IMPROVE PHASE

DMAIC Methodology

Define
➢ *IDENTIFY OPPORTUNITY*

STOP Tollgate Review

Measure
➢ *DESCRIBE AS-IS CONDITION*

STOP Tollgate Review

Analyze
➢ *IDENTIFY KEY CAUSES*

STOP Tollgate Review

Improve
➢ *PROPOSE & IMPLEMENT SOLUTIONS*

Validate & Replicate Changes

STOP Tollgate Review

Control
➢ *SUSTAIN THE GAIN*

STOP Tollgate Review

Learning Objectives: Improve Phase

➢ Understand the Lean Principles of value, value stream map, flow, pull and perfection.

➢ Improve workspace by implementing 5S.

➢ Identify opportunities for Mistake Proofing.

➢ Understand the importance of Standard Work within a process.

➢ Identify and implement visual controls in your workspace.

"Improvement usually means doing something we have never done before." - Shigeo Shingo

Triple Constraints of Projects

- Quality (Better)
  - Clear and Specific

- Time (Faster)
  - Amount of time to complete process tasks

- Cost (Cheaper)
  - Money and Effort

- Prioritizing Constraints
  - Should be based on the view of the customer.

Lean Principles

What is Lean?

Tools and Methodology to:
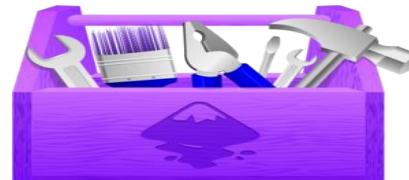

Eliminate Waste

WAR ON WASTE!

Improve Flow

By using:

Mistake Proofing

Visual Controls

Set Up Reduction

Batch Reduction

5S + 1

Pull/Kanban

Standard Work

Point of Use System

Lean Toolbox

Value Stream Mapping

Cellular Flow

House of Lean identifies the major concepts incorporated within Lean (TPS).
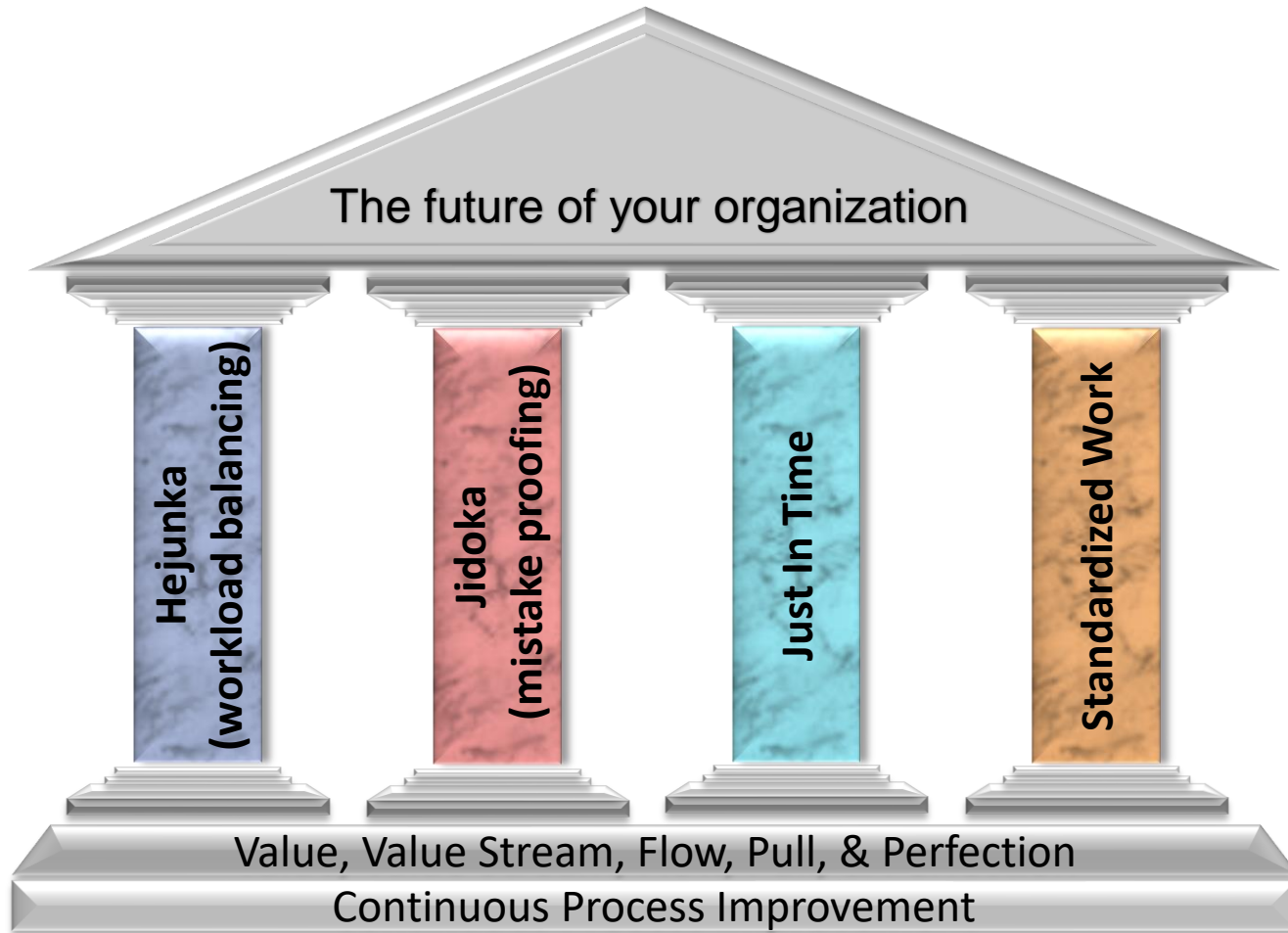
The future of your organization

| Hejunka (workload balancing) | Jidoka (mistake proofing) | Just In Time | Standardized Work |

Value, Value Stream, Flow, Pull, & Perfection
Continuous Process Improvement

There are 5 Lean Principles

1. **Value** specified from the customer's perspective.

2. The **Value Stream** has been identified for each service.

3. The product/service **Flows** without interruptions.

4. The customer can **Pull** value through the process.

5. Continuous pursuit of **Perfection.**

Lean Principles – Value

➢ Critical starting point for Lean.

➢ **Can only ultimately be defined by the customer**.

  – NO two customers define Value identically.

➢ Critical questions we must ask ourselves.

  • Do we truly understand Value from our customer's perspective?

  • Are we truly focused on providing that Value?

  • What are the barriers & obstacles preventing

    us from focusing on and providing that Value?

$$Value = \frac{Features \times Performance \times Quality}{Cost \times Time}$$

Definition of Waste (Muda)

Those elements of a process that **Do Not Add Value** of a Product *<u>as perceived by the Customer</u>*, but **increases Cost and Cycle times.**

Anything other than the **minimum** amount of:

- **Equipment**
- **Materials**
- **Parts**
- **Space**
- **Worker's time**

Which are absolutely essential to **add value** to the product.

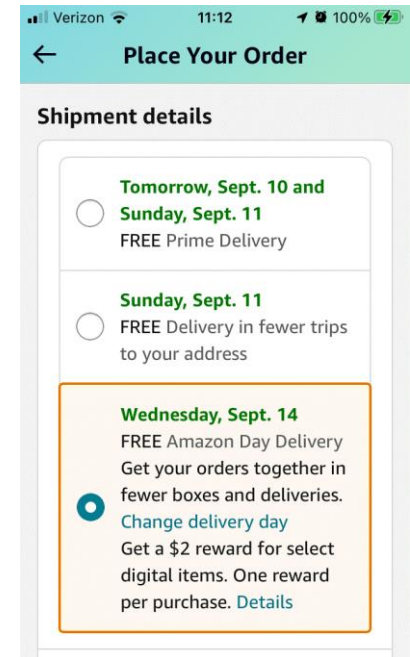"The most dangerous kind of waste is the waste we do not recognize." – Shigeo Shingo

Eight Types of Waste

IDENTIFY TO **REDUCE** AND/OR **ELIMINATE** THESE WASTES:

Types of Waste:

T Transportation

I Inventory (Excess)

M Motion

W Waiting

O Over-Production

O Over-Processing

D Defects

U Under utilization of employees

Transportation

Waste caused by **<u>unnecessary</u>** movement of material or product.

Primary Causes:
- Inefficient Facility Layout
- Multiple Storage Location
- Batch (Push) Mentality

- Lack of Right-Sizing
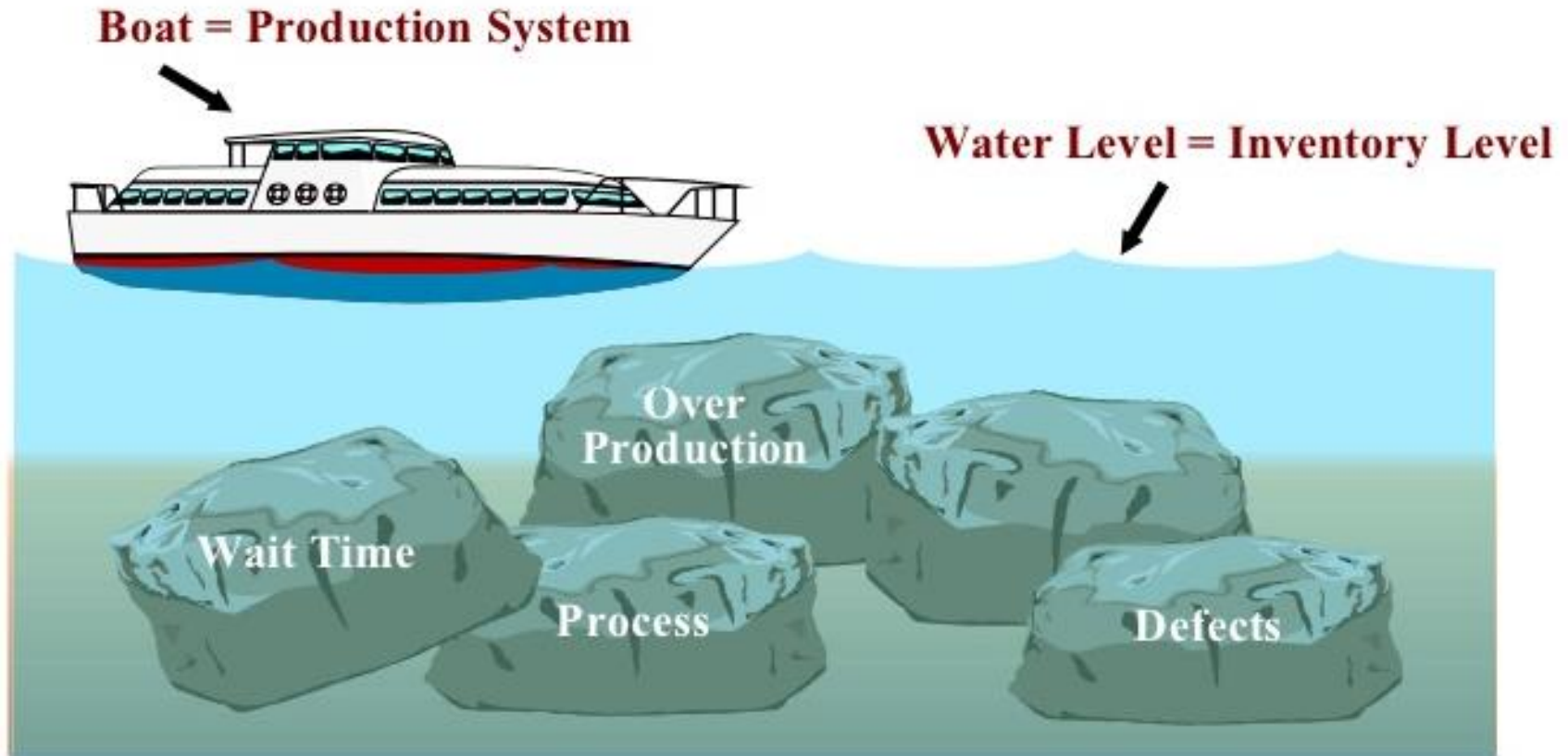- Long Setup Times
- Lack of Multi-Skilled Workers

Waste of materials, parts and assembled goods, when purchased or produced **in advance** of customer requirements.

