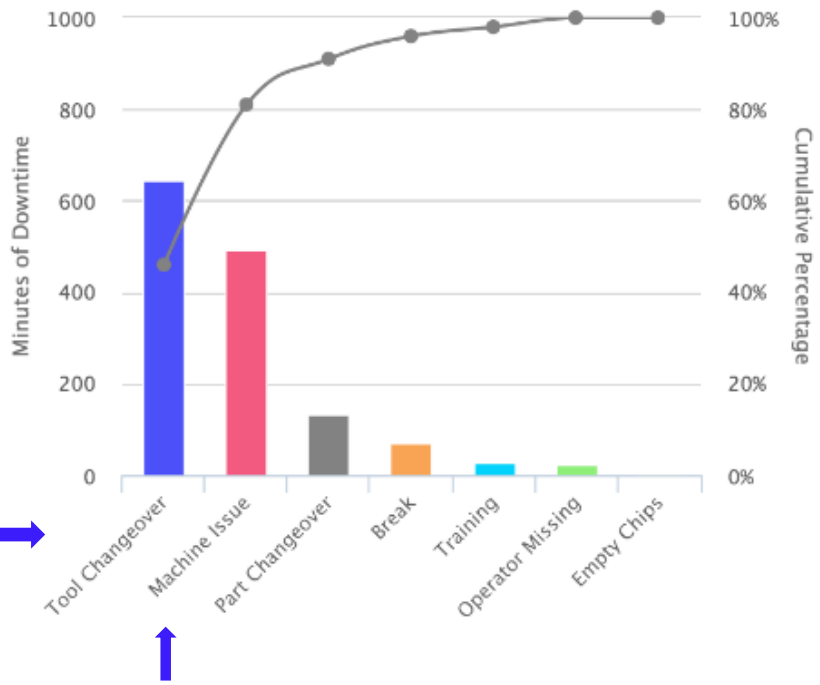
1. Equipment downtime
2. Changeover
3. Minor stops
4. Speed Loss
5. Rework/Scrap

**Break down each category for effective Problem Solving**

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# PARENTO ANALYSIS

Use Team Improvement Boards to Pareto Losses



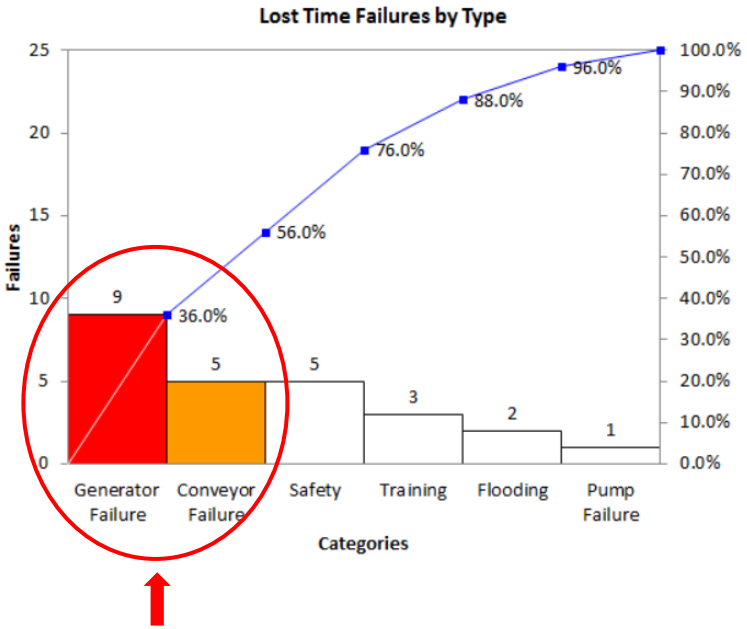

Reduce the Planned (Changeover)

Eliminate the Unplanned Issues

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# PARENTO ANALYSIS

Second Level Breakdown Pareto May Be Necessary




Breakdown the Machine Issues

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# VISUAL
## MANAGEMENT

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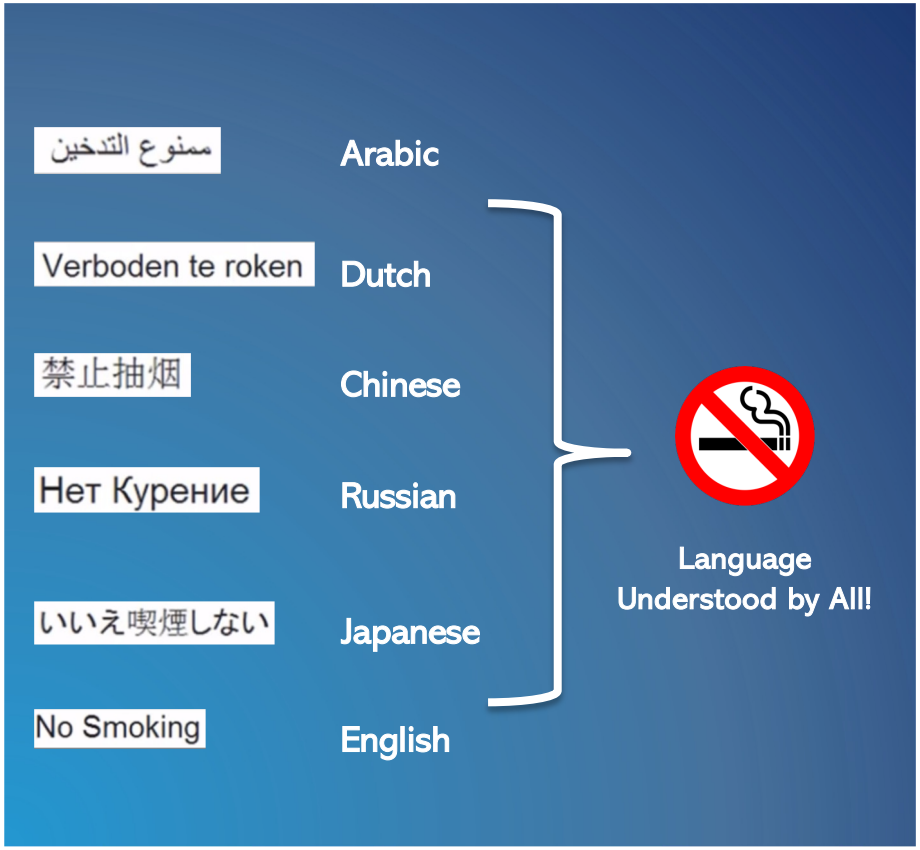
# LEARNING
## OBJECTIVES

- Understand what is Visual Management
- Understanding why Visual Management is important in a Lean Environment
- Learn how to implement Visual Management that fits in your organization

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# What is Visual Management?

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# VISUAL

## MANAGEMENT

Can you understand what
is show on the left?

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# WHAT IS
## VISUAL MANAGEMENT?

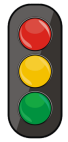
- The ability to manage everything in your business visually



- Managing visually is the ability of a system to quickly show the current status to anyone that stands and observes, within 30 seconds.




- ***EVERYONE*** in your business understands and knows how to respond if something is wrong.



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# WHAT IS
## VISUAL MANAGEMENT?

- Visual Management helps us become more effective problem-solvers by helping us with problem detection, since it helps us identify abnormalities quickly and easily.