Increases Cycle Time & Process Lead Time

Inventory Hides Problems!

Boat = Production System

Water Level = Inventory Level

Over Production

Wait Time

Process

Defects

Rocks = Hidden Problems (Uncovered as Inventory is Reduced)

8 Wastes - Motion

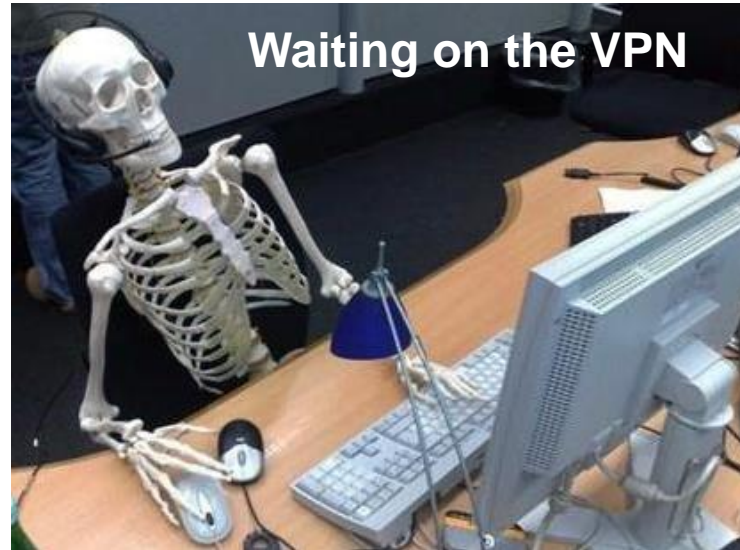Caused by **non-value added movement** of workers and / or production machines.

Primary Causes:
- ➢ Inefficient workplace layouts
- ➢ Inefficient tools and / or fixtures
- ➢ Lack of Standard Work causing inconsistency
- ➢ Batch movement of product

Waiting

Occurs whenever the hands of an employee are idle.

Waiting on the VPN

Over-Production

Caused by producing **more** than the customer needs (Push) and leads to **excessive inventories**.

8 Wastes – Over-Processing

The Waste of **Unnecessary** or Non-Optimized Processes and/or Operations.
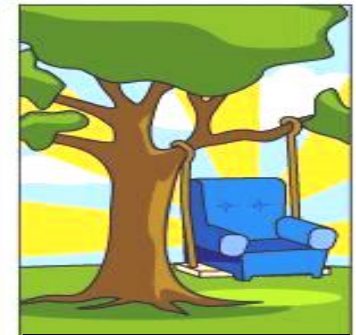

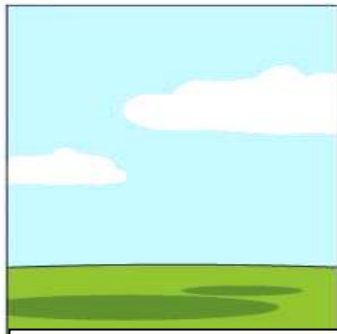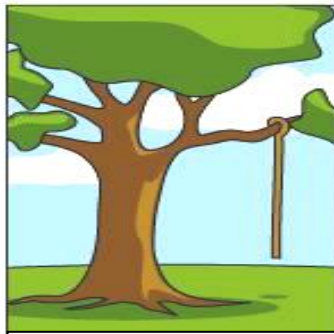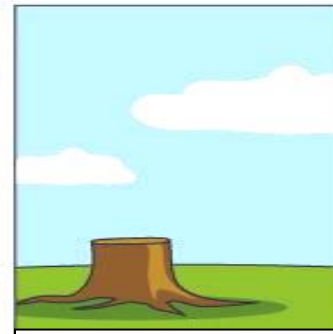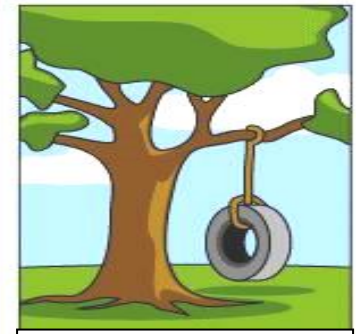| How the customer explained it	How Project Lead understood it	How Analyst designed it	How Programmer wrote it	How Consultant described it
How Project was documented	What operations installed	How Customer was billed	How it was supported	What Customer really needed

"There is nothing so useless as doing efficiently that which should not be done at all." - Peter Drucker

*"Stop Trying to Delight Your Customers", By Dixon, Feeman & Toman, Harvard Business Review, 2010

Defects / Rework

Waste that occurs when a process, product, or data **does not conform** to customer specifications. The result could cause product rework, scrap, or the escape of a defect to the customer.

What Causes Defects?

➤ Poor procedures or standards.

➤ Non-conforming materials.

➤ Worn or out of tolerance tooling.

➤ Human mistakes.

ULTIMATE WASTE
Waste of a person's time

Long Lines
- DMV
- DEERS
- Chick-Fil-A

Give me a call!

Type of Waste	Physical Process	Example	Ways to Eliminate
Transporting	Parts Moving to Warehouse and Back	Movement of Goods	Make the distance over which something is moved as short as possible
Inventory (Excess)	Excessive completed work or supplies	Supplies in a Warehouse that aren't being used, taking up space	Produce or maintain only enough to satisfy the work requirements of the customer
Motion	Retrieving Parts, Tools, Information	Poor Office Lay-Out	Arrange your files, parts, or tools so you can easily retrieve them
Waiting	Out of supplies, Lack of Information	Meetings, Approval, System Down Time	Prepare agendas, standardize required signature approval process, make a plan for outages
Over-Processing	Performing Unneeded Operations	Approvals (Too Many Sign-offs)	Eliminate signature requirements where possible
Over-Production	Working Ahead of Schedule	Printing Paper Too Soon	Establish a workflow sequence for the production
Defects	Scrap or Rework	Drawing or Planning Errors, Rework	Establish standardized work procedures
Under utilization of employees	Workload is not balanced	Favoritism among workers, too much work given to star players	Spread tasks evenly among employees

**There are 5 Lean Principles.**

1. **Value** specified from the customer's perspective.

2. The **Value Stream** has been identified for each service.

3. The product / service **Flows** without interruptions.

4. The customer can **Pull** value through the process.

5. Continuous pursuit of **Perfection.**

Value Stream Mapping

➢ A "VISUAL" planning tool used to identify non-value added activity (NVA) and develop plans to eliminate the waste.

➢ Includes the entire set of activities running from requirement to finished product for a specific product or service.

➢ Seeks to optimize the whole from the standpoint of the final customer.

➢ Value Stream Analysis is the key to all improvement activities. Three Designations for Value (Measure Phase).

- **Value Added**
- **Business Value (Non-Value Added but required)**
- **Non-Value Added (Waste)**

1: SIPOC

2: BOUNDARIES

3: VOICE OF THE CUSTOMER

4: GATHER APPROPRIATE INFORMATION

See the Process…

See the Waste…

5: WALK THE PROCESS

6: CREATE CURRENT STATE MAP

7: SPAGHETTI MAP / CIRCLE DIAGRAM

8: VALUE ANALYSIS

9: CREATE IDEAL STATE MAP

Visualize the Perfect State…

Lead the Way toward it…

10: DEVELOP FUTURE STATE MAPS

11: DEVELOP ACTION PLAN

12: IMPLEMENT THE PLAN

There are 5 Lean Principles.

1. **Value** specified from the customer's perspective.
2. The **Value Stream** has been identified for each service.
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5. Continuous pursuit of **Perfection.**

The continuous, progressive adding of Value in the eyes of the customer.

- Starts at receipt of customer request.

- Ends at delivery to customer.

- Flow utilizes the fewest number of steps with **no interruptions**.
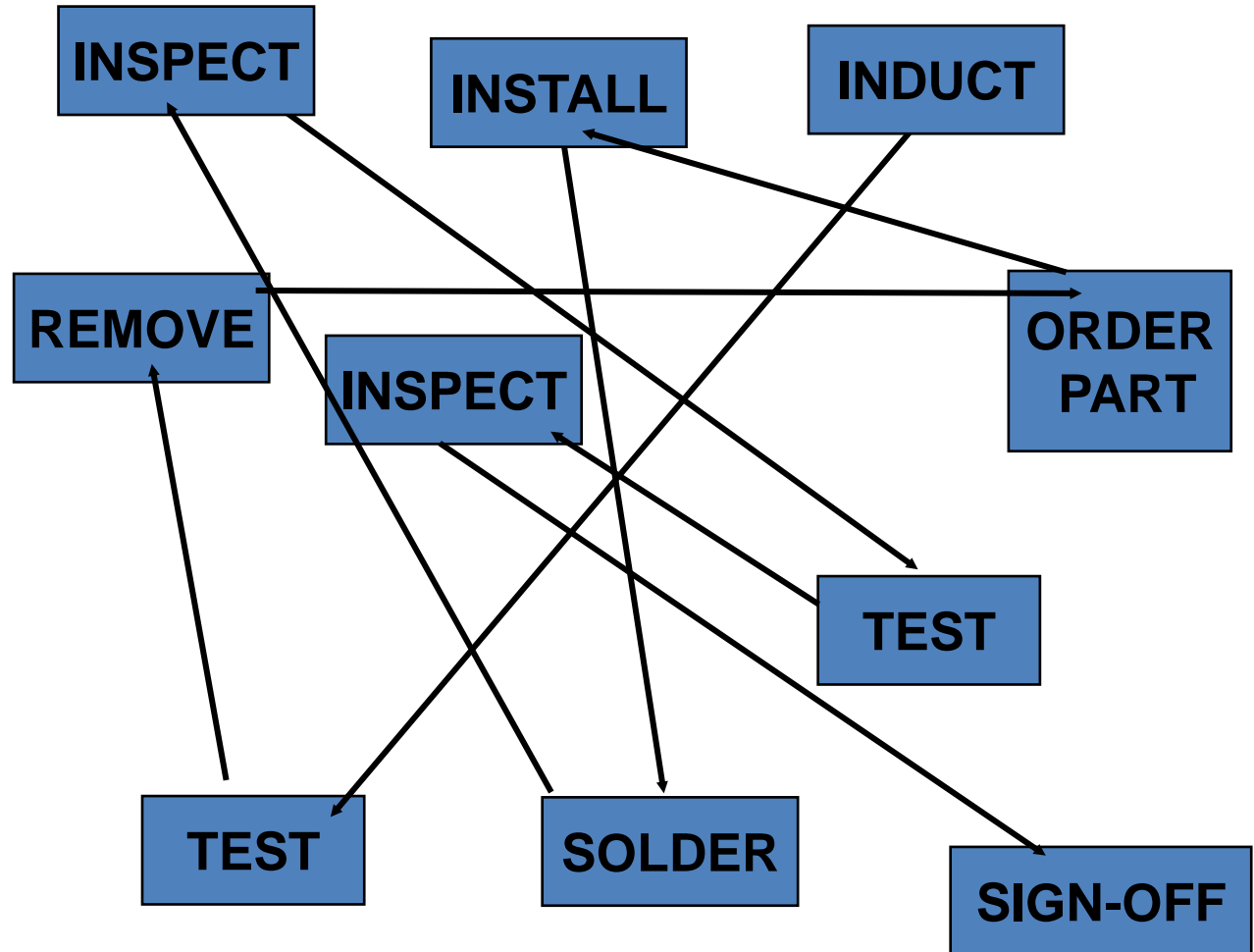
- Eliminates waste.
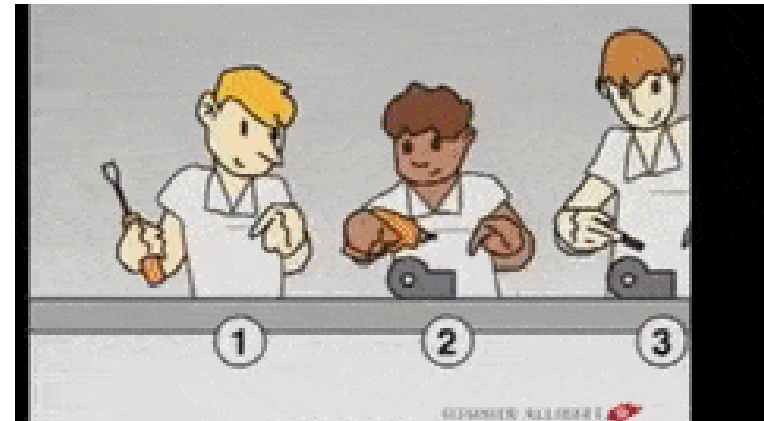
**People always working on the product
and the product always being worked on.**

Workplace Layout

- **Batch operations**
- **Isolated processes**
- **Unknown status**

INSPECT

INSTALL

INDUCT

REMOVE

INSPECT

ORDER PART

TEST

TEST

SOLDER

SIGN-OFF

➢ Batching: Production of large lots of identical items to meet **anticipated demand**.

- Production is to schedule, not to demand.

➢ Makes great efficiencies possible for equipment amortized over large quantities.

➢ Increases inventory and cycle times.
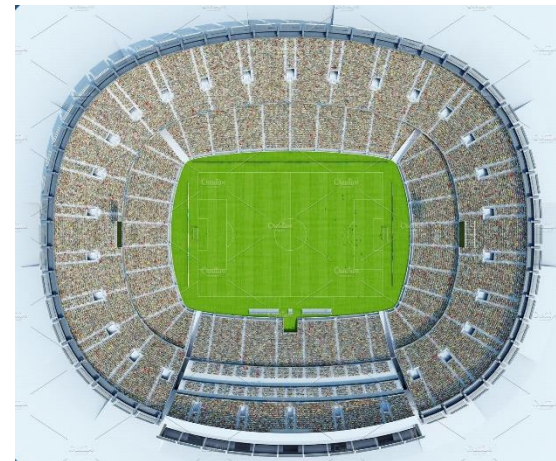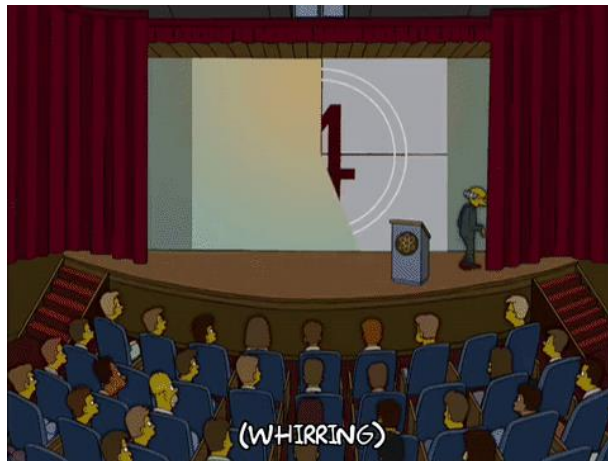
➢ Examples of Batching

- Waiting for a table at a restaurant (Table for 4).

- Waiting at IPAC to get CAC.

- On the telephone when on hold.

➢ Batching may be required in some instances

➢ Providing a product / service to a specific group / crowd.

➢ Examples: In-class training, Base tours, Award presentations, Carpooling, etc.

Batch Processing

Process A: 10 minutes   Process B: 10 minutes   Process C: 10 minutes
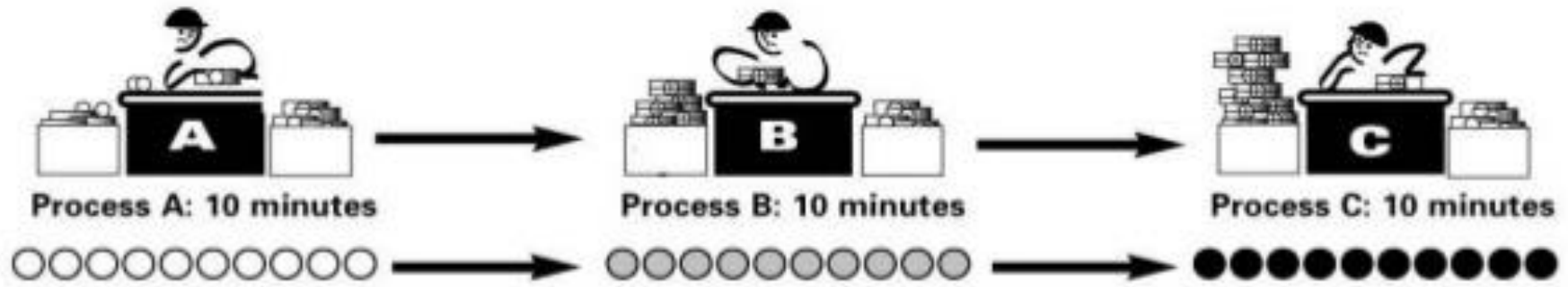
Process Example
- – Make 10, Move 10
- – Cycle Time: 1 minute per item

Process Metrics:
- – Lead Time (Total Process Time) for Above Process: 30 minutes
- – First Piece Output: 21 minutes
  - • 10 minutes (Process A) + 10 Minutes (Process B) + 1 Minute (First Completed Item for Process C)

One Piece Flow (Ideal Batch Size)

- Focuses on completing the production of one piece from start to finish with as little work in process inventory between operations as possible.

- Items flow non-stop (no piles between steps).

- One item is completed for each item started.

- **"One" does not need to be taken literally.**
  - Should be based on customer demand
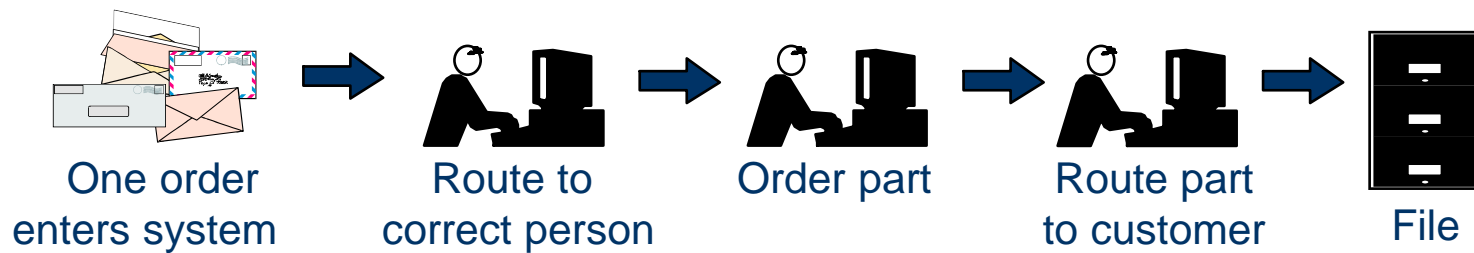 - Could be one unit of order.

Only process:

- What the customer wants,

- In the quantity the customer wants,
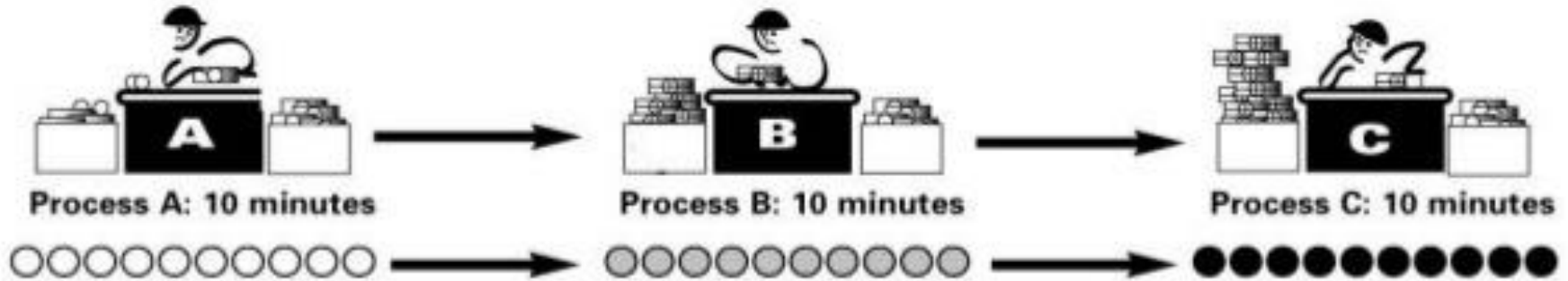
- When the customer wants it.

The Ideal State:

Produce and move one piece at a time.

One order enters system → Route to correct person → Order part → Route part to customer → File

Segregate excess WIP away from the improved process; develop a plan to eliminate it.

Continuous Flow Example

Batch Processing

Process A: 10 minutes → Process B: 10 minutes → Process C: 10 minutes

Continuous Flow Processing
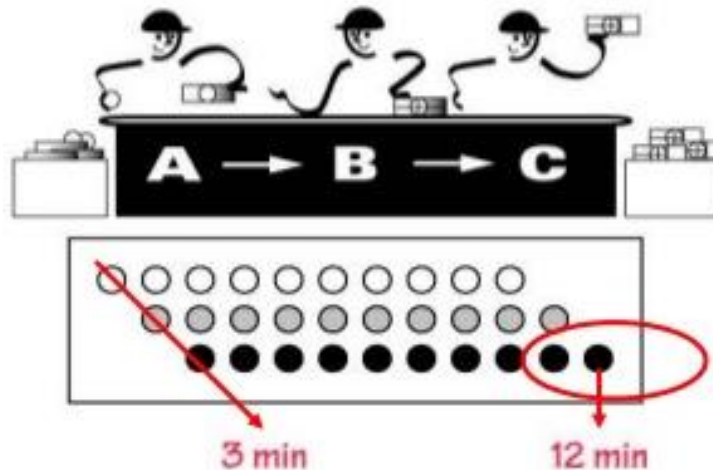

A → B → C

3 min | 12 min

Batch-and-Queue Process
- Make 10, Move 10
- Cycle Time: 1 minutes per/item

Process Metrics:
- Lead Time: 30 minutes
- First Piece Output: 21 minutes

Waste Identified:
- Waiting, Inventory (Excess)

Continuous Flow Process
- Make 1, Move 1
- Cycle Time: 1 minutes /item

Process Metrics:
- Lead Time: 12 minutes
- First Piece Output: 3 minutes

Waste Reductions:
- Wait Time, Work-In-Process Inventory

If One-Piece Flow is best – then why do we batch?