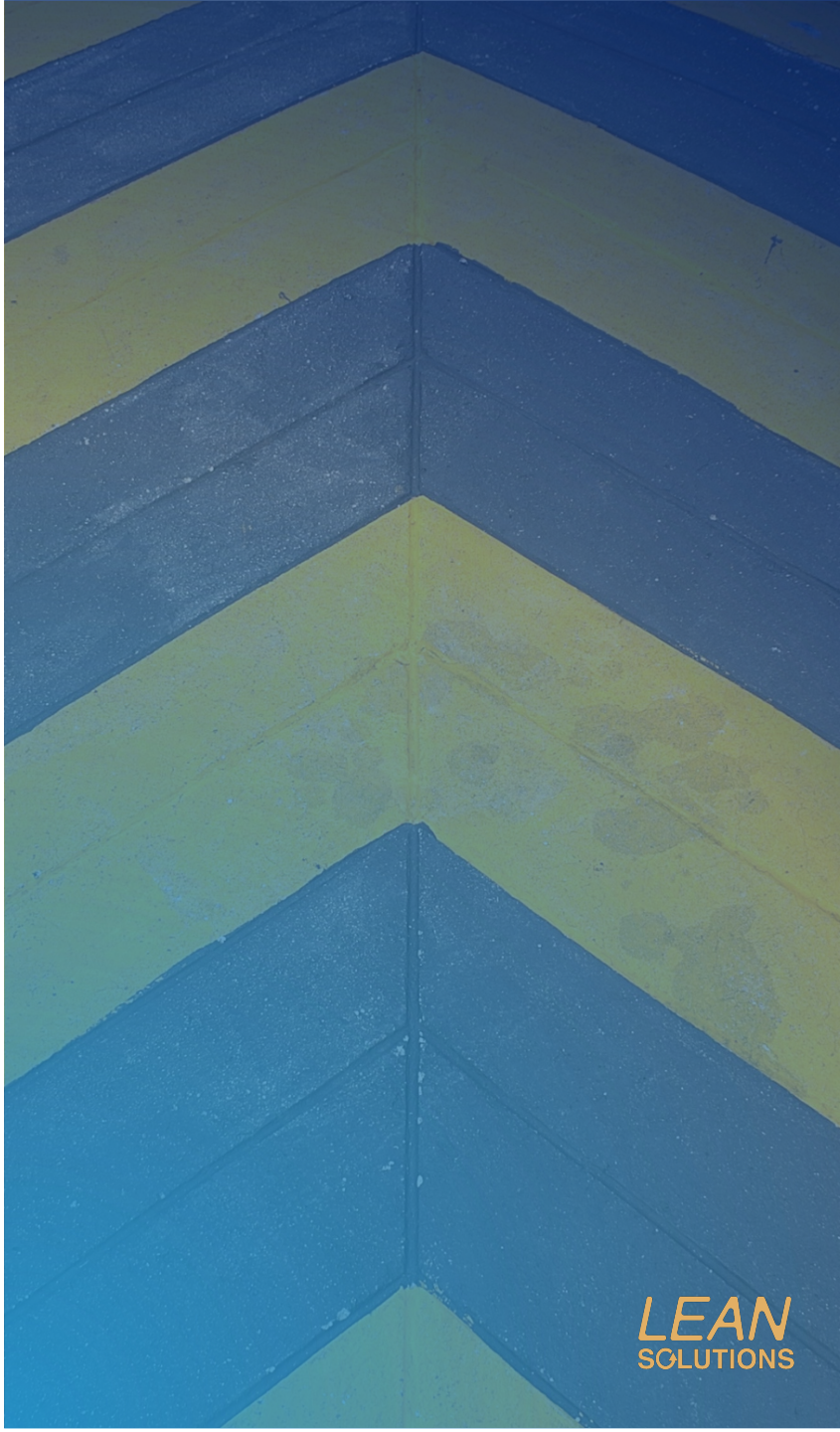
- Visual Management helps us manage with our eyes. Done correctly, it helps us see at a glance how we're doing without having to read through reports, look up data, or wait for a briefing.

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# 4 COMMON TYPES

## VISUAL SIGNALS

- Visual Instructions
- Visual Management
- Visual Representations



# 4 COMMON TYPES

- Visual Signals
- **VISUAL INSTRUCTIONS**
- Visual Management
- Visual Representations



# 4 COMMON TYPES

- Visual Signals
- Visual Instructions
- **VISUAL MANAGEMENT**
- Visual Representations



# 4 COMMON TYPES

- Visual Signals
- Visual Instructions
- Visual Management
- **VISUAL REPRESENTATIONS**





# WHY

## VISUAL MANAGEMENT

Provide Real Time Information

Reduce Waste and Poor Quality

Empowerment and Ownership

Drive Accountability

Faster Response Time to Problems

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# WHY

## VISUAL MANAGEMENT

Easy to See Processes

Workflow is Clear

Inexperienced Can Understand

Easier to Manage

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# WHY

## VISUAL MANAGEMENT

Develop a Routine

Daily, Weekly, Monthly

Show All Areas of the Organization

Should be a Display of Plant Performance

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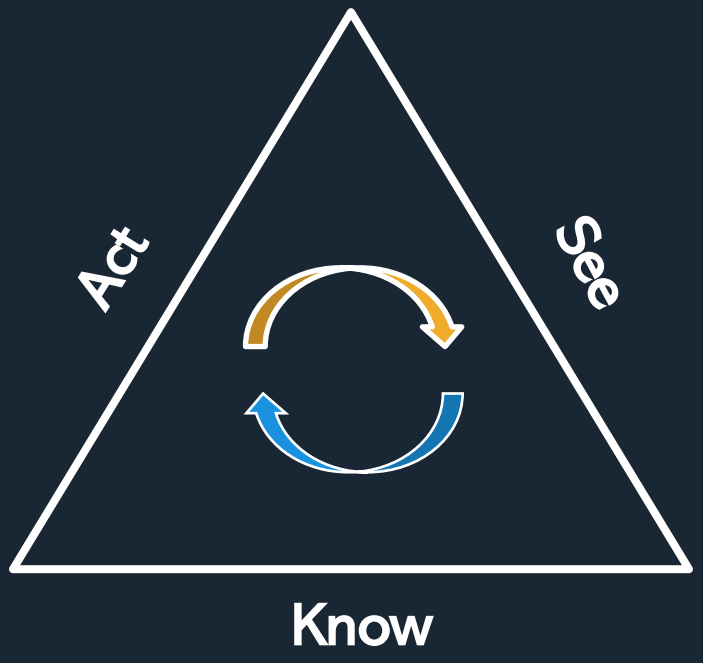
# THE VISUAL OFFICE

Make problems visible

Communicate status

Improve productivity

Improve confidence




VISUAL MANAGEMENT CYCLE

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# How do we Implement Visual Management?

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# SAFETY

## AND SIMPLE IDENTIFICAITON

Fire Dangers

Fire Extinguishers

Chemical Dangers

Storm Shelters

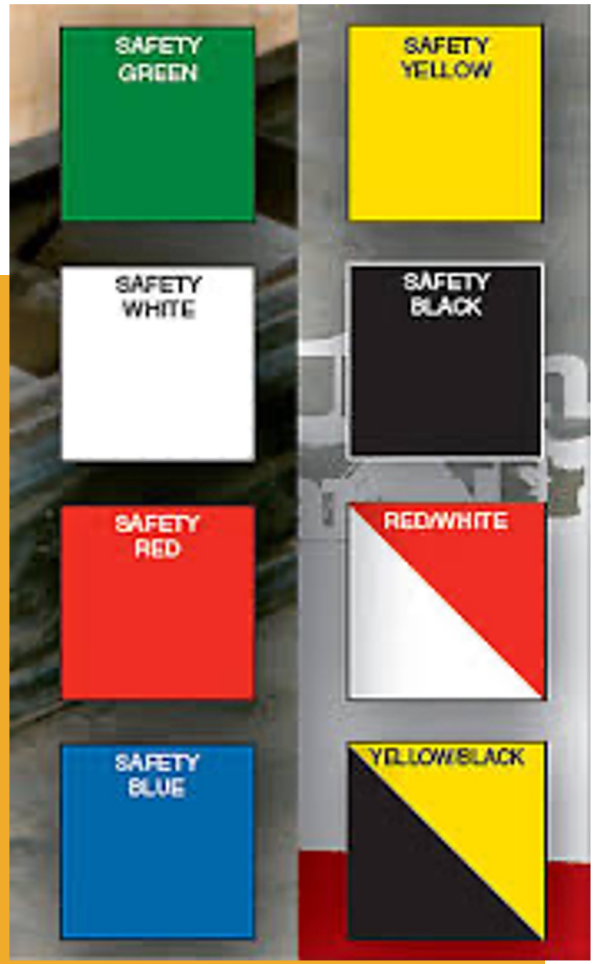
Emergency Shut Off's

Electrical Box Clearance

High Voltage Notification

Evacuation

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# COMMON
## COLORS

DANGER

WARNING

CAUTION

NOTICE

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# VISUAL MANAGEMENT AND 5S









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# DESIGNING VISUAL SYSTEMS

- Who is your audience
- Using the right media
- Don't overdo it

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# LEADING CHARACTERISTICS

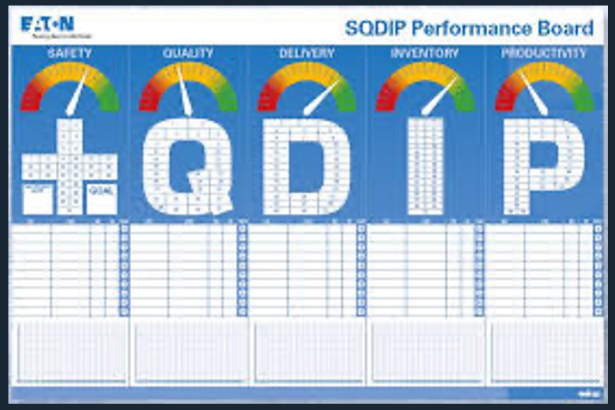
- Clear and easy to understand
- Team ownership
- Promote team ownership
- Close to the process
- Limit the data displayed