One reason is
SET-UP TIME

The amount of time taken to change over from the completion of the previous process to the beginning of the next process … "clock time" not labor time.

Set-Up Reduction or SMED

Taiichi Ohno / Shigeo Shingo found the real challenge was to create continuous flow in "small-lot" production.

Ohno achieved small lot continuous flow by:

- Aligning equipment & resources to the Value Stream.
- Physically locating machines / people close together.
- **Driving down batch sizes.**
  - Single Minute Exchange of Die (SMED).
  - Splitting and right-sizing of operations.
- Cross Training.
- Simple production control processes – Pull / Kanban.
- Aggressive root cause analysis.
- Application of Lean tools such as Kitting, Point of Use Systems (POUS), and visual controls.

You drive a car / truck

Your vehicle needs:
   1) Four new tires,
   2) Full tank of gasoline, and
   3) You need a drink of Gatorade.

QUESTION:
How long will it take you to accomplish these three tasks?

©Jim Garrahan - 2005

Set-Up Times and Lot Sizes Interact

➢ **Lot sizes** are made large because set-ups take a long time.

- Attempt to increase total throughput.

- Ignores underlying issues.

➢ **Set-ups** take a long time because they are not done often.

➢ The cycle repeats endlessly.

- It's best to improve set-ups first.

- Set-up reduction "feels" contradictory and so it is often ignored; spend effort improving NVA to improve VA.
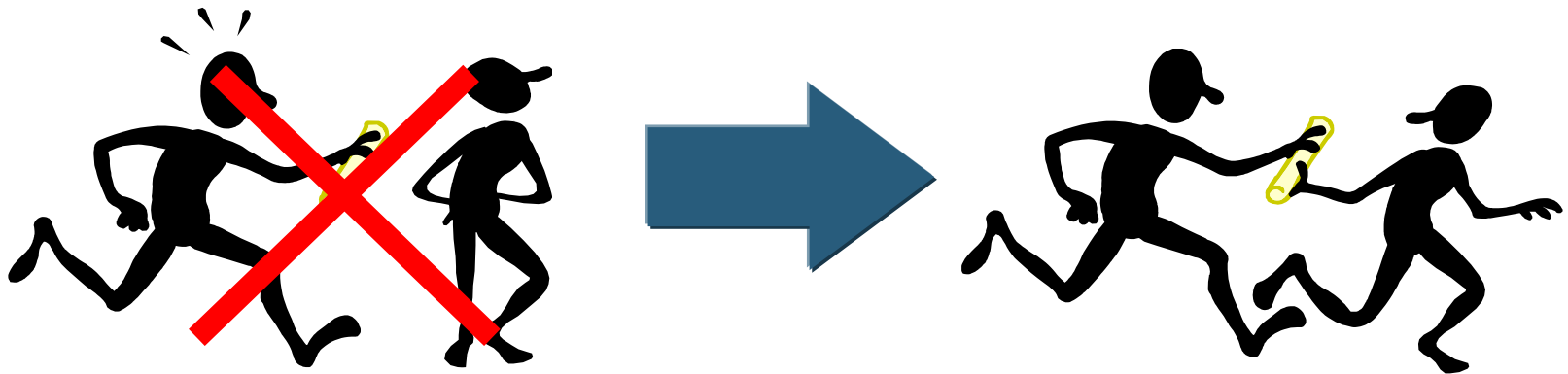
Why Address Set-Ups?

➢ Improve flow by reducing cycle times.

- Allows smaller lots.
- Resources are spent on VA activities.

➢ Reduce costs.

- Reduces WIP and carrying costs.

➢ Resource flexibility

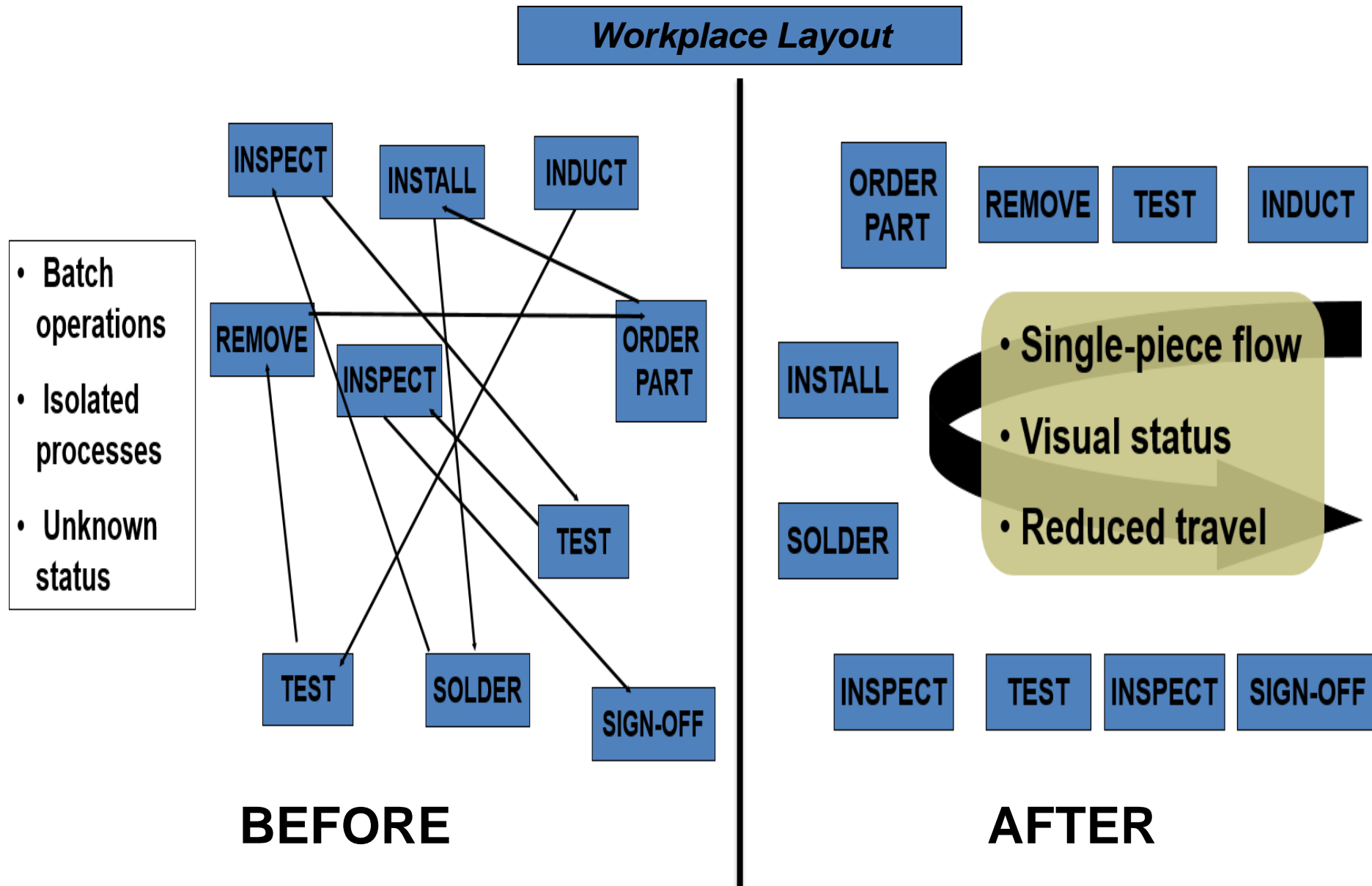- Increases ability to change products or services in a timely manner.

Ways to Streamline Set-Up

➢ Change tasks: Reduce/eliminate, combine, re-sequence, put in parallel

➢ Fix settings, eliminate adjustment

➢ Eliminate threads

➢ Unit tool changes

➢ Reduce hand tools

➢ Focus storage

➢ Plan and stage

➢ Use casters & rollers

➢ Standardize

Workplace Layout

- Batch operations
- Isolated processes
- Unknown status

INSPECT INSTALL INDUCT

REMOVE INSPECT ORDER PART

TEST SOLDER SIGN-OFF

BEFORE

ORDER PART REMOVE TEST INDUCT

INSTALL

SOLDER

- Single-piece flow
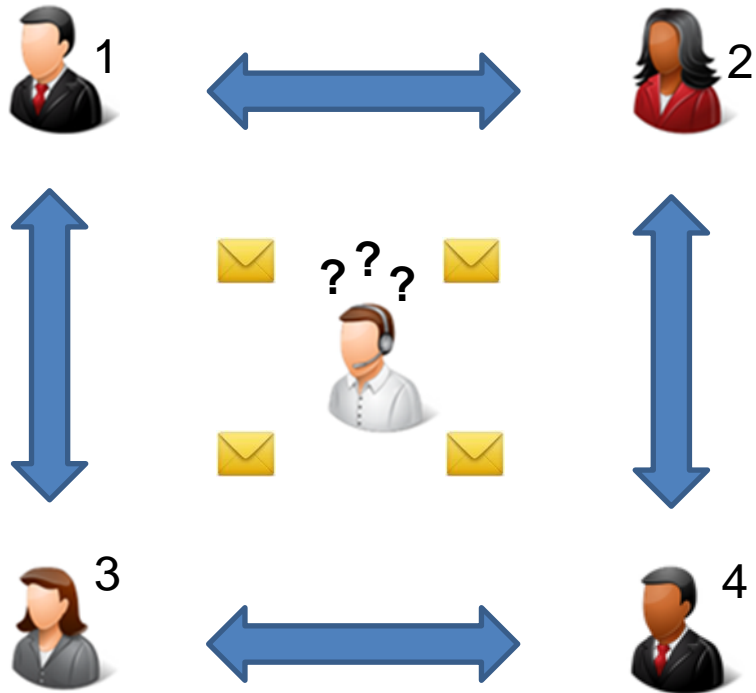- Visual status
- Reduced travel

INSPECT TEST INSPECT SIGN-OFF

AFTER

Work Cell or Office Space?

Andon signals need for help

Admin support to keep the value-added workers on task and undistracted!

Raw Materials

Cross-trained employees to adjust with changing demand!

Finished Goods

Lean Flow In the Office

1

2

? ? ?

3

4
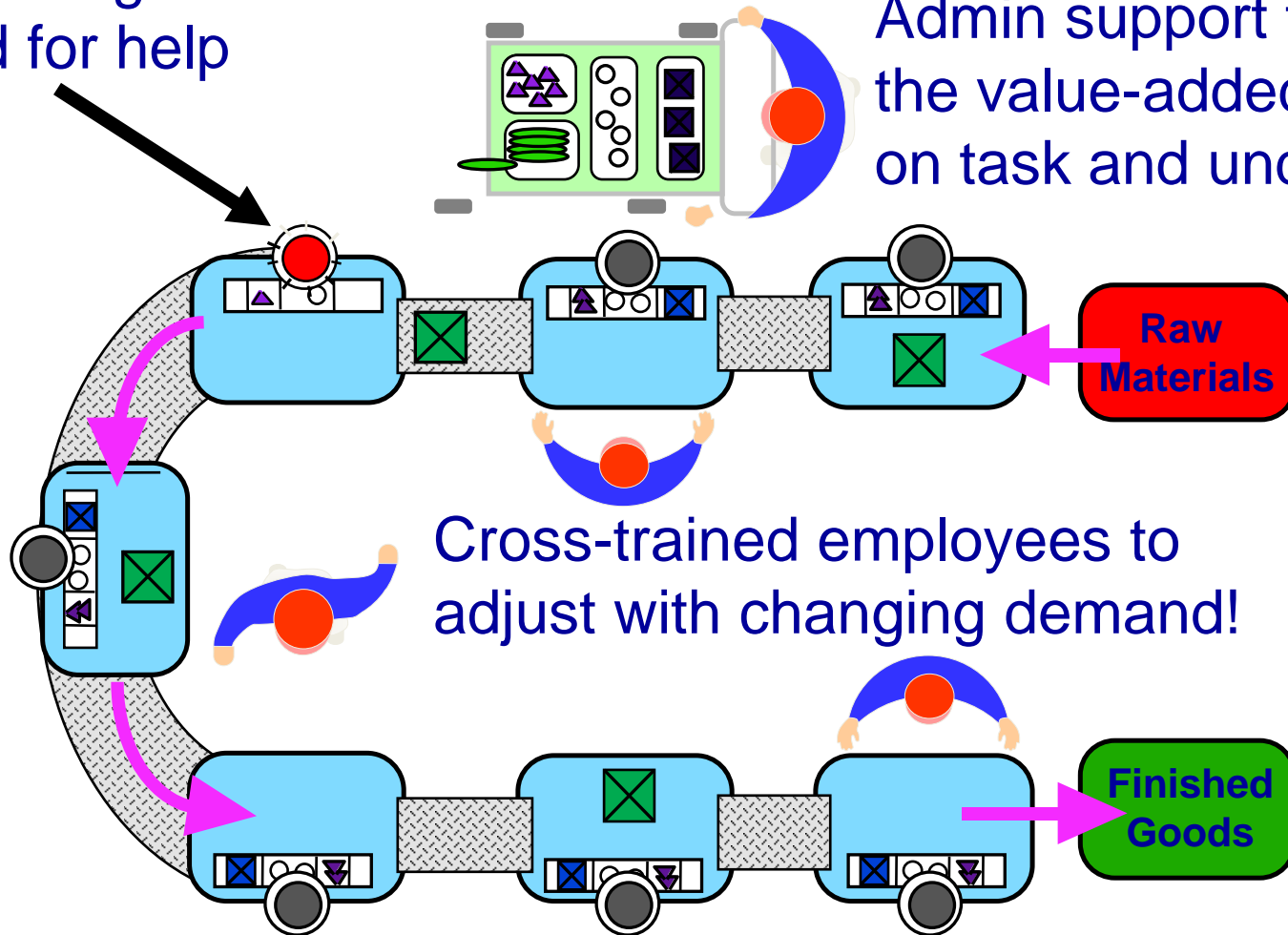
Before Lean
Shotgun Email Method

Problems:
➢ Confusing
➢ Wasted Time
➢ Increased Costs

Combining two documents into one with Tracked Changes takes a **MINIMUM** of **15** steps to complete.

In this example, you are combining 4 documents which means you would need to complete the combine process 3 times:
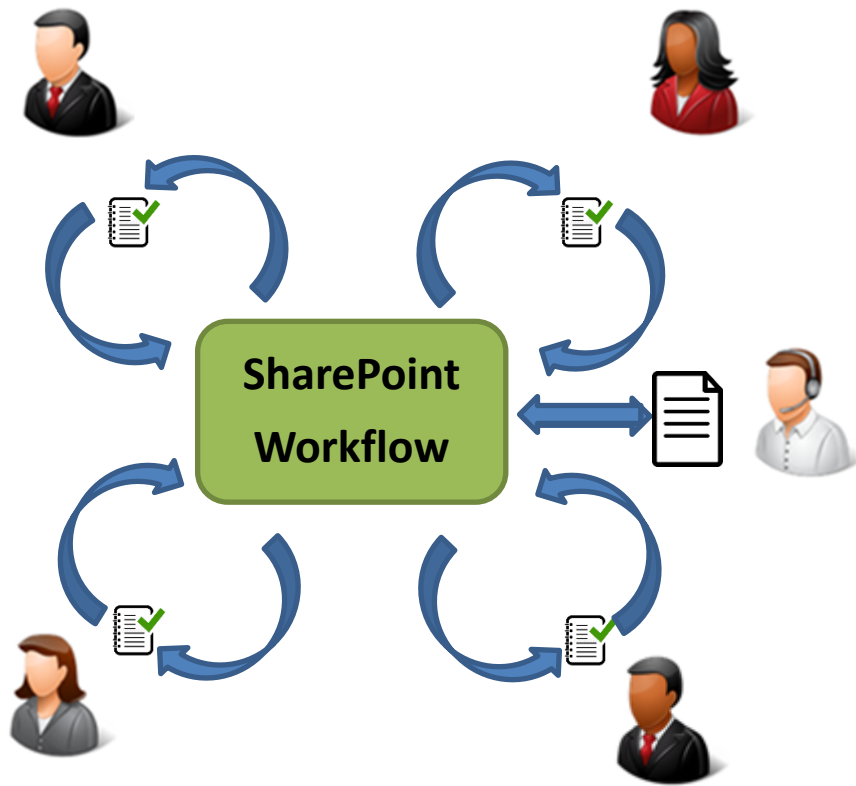
Document 1 + 2
Document (1 & 2) + 3
Document (1 & 2 & 3) + 4

TOTAL MINIMUM STEPS: **45**

Lean Flow In the Office

After Lean

SharePoint Workflow

Benefits:
➢ Reduce Errors
➢ Improved flow, less confusion
➢ Decreased Costs

All changes are in ONE DOCUMENT with Tracked Changes. Processing this document now takes a **MINIMUM** of **5** steps to complete.
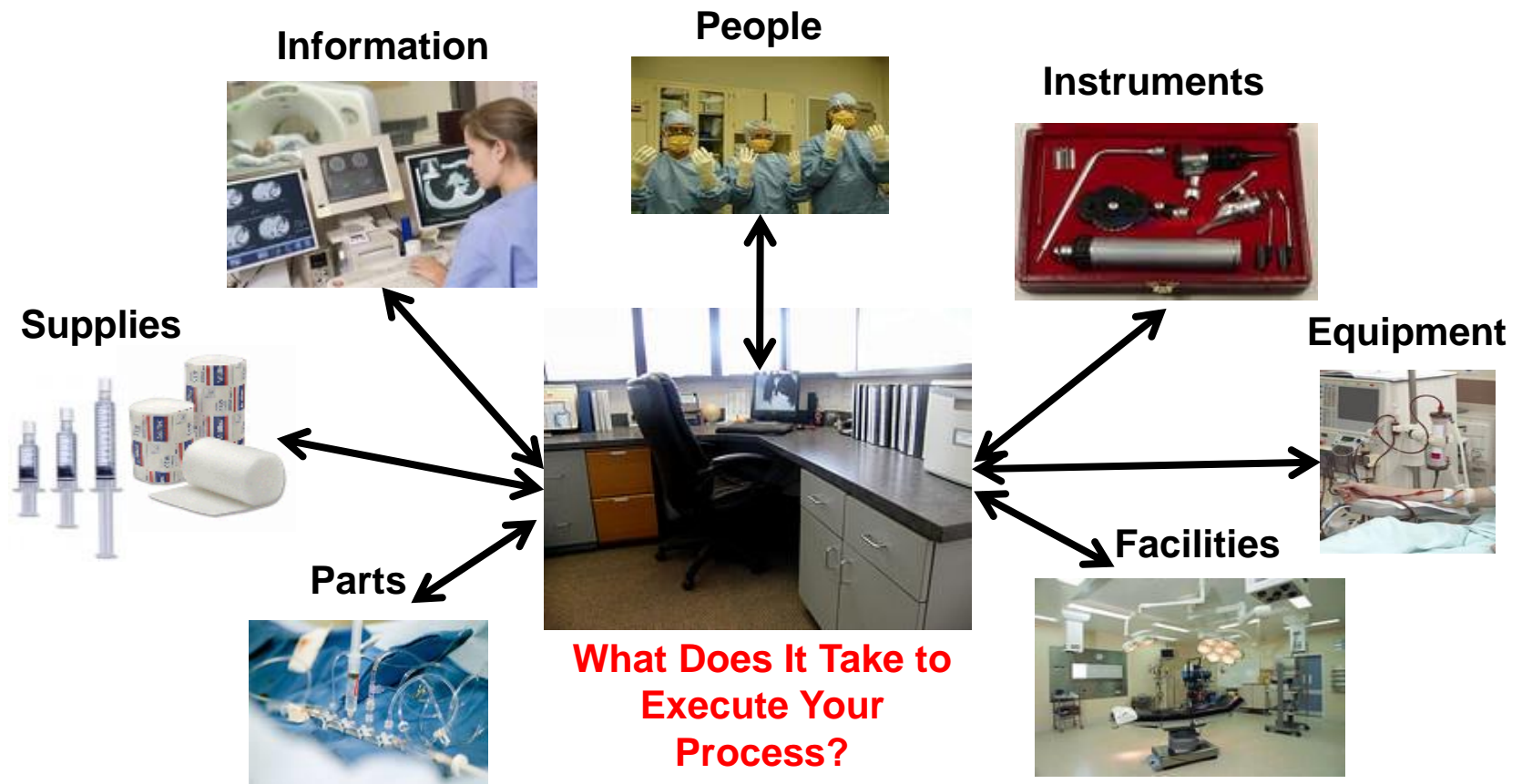
Before:
TOTAL MINIMUM STEPS: **45**

After:
TOTAL MINIMUM STEPS: **5**

Total Reduction: 89% reduction

Point of Use Systems (POUS)

POUS is a practice that ensures that the right information, parts, tools, equipment & people are available where & when needed. *Are your workers treated like doctors in an operating room?*

Information

People

Instruments

Supplies

Equipment

Parts

Facilities

What Does It Take to Execute Your Process?

POUS/Kitting Examples

Quality is defined by the customer

Make no defects

Pass no defects

$1.25 per bag x 3 bags = $3.75 COPQ

What is the ideal batch size?

**All processes should be run with a "make one, move one" approach.
True or False?**

Why would we focus on reducing setup time?

There are 5 Lean Principles.