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# VISUAL MANAGEMENT
## BOARD EXAMPLES




Safety Cross




QDPI Indicators
with Safety 1st

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# HOW TO START

## YOUR VM JOURNEY

- Go See
- Brainstorming Activity – What problems are you trying to solve?
- Team members understand why VMS are beneficial
- Discuss VMS components
- Create board using the VM board elements
- Try it out! Check and adjust as needed

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# POINTS
## TO REVIEW

- Keep it Clear and Concise
- Who, What, Where
- Basic Markings First
- Understandable for All

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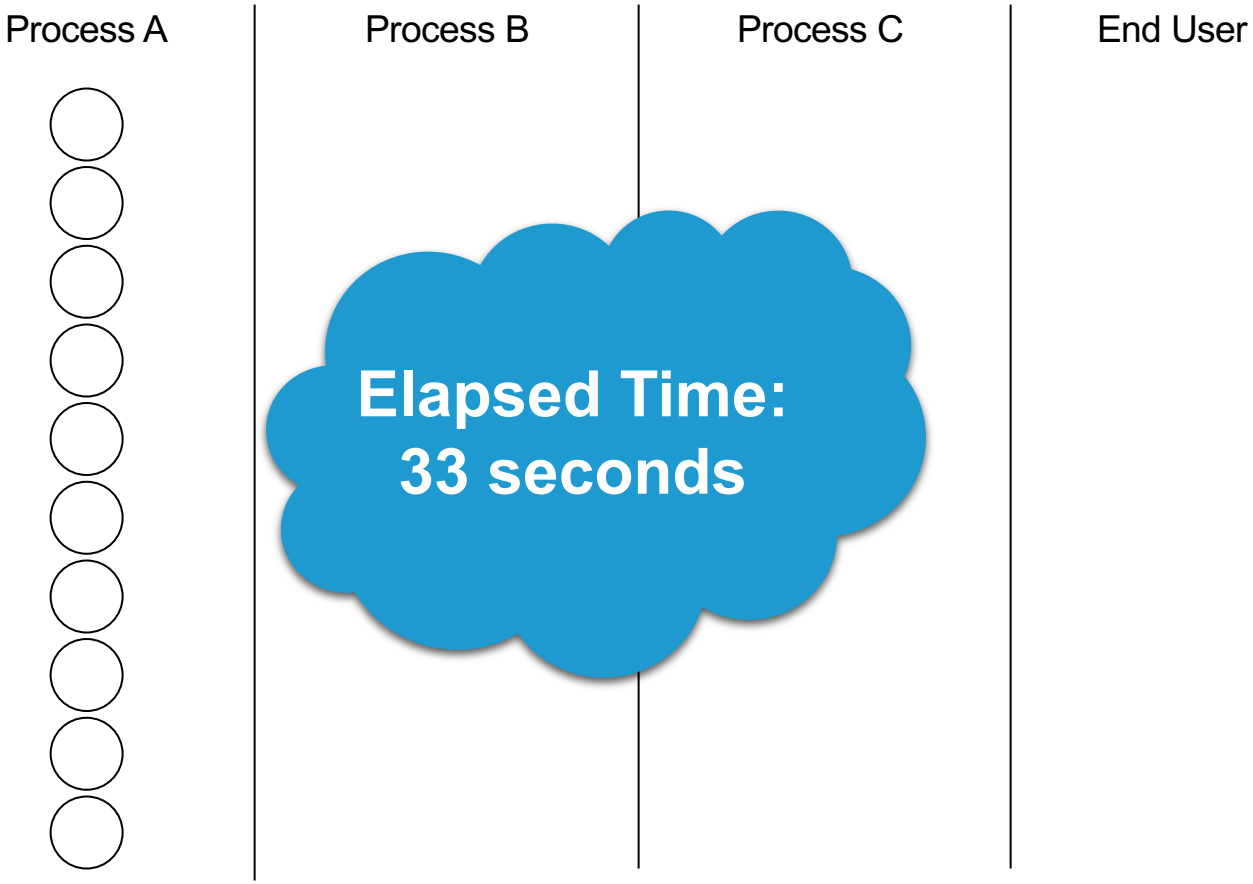


# 6 FUNDAMENTALS OF LEAN

- Value
- Value Stream
- Flow
- Pull
- Perfection

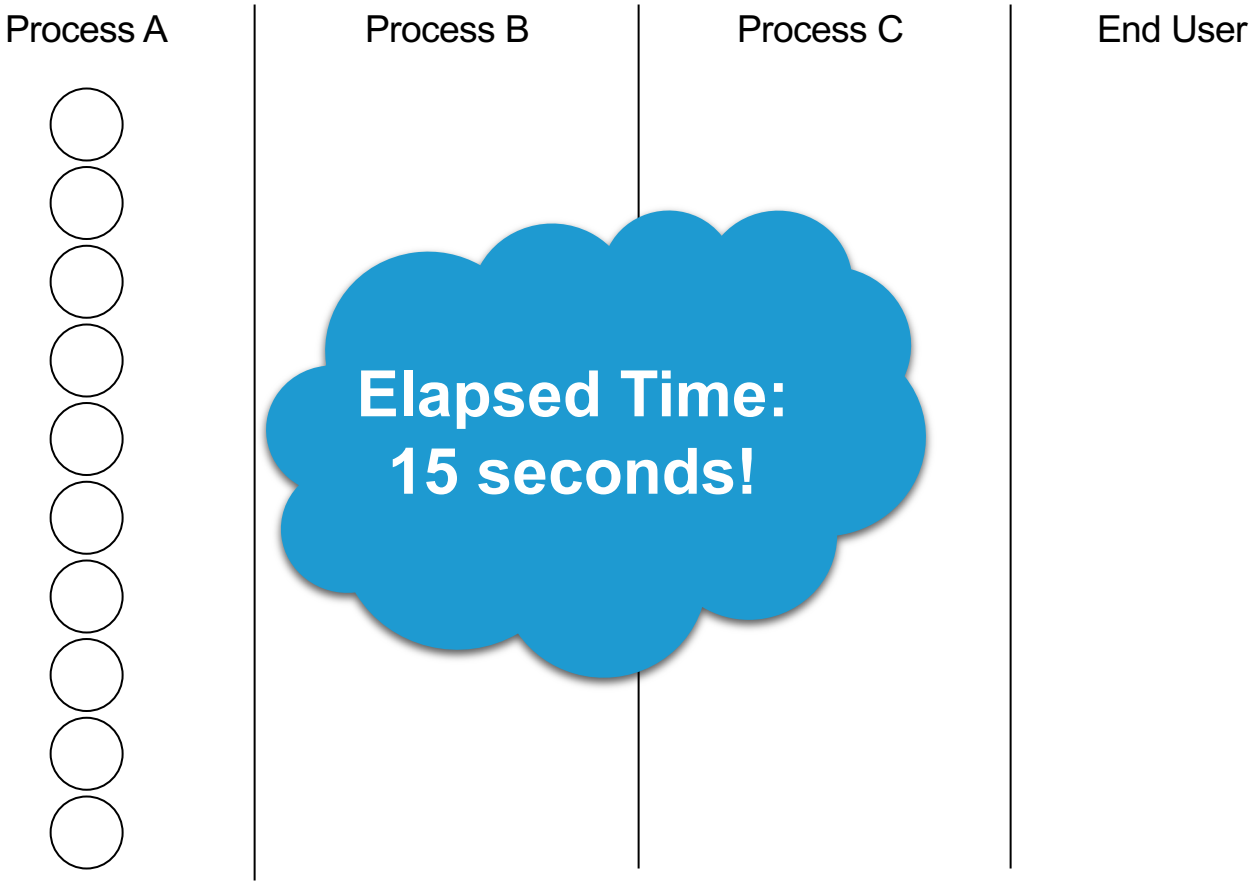
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# BATCH & QUEUE




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# SINGLE PIECE FLOW




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## Upstream (suppliers)




## Downstream (customers)

"The ideal arrangement for Flow production should resemble a watershed: the river being the main assembly track, fed by tributaries in the shape of sub-assembly lines which, in turn, would be supplied by streams representing the machine lines fed by brooks typifying the material conveyors. Each part should flow continuously forward … ultimately to the sea - the customers."