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2. The **Value Stream** has been identified for each service.
3. The product / service **Flows** without interruptions.
4. The customer can **Pull** value through the process.
5. Continuous pursuit of **Perfection.**

Just-in-Time (JIT) is a methodology aimed primarily at reducing flow times within a system as well as response times from suppliers and to customers.

JIT methodology includes:

- Don't produce something unless the customer has ordered it (**Pull**).

- Level demand so that work may proceed smoothly throughout the workspace (**Heijunka**).

- Link all processes to customer demand through simple visual tools (**Kanbans**).

- Maximize resource flexibility.

"Flow where you can, Pull where you can't"
Christoph Roser in "All About Pull Production"

Push:

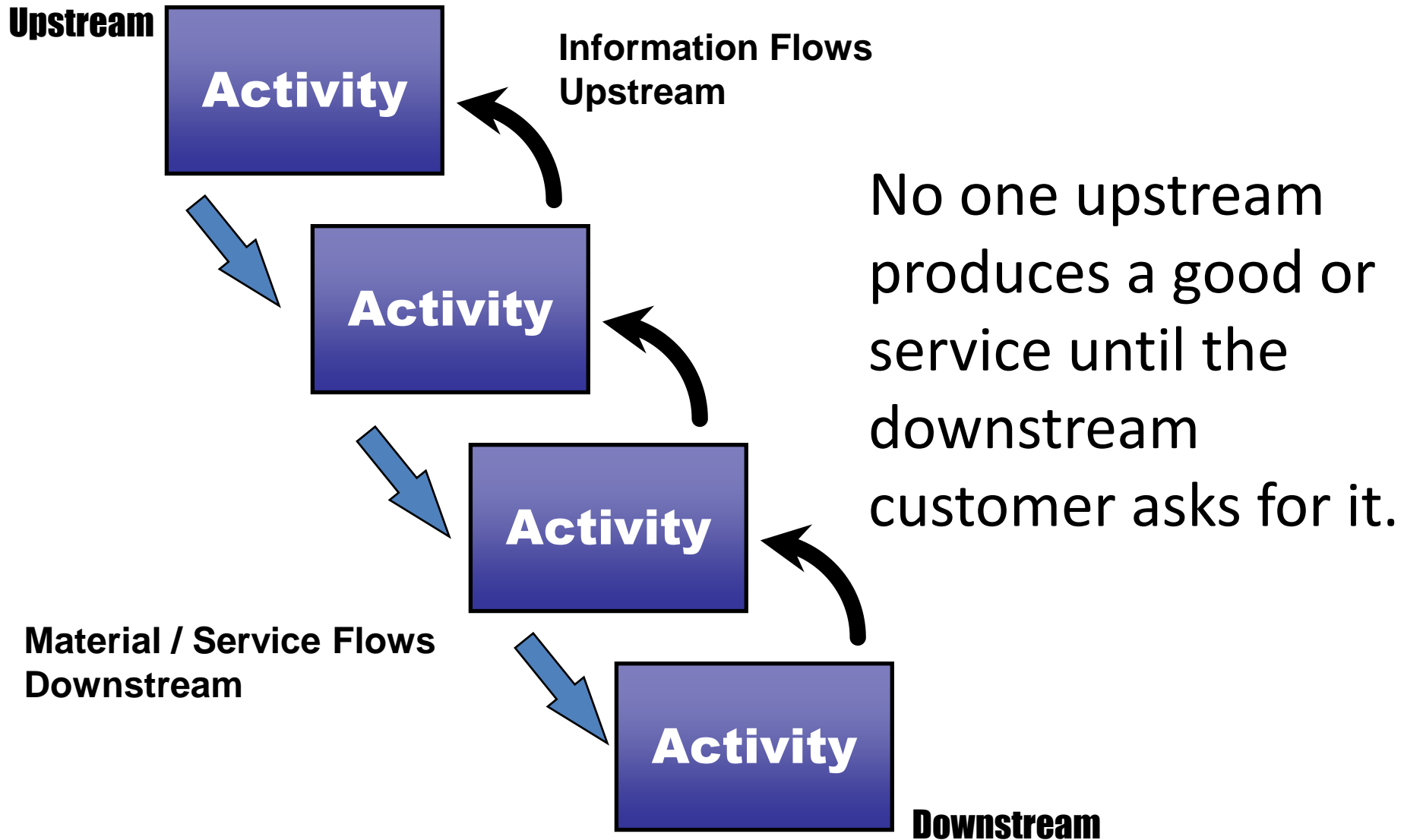Work is pushed into the system or process based on **forecasts or schedules**.

Pull:

A **customer-driven system** that produces and moves a product/service *only* when the customer needs it.
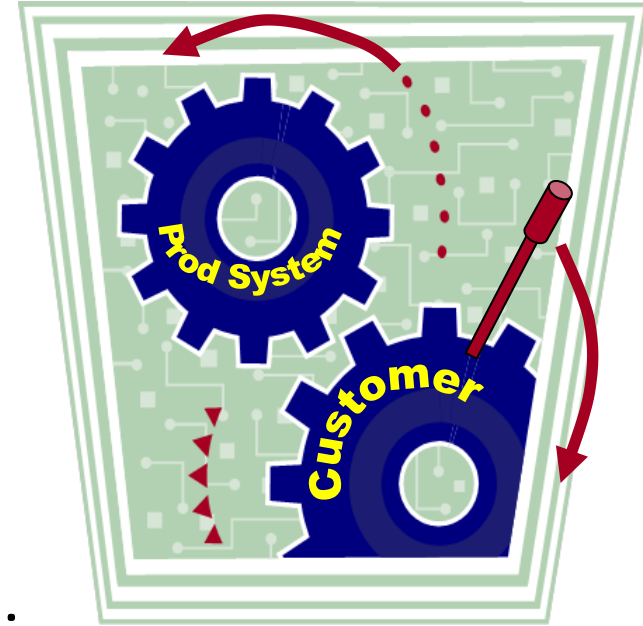
"The slower but consistent tortoise causes less waste and is much more desirable than the speedy hare that races ahead and then stops occasionally to doze. TPS can be realized only when all workers become tortoises." – Taiichi Ohno

Pull Systems

Upstream

Activity

Information Flows
Upstream

Activity

No one upstream produces a good or service until the downstream customer asks for it.

Material / Service Flows
Downstream

Activity

Activity

Downstream

Pull Systems

Pull

Elements

➢ Upstream Supplier

➢ Downstream Customer

➢ Visual Trigger (Kanban)

Sequenced

➢ Use First In First Out (FIFO) lanes

Replenished

➢ Create supermarkets

➢ Increases speed to your customer.

➢ Reduces inventories without creating parts shortages.

➢ Decreases floor space.

➢ New thought process: replaces "Ready or not here I come" with "OK, now I'm ready".

Heijunka – Workload balancing.

Kanban – system of visual tools that synchronize and provide instruction to suppliers and customers.

Both Heijunka and Kanban in turn depend on:
- Quick changeovers (Set-ups).
- Visual Management.
- Capable processes, including methods, workers, and machines.

Heijunka (Hi-junk-a)

Even distribution of work to meet Takt Time (Workload Balancing), especially for different products from the same process.

To avoid waste (muda), processes need:

- Predictability – Leveling demand.
- Flexibility – Decreasing changeover (set-up) time.
- Stability – Averaging production volume and type over long term.
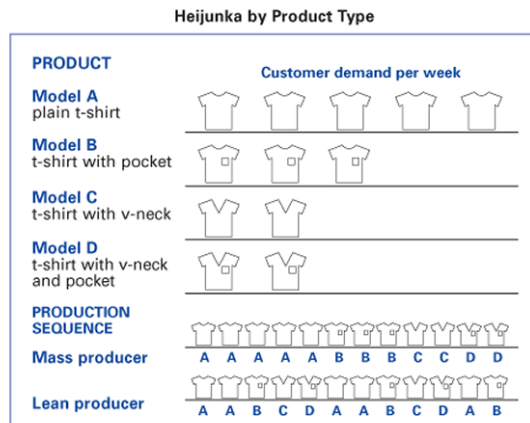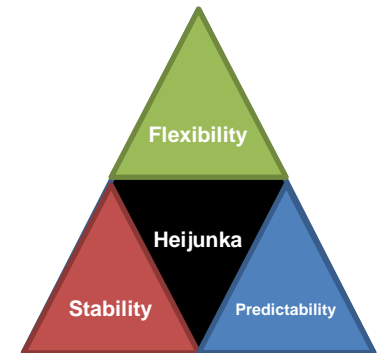
Heijunka by Product Type
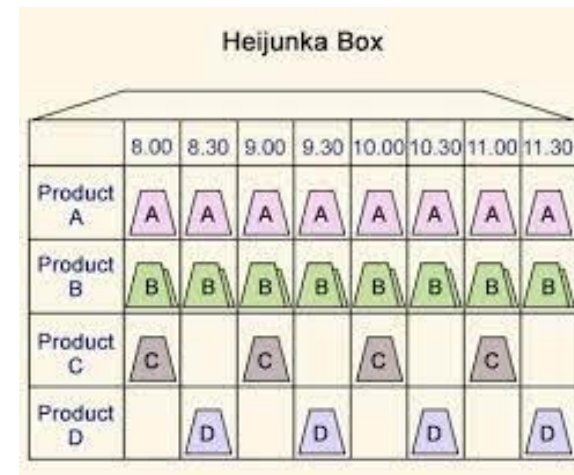
Heijunka Box

➢ A Heijunka box helps to:

- Determine pitch for each product.

- Create a production sequence.

- Create a production sequence table.

➢ A Heijunka box is the schedule of work that includes what things arrive when and when they should be done.

Day/Time

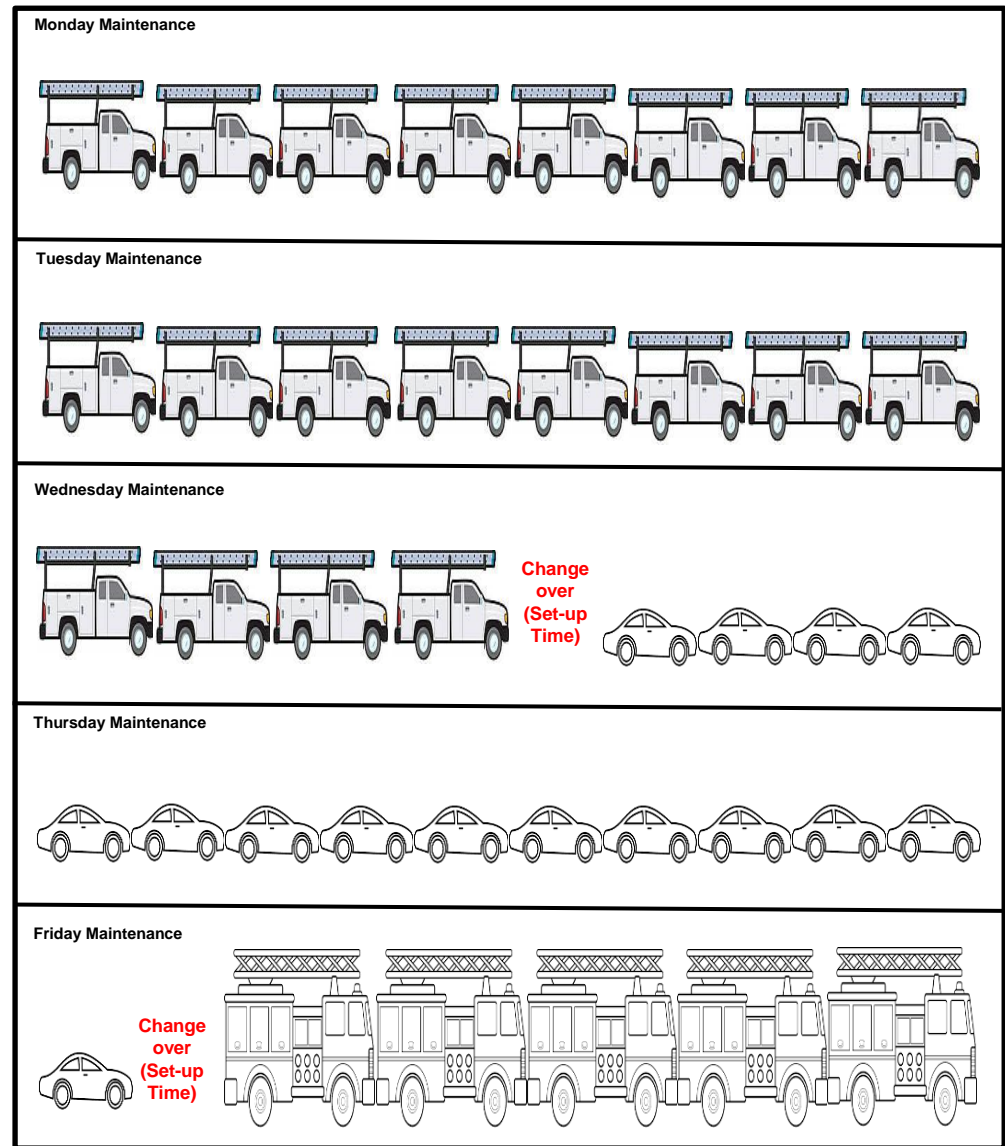
Heijunka Box

Traditional Production Example – Unleveled

Traditional Production
- Maximize use of equipment time.
- Unpredictable work schedules (Muri - Strain)
- Occasional overtime

Produce Large Batches (Mura - Uneven)
- Long Set-up Time

Prevents Value Flow (Muda - Waste)
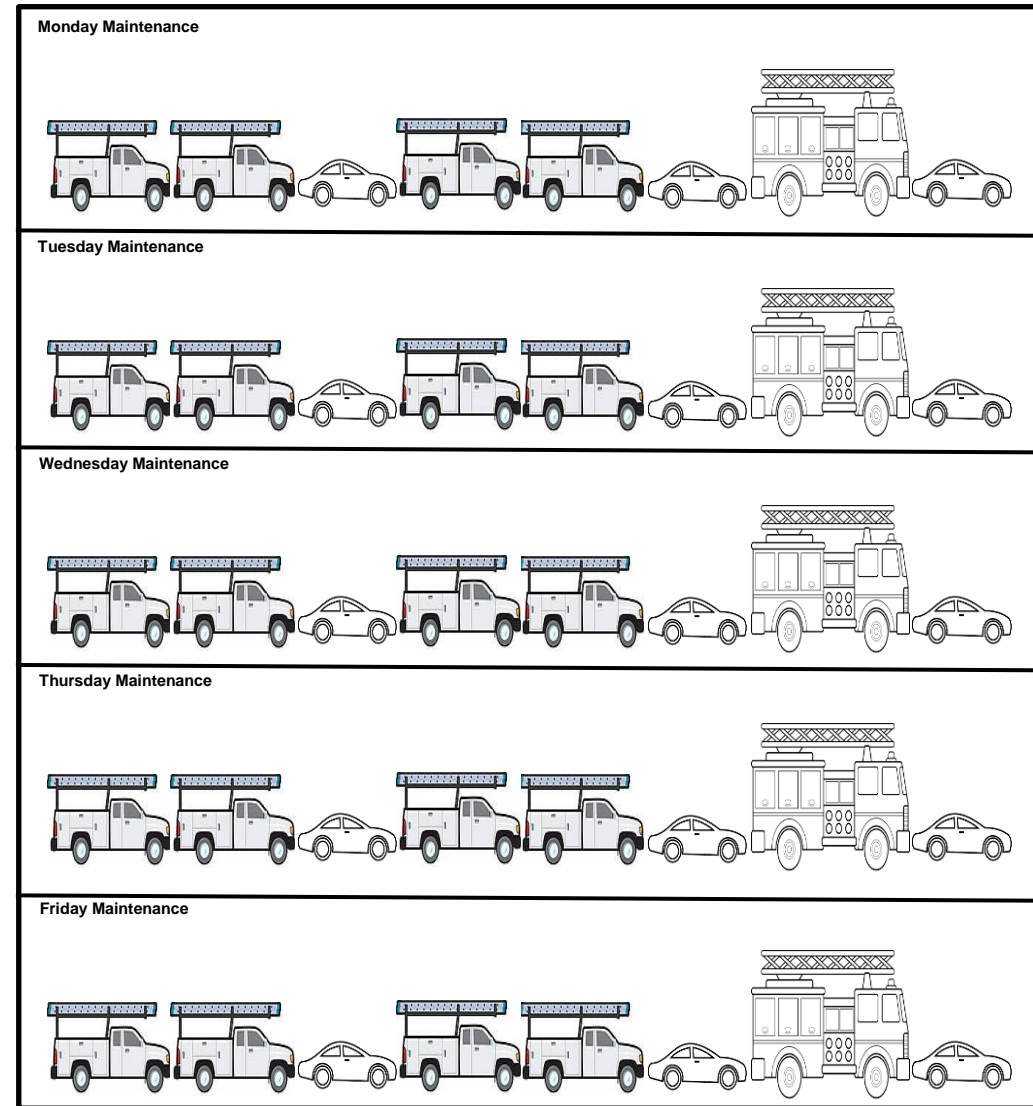- Long wait times and excessive inventory

Leveled Production

- Predictable work schedules
- Overtime savings

Produce Small Batches

- Minimize set-up time
- Flexibility to meet customer demand

Promotes Value Flow

- Reduced wait time and inventory levels

Monday Maintenance

Tuesday Maintenance

Wednesday Maintenance

Thursday Maintenance

Friday Maintenance

➢ **Kanban** – system of visual tools (pull signals) that synchronize and provide instruction to suppliers and customers.

➢ Kanban Rules:

- Never move defective items.
- The customer withdraws only what is needed.
- **Produce only the quantity withdrawn by the customer.**
- Use Kanban to fine-tune (level) production.
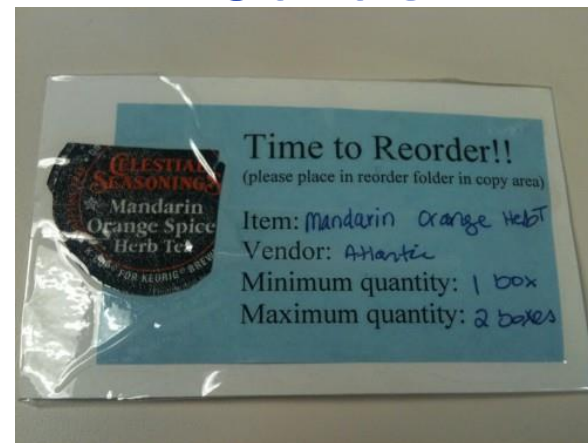- Stabilize and strengthen the process.
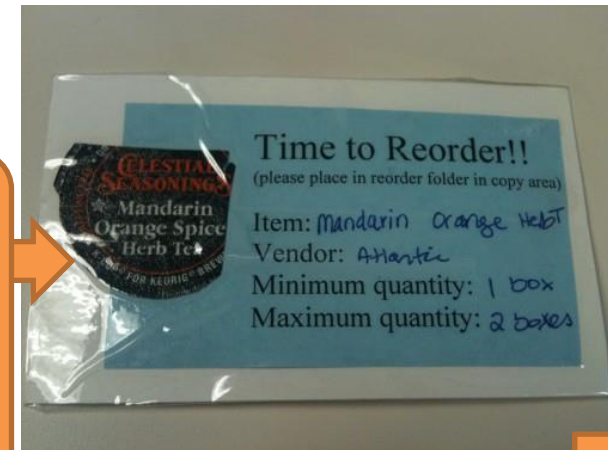
Floor Markings

Containers (Kits)

Lights

Cards

Reordering Office Coffee

Step One: Remove Empty Box

Step Two: Locate New Box

Step Three: Pull Kanban

Step Six: Replace Stock

To-Be Ordered

Awaiting Delivery

Step Five: Place Kanban in Reorder Pouch

Step Four: Replace Box

What is the primary difference between a Push system and a Pull system ?

What are the benefits of a pull system?

What is the purpose of using a Kanban system?

Lead Time

➢ The time required to **complete an entire process** (including wait times) from order to delivery.

➢ Measured in elapsed time (minutes, hours, etc.).

➢ Lead Time can be *approximated* using <u>Little's Law</u>:

$$Lead\ Time = \frac{Work\ In\ Process\ (WIP)}{Exit\ Rate\ (ER)}$$

➢ **WIP** is the "number of things in process" at any given time.

➢ **EXIT RATE** (or Throughput) is the amount of work completed over a given period of time, which <u>should</u> meet customer demand

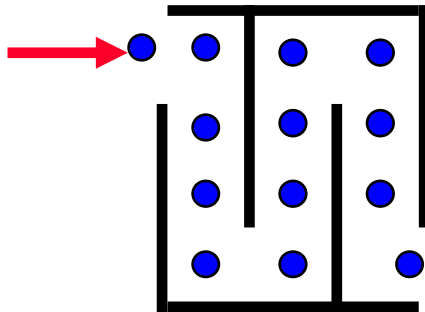➢ Common Synonyms: Throughput Time, Delivery Time, Turnaround Time.