Frank Woollard, *Principles of Mass and Flow Production*, 1954

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# FLOW & PULL

## Enablers for Flow

1. Use Single Piece Flow  or Smaller Batches
2. Total Productive Maintenance ( TPM )
3. Line Balancing ( Cycle Times and Takt Times )
4. Theory of Constraints
5. Mistake Proofing ( Poka Yoke )
6. Jidoka
7. SMED ( Quick Change Over )

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# ONE PIECE FLOW VS BATCH

One Piece Flow



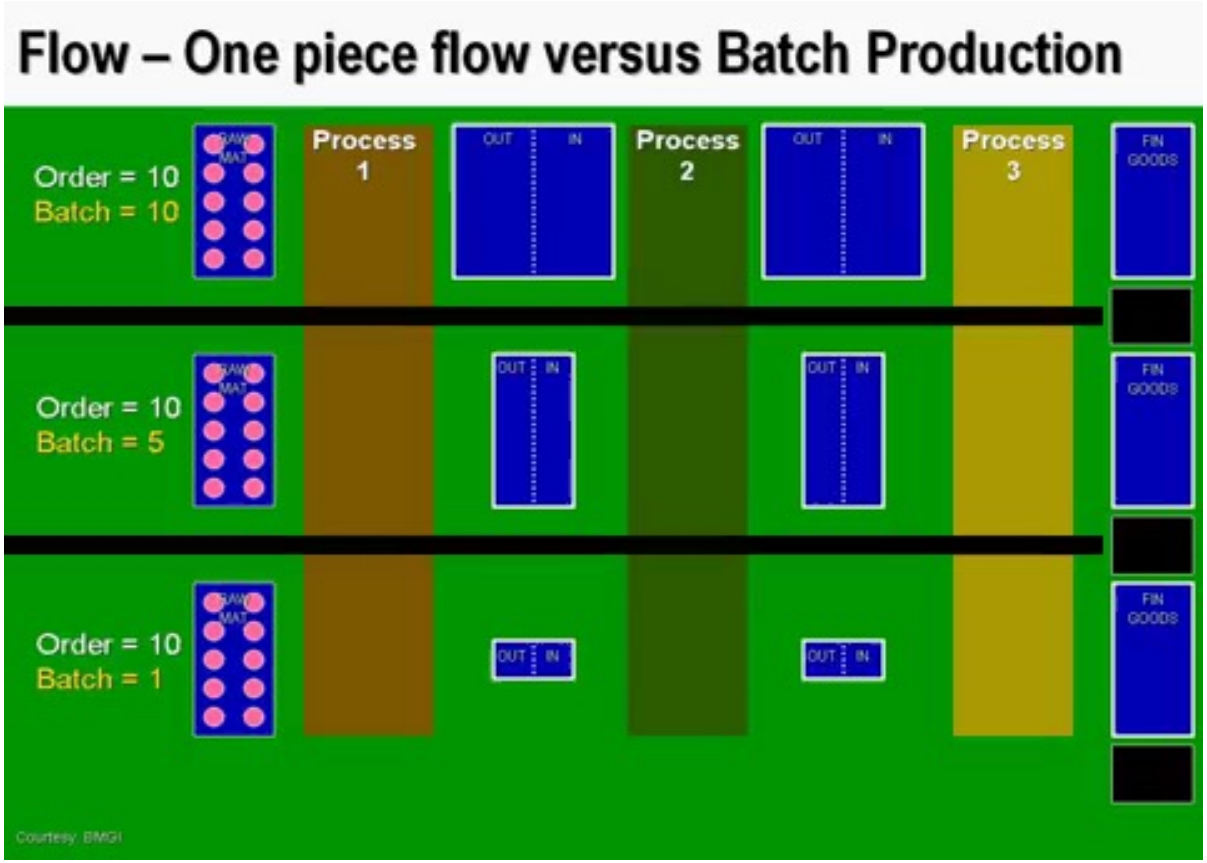

Batch




https://www.youtube.com/watch?v=cnLuztl-aGg

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# ONE PIECE FLOW VS BATCH




https://www.youtube.com/results?search_query=single+piece+flow+vs+batch

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# BATCH VS SINGLE PIECE FLOW



https://www.youtube.com/watch?v=cu9CVFEHee4&list=PLGvZFHF27rGzmn1iFmj8v_3rCn07ytImO

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# LINE BALANCING

Understand the TAKT TIME and CYCLE TIMES of the operations in your process and BALANCE your line.  The goal is :

**CYCLE TIMES = TAKT TIME**

Definitions:

TAKT TIME = Demand Time =  Time needed to produce each unit of product or service in order to keep up with customer demand

CYCLE TIME = Actual time taken for production of each unit or service

*Note:  Always be aware for the specific definition of Cycle Time in your work or business because there can be subtle differences between companies*

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# LINE BALANCING EXAMPLE

Demand is 4,800 units per month.  Assuming 30 days per month and 8 hours per day.

Therefore TAKT TIME in minutes is:

Total time period in minutes  ÷  total number units demanded

**(30 x 8 x 60 ) ÷ 4800 =  3 minutes**

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# QUIZ 6:

1. What is the Japanese name used for ‘Mistake Proofing’ of a process step ?
   - **POKA YOKE**

2. FLOW is critical to any process. What needs to Flow in an Airport or Hospital ?
   - **PEOPLE, INFORMATION, LUGGAGE, EQUIPMENT**

3. **SMED** is an acronym used in Lean Manufacturing. What is another name for SMED?
   - **QUICK CHANGE OVER**

4. A fundamental concept of any Lean Process is that it has no delays, constraints, waiting or bottlenecks. This Lean concept is called _____.
   - **FLOW**

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# Case Study of Improved Flow Production

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# PRODUCTS



Shelves for Food Sector



Modular Cold Rooms

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# THE PLANT





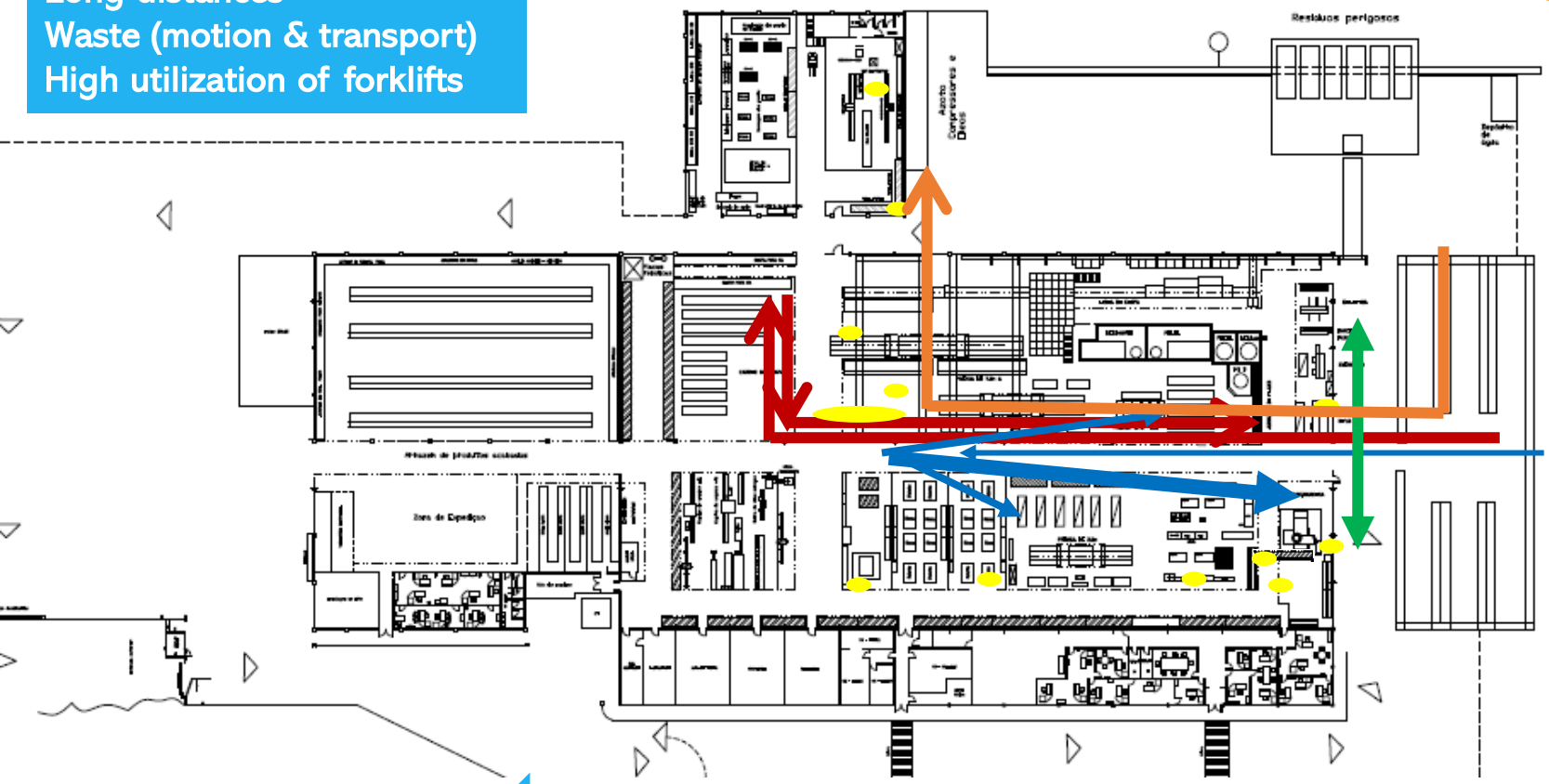
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# ANALYSIS OF FLOWS

## IN JANUARY - 2017

**Flow Analysis**
**Long distances**
**Waste (motion & transport)**
**High utilization of forklifts**

WIP



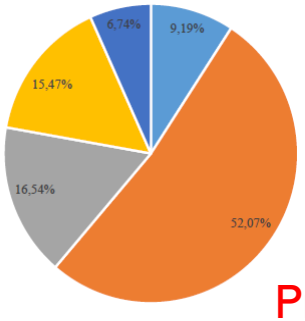

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# DATE ANALYSIS

## IN JANUARY - 2017

### Collection of times and distances

**Materials transported by Operator from:**

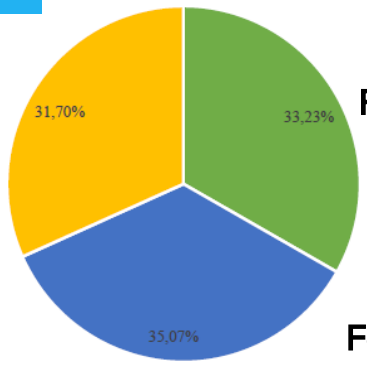



**Logistics: 26%**

**Not adding value**

**Production!! 52%**

**How is transported:**




**Manual**

**Pallet truck**

**Forklift**

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To / From

| From \ To | Armazém | Linha Chapa | Armazém Chapa | Puncionadora | Máquinas Tradicionais | Preparação da prensa de 3,2m | Prensa 3,2m | Prensa 5,2m | Prensa 6m | Prensa 12m | Ferragem Pivotantes | Ferragem Deslizantes | Corte PVC | Angulos | Máq. Madeiras | Alumínios | Salas Limpas | Coolblok | Estabilização | Expedição | Rua |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Armazém | | | | | I | II | II | | | | 卌 | 卌 II | 卌 II | III | II | III | 卌 | 卌 II | | 卌 卌 卌 卌 III | |
| Linha Chapa | | | 卌 卌 I | 卌 IIII | | | | IIII | I | II | | | | | | | II | | | | 卌 |
| Armazém Chapa | 卌 | | | | | | | IIII | 卌 | 卌 卌 I | | | | | | | | | | | |
| Puncionadora | | | | | 卌 卌 卌 III | II | | | | | I | | | | | | I | | | | III |
| Máquinas Tradicionais | | | | I | | 卌 卌 卌 卌 IIII | | 卌 II | | I | 卌 II | I | | | | | | | | IIII | |
| Preparação da prensa de 3,2m | | | | | I | | | | | | I | | | | | | | | | I | III |
| Prensa 3,2m | | | | | | | | | | | IIII | 卌 | | | | | II | | | | |
| Prensa 5,2m | | IIII | 卌 I | | | | | | | | | | | | | | | | 卌 III | II | I |
| Prensa 6m | | I | II | | | | | I | | III | I | | | | I | | | | IIII | 卌 II | I |
| Prensa 12m | | III | II | | | | | | | | | | | | | | | | II | 卌 II | 卌 I |
| Ferragem Pivotantes | II | | | | I | | | | | | | | | | I | II | I | | 卌 卌 卌 III | 卌 | |
| Ferragem Deslizantes | | | | | | I | I | | | | | | | | | III | II | | 卌 I | | II |
| Corte PVC | II | | | | | III | | I | | | 卌 | III | | | | | | | | | |
| Angulos | | | I | | | II | I | | | | | | | | | | | | II | III | I |
| Máq. Madeiras | I | | | | | | | | II | | | I | | | | | II | | | | I |
| Alumínios | | | | | | III | | | | I | 卌 II | 卌 卌 I | | | | | | | | I | |
| Salas Limpas | | | I | I | | I | | I | | | | | | I | | | | | | I | I |
| Coolblok | | | | | | | | | | | | | | | | | | | | I | |
| Estabilização | | | | | | | | | | | I | | | | | | | | | 卌 卌 卌 卌 卌 III | |
| Expedição | | | | | | | | I | | | I | | | II | | | | | IIII | | 卌 卌 |
| Rua | I | 卌 II | | IIII | III | I | I | II | III | IIII | III | II | | I | I | | | | | 卌 | |

**Matrix of all production flows and their frequency**

**Data for layout changes, milk-run and raw-material storage**

# IMPROVEMENTS

## OF FLOWS IN 2018

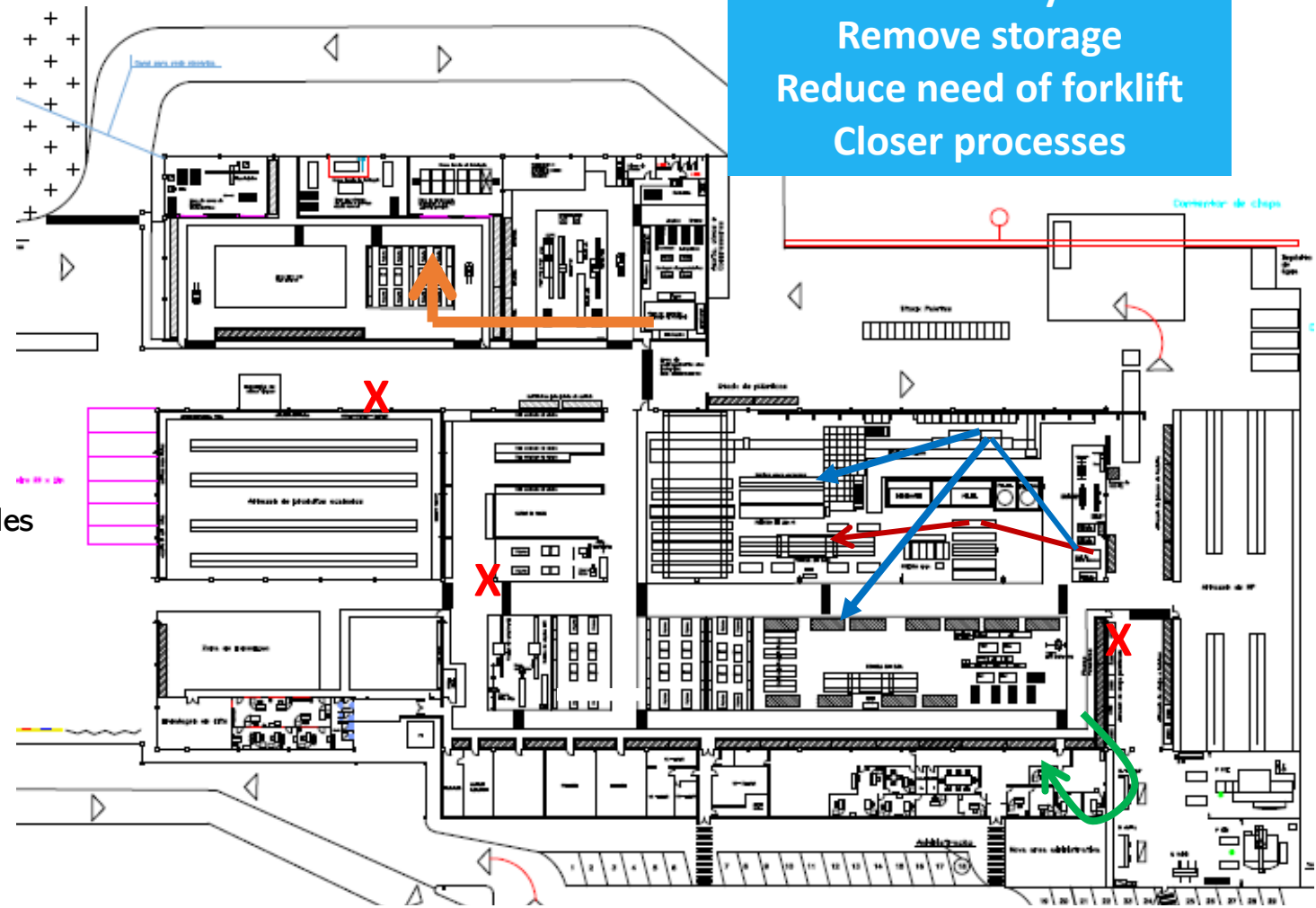
Aluminium profiles

Steel plates

Wood pannels

Plastic and rubber profiles

**Machines Layouts**
**Remove storage**
**Reduce need of forklift**
**Closer processes**

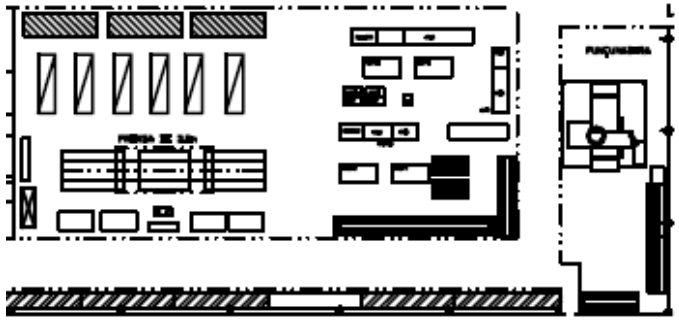



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# CREATING FLOW

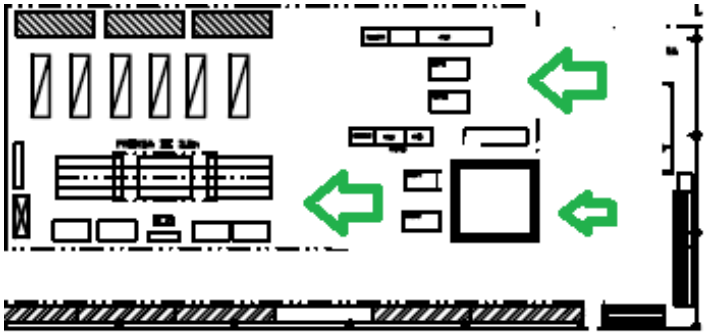
## DOOR INJECTION PRESS

### Before



- No material Flow
- Machine stopped due to lack of prepared parts.
- Preparation stopped due to lack of components.
- Push production. No balance.
- Use of forklifts. Rack storage.
- 4 shifts (7 days / week) – total of 14

### After



- Material Flow
- Machine is **pulling** production from Prep
- Preparation with Kanban system from warehouse.
- Reduced use of forklifts. Materials in conveyors or pallets.
- 3 shifts (5 days / week) – total of 13
- Tools: 5S, Kanban, Create Flow, Kaizen

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# Make Space for Flow

## CLEAR AISLES



5S & Organization also played an important role in reducing waste

## No Need for Forklifts



From “we need more forklifts trucks!” to “we need more wheels and trolleys”

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# Layout Changes - More Flow, Less Waste

## Change Layouts (team work)



**Changed machine position so that material could flow directly to warehouse or next process**

## Reduce stock / increase flow



**Remove pallet racking storage => material needs to flow + less use of forklifts**

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# Removing WIP – More Flow, More Space

## Prodution Area Shelves /WIP



**Removing this racks was one of the first actions. Benefits helped to reduce resistance to change!**

## Flow, space and less WIP



**The next step was changing machines and giving a fresh look to the shopfloor!**

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# Reducing the Need of Forklift Trucks

## Milk-run for long profiles



**Long aluminium profiles (6m / 20ft) were now simple to deliver to cutting machine**

## Materials moved in trolleys

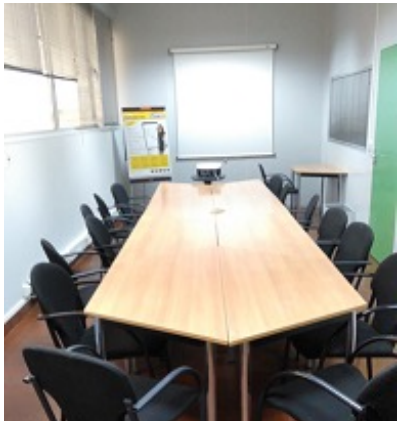


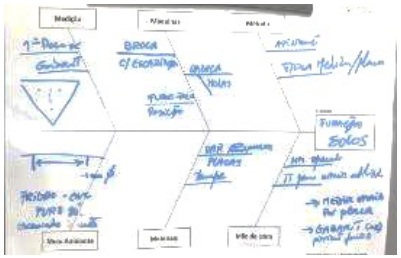
**Build trolleys to materials that are difficult to transport, assuring no damages or scratches**

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# QUALITY ACTIONS

## PROBLEM SOLVING TRAINING



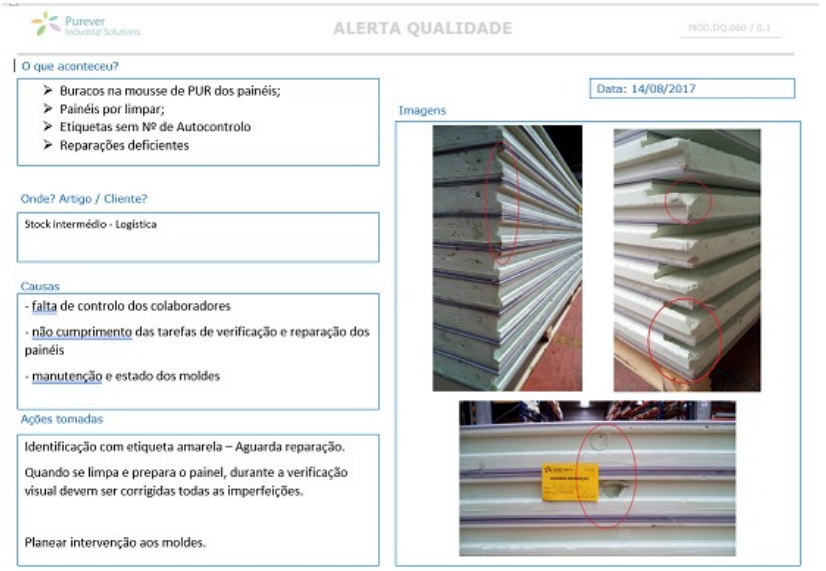


Train

& Practice

Basic Quality Tools!!

## QUALITY ALERTS



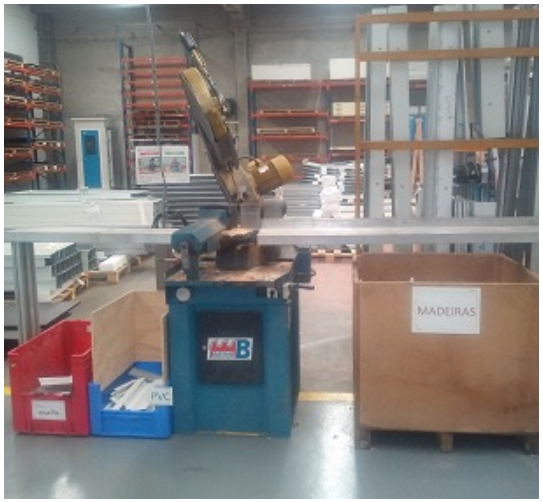

**Visually displayed in all areas**

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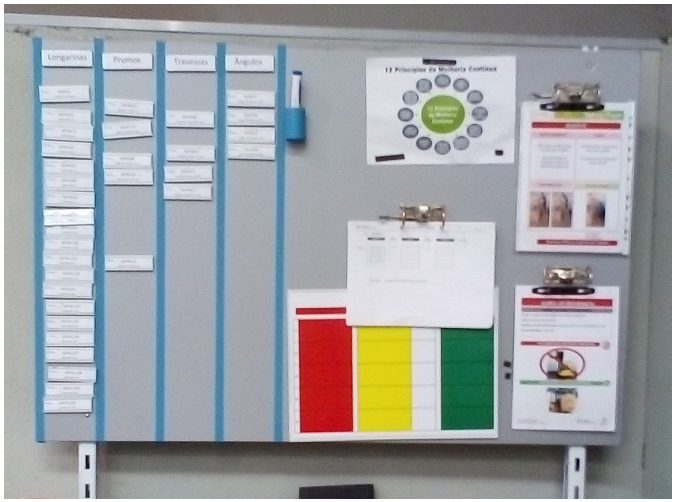
# MORE IMPROVEMENT EXAMPLES



Ergonomic
No pallet.
No Forklift.
No damages.




Kanban Board
near operator



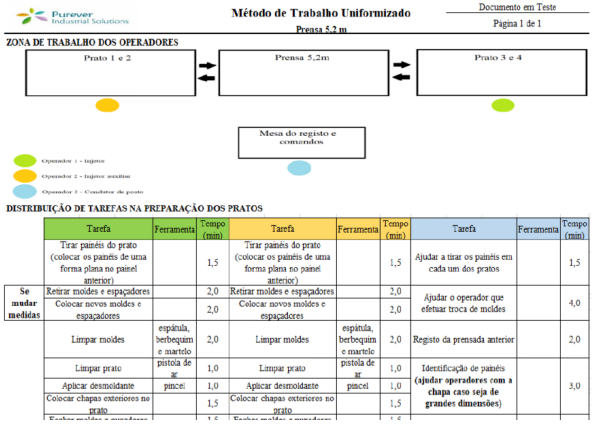
Colour code to
prevent mistakes

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# SMED (RAPID CHANGEOVER)



Organization & Visual Management



Método de Trabalho Uniformizado

Prensa 5,2 m

Documento em Teste

Página 1 de 1

ZONA DE TRABALHO DOS OPERADORES

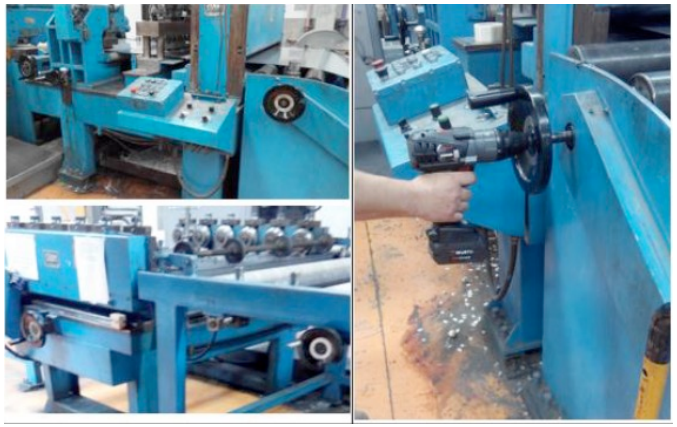
Prato 1 e 2 | Prensa 5,2m | Prato 3 e 4

Mesa do registo e comandos

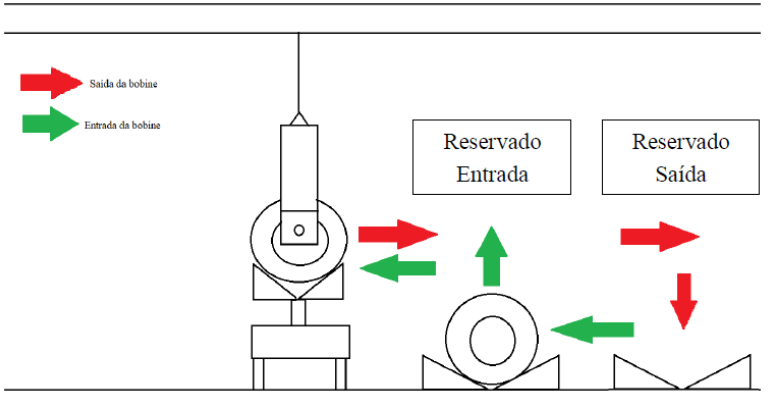
DISTRIBUIÇÃO DE TAREFAS NA PREPARAÇÃO DOS PRATOS

| | Tarefa | Ferramenta | Tempo (min) | Tarefa | Ferramenta | Tempo (min) | Tarefa | Ferramenta | Tempo (min) |
|---|---|---|---|---|---|---|---|---|---|
| | Tirar painéis do prato (colocar os painéis de uma forma plana no painel anterior) | | 1,5 | Tirar painéis do prato (colocar os painéis de uma forma plana no painel anterior) | | 1,5 | Ajudar a tirar os painéis em cada um dos pratos | | 1,5 |
| Se mudar medidas | Retirar moldes e espaçadores | | 2,0 | Retirar moldes e espaçadores | | 2,0 | Ajudar o operador que efetuar troca de moldes | | 4,0 |
| | Colocar novos moldes e espaçadores | | 2,0 | Colocar novos moldes e espaçadores | | 2,0 | | | |
| | Limpar moldes | espátula, berbequim e martelo | 2,0 | Limpar moldes | espátula, berbequim e martelo | 2,0 | Registo da prensada anterior | | 2,0 |
| | Limpar prato | pistola de ar | 1,0 | Limpar prato | pistola de ar | 1,0 | Identificação de painéis (ajudar operadores com a chapa caso seja de grandes dimensões) | | 3,0 |
| | Aplicar desmoldante | pincel | 1,0 | Aplicar desmoldante | pincel | 1,0 | | | |
| | Colocar chapas exteriores no prato | | 1,5 | Colocar chapas exteriores no prato | | 1,5 | | | |

Standards & Team Work



Reduce time




Preparation – External activities

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# RESULTS 2017 VS 2018

## Weekly Results

| RESULTS | Jun-17 | Nov-18 |
|---|---|---|
| OUTPUT (m2/week) | 500 | 1500 |
| OEE | 41.7 % | 78.9 % |
| Defects | 1.5% | 0.2% |
| Average WIP | 50 Units | 25 Units |

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# 6 FUNDAMENTALS OF LEAN

- Value
- Value Stream
- Flow
- Pull
- Perfection

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# Pull

(Downstream Demand Driven Production)

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Pull is Sometimes Referred to as

# 'Just-In-Time Production'

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# JUST IN TIME

**"PULL" and "KANBAN" are fundamental for**…a JUST-IN-TIME process

- WHAT is needed
- HOW MUCH is needed
- WHERE it is needed
- (WHEN it is needed)

Note: 'WHEN' is usually not necessary because it assumed it is needed ASAP

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# KANBAN

Kanban is the Japanese word for ‘card’ or ‘ticket’

The Kanban card was an authorization for materials to be moved from an Upstream location to a Downstream location. The card had printed on it What was needed How much was needed and Where it is needed.

A sequence of Kanbans pulls material through the process

Electronic signals are generally used today, but the system is still called a Kanban

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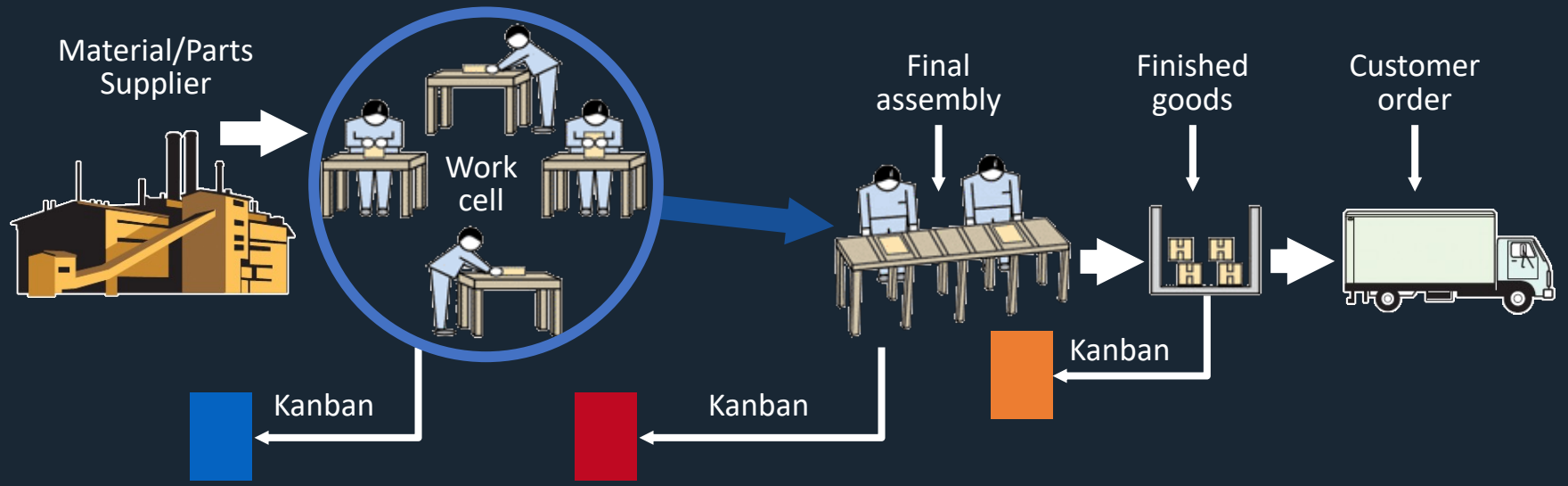
# KANBAN CARD EXAMPLE




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# KANBAN

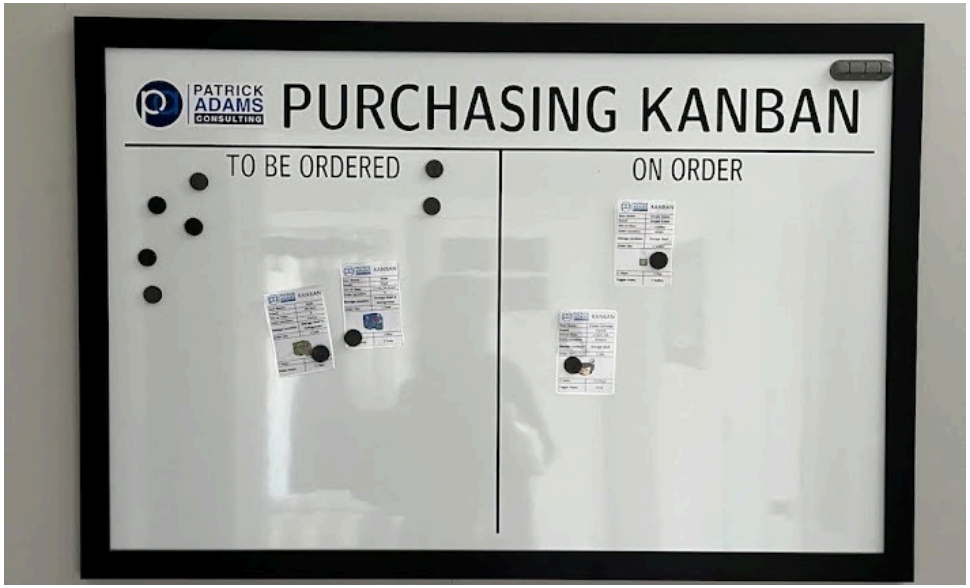
## Good Kanban Systems Help to Minimize Inventory & WIP




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# KANBAN BOARD EXAMPLES



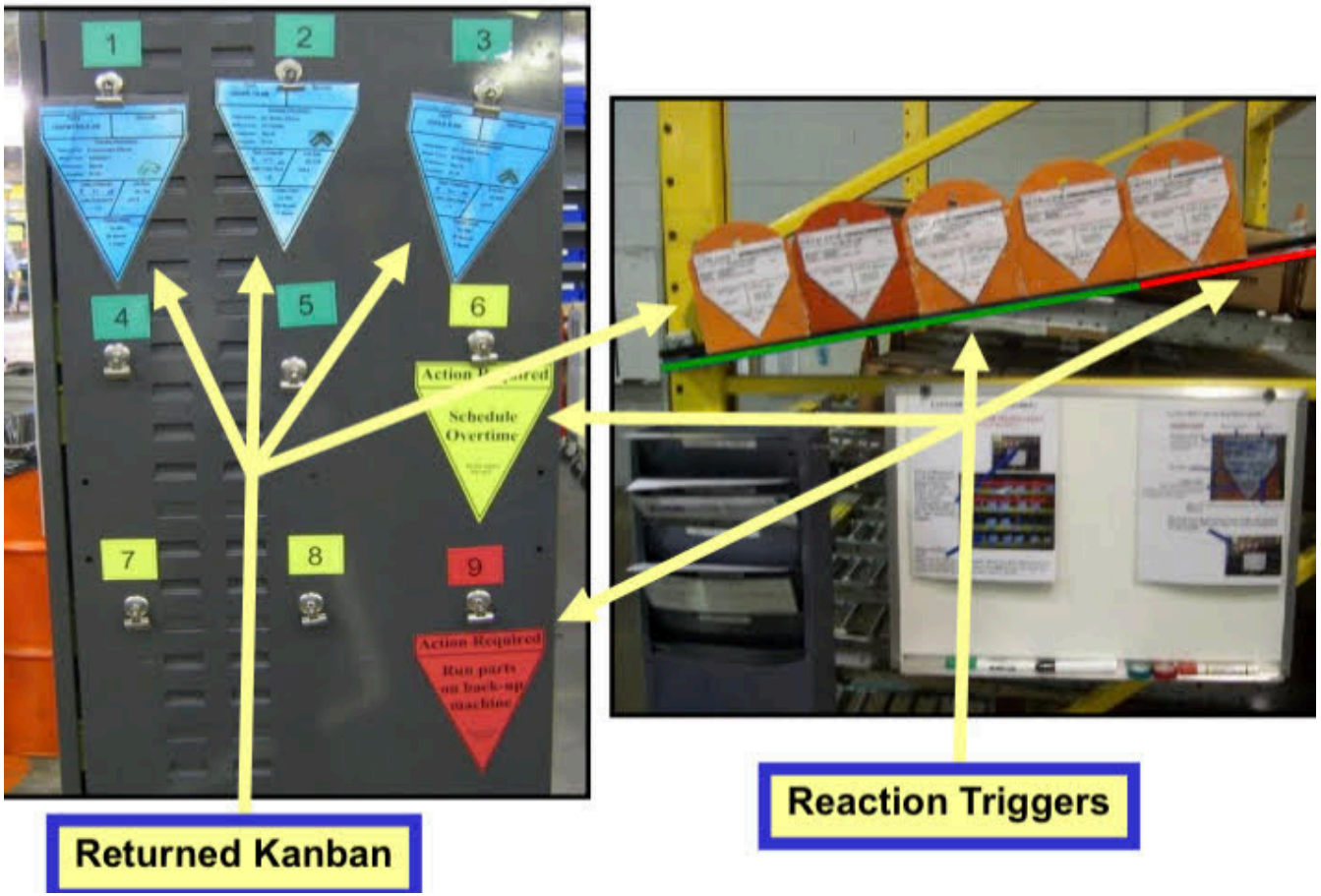

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# KANBAN BOARD EXAMPLES




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# KANBAN BOARD EXAMPLES




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# QUIZ 7:

1. What is a ‘Gemba Walk’ ?
   - **Going to see for yourself what is happening where the real work is done**

2. What is the benefit of having a Visual Work Place ?
   - **All team members can see the status of work and operations easily and at the same time.**

3. Give one example of a Visual Management tool or technique ?
   - **Color Coding, Notice Boards, Graphs and Charts, Good Labelling**

4. What are the key components to a good SOP (Standard Operating Procedure)?
   - **What**
   - **How**
   - **Why**
   - **Use a picture or video**

5. A fundamental concept of any Lean Process is that it has well defined and repeatable actions by workers. This concept is call _____work
   - **STANDARDIZED**

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# HOMEWORK REVIEW

**(Open Computers and Log into your Portal)**

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# CONGRATULATIONS!

**You have completed the Lean Yellow Belt Section.**

**Good Luck in your Exam!**

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