Think about the lines at Disneyland in March…
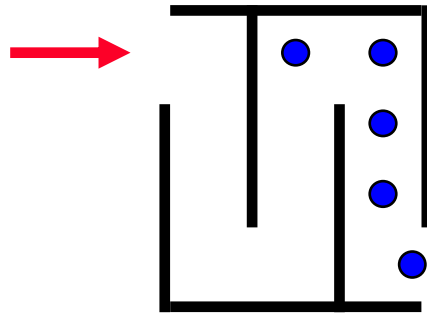
$$\text{Lead Time} = \frac{\text{WIP}}{\text{Exit Rate}} = \frac{\textbf{5 people}}{\textbf{1 person/minute}}$$

Lead Time = **5 minutes**

…and then think about them in July…

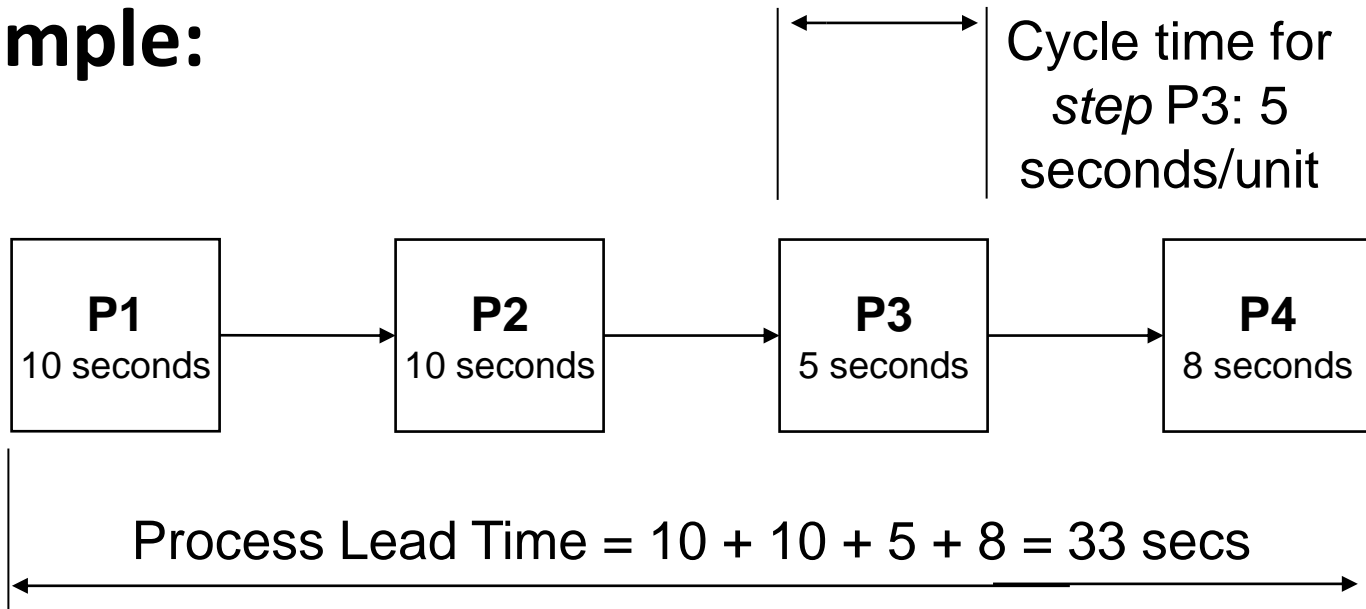$$\text{Lead Time} = \frac{\text{WIP}}{\text{Exit Rate}} = \frac{\textbf{13 people}}{\textbf{1 person/min.}}$$

Lead Time = **13 minutes**

…Conclusion: Fixed Capacity (Exit Rate) + Increased People (WIP) = Slower Lead Times!

Cycle Time - Example

➤ Cycle Time: The time it takes a product to move (cycle) through a _step_ or a _process_, including queue and move times.

➤ Measured in time per unit (minutes/batch).

➤ Cycle Time is the inverse of Throughput (Exit Rate).

Example:

Cycle time for _step_ P3: 5 seconds/unit

P1		P2		P3		P4
10 seconds	→	10 seconds	→	5 seconds	→	8 seconds

Process Lead Time = 10 + 10 + 5 + 8 = 33 secs

Average Exit Time = 1 unit every 10 secs (bound by the slowest step)

Takt Time: The rate at which a product or service needs to be provided to meet customer demand.

$$Takt\,Time = \frac{Time\ available\ for\ work\ in\ the\ given\ time\ period}{Customer\ demand\ for\ a\ given\ time\ period}$$

Process Sequence: The steps necessary to produce a product or service, with some process steps being dependent upon other steps being performed first.

Pitch: Customer configured delivery requirement based on Takt Time (Takt Time x batch quantity).

Takt Time

250 Available Workdays per Year.

- (assuming 5-day work week)

Customer requires 30 Units per Year.

$$\text{Takt Time} = \frac{(250\,\text{days})}{(30\,\text{Units})}$$

$$\text{Takt Time} = 8.3\,\text{days per Unit}$$

- With a Takt Time of 8.3 days, you must induct and sell a unit every 8.3 workdays in order to meet the Customers annual demands.

- A tool to see how the process is performing against the customer expectations.

- **Helps identify constraints / bottlenecks to balance workload (Mura).**

- Data for Takt Charts are drawn from the data blocks of the Value Stream Map, and from customer demand.

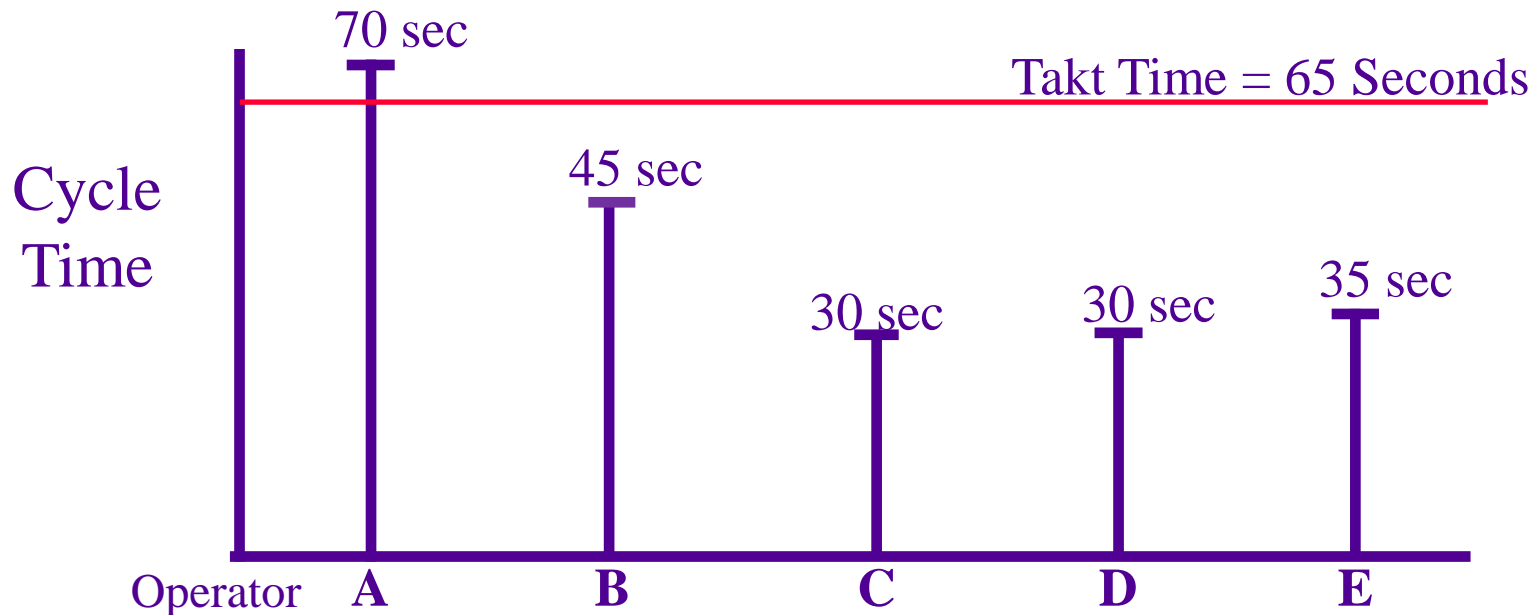- Plot the steps on the horizontal axis using time as your vertical axis.

Takt Time = 65 Seconds

Cycle Time

Operators   A   B   C   D   E
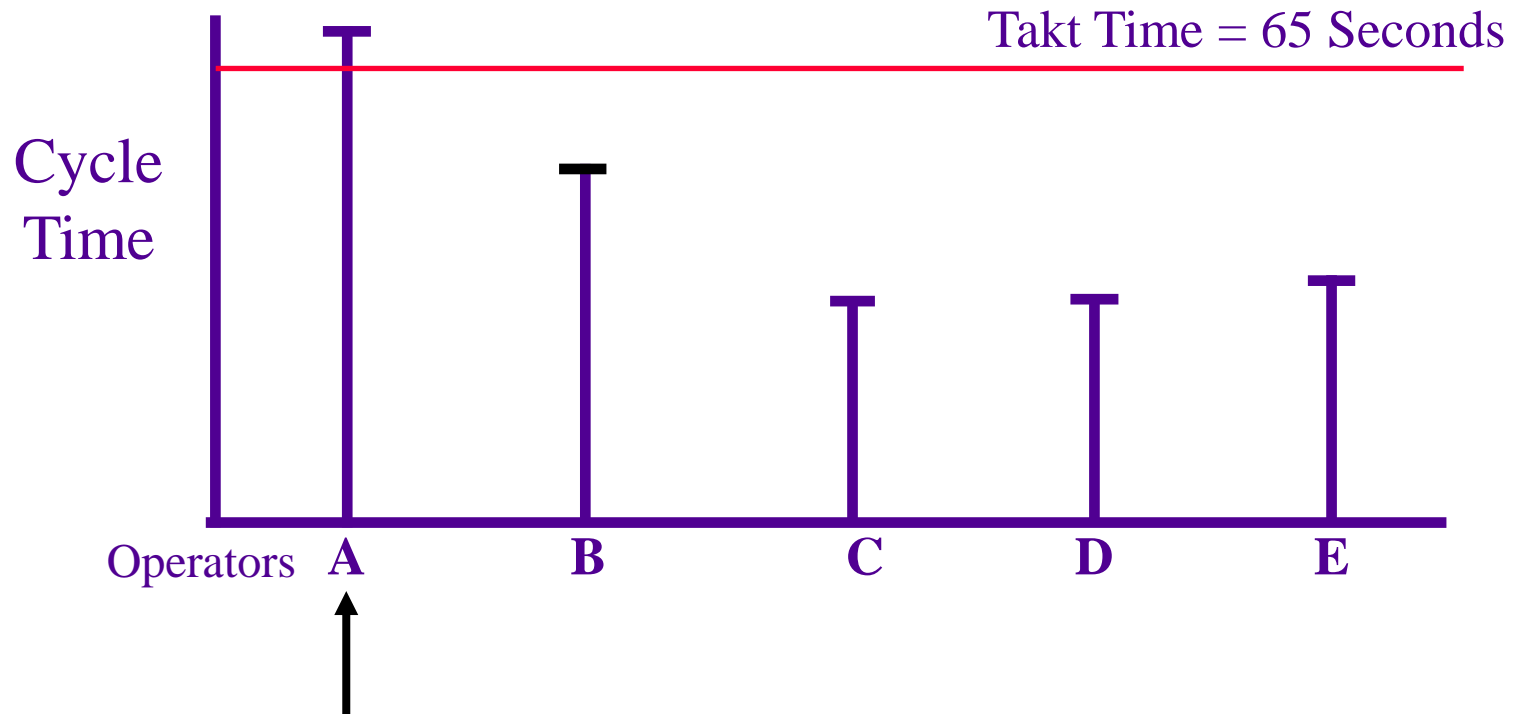
"Operator A" is a constraint because they cannot meet the Takt Time.

Chart existing operator cycle times

Cycle Time

70 sec

Takt Time = 65 Seconds

45 sec

30 sec

30 sec

35 sec

Operator   A   B   C   D   E

Can we reduce the cycle time of Operator A as well as reduce manning?

$$* \ Minimum \ Staffing = \frac{Total \ time \ of \ all \ tasks \ for \ all \ operators}{Takt \ Time}$$

* If the numerator or denominator changes, staffing must be adjusted and work assignments rebalanced.

This equation is to be used to identify potential areas for improvement and not a justification for manpower reduction efforts.

Minimum Staffing $= \dfrac{(70+45+30+30+35) \text{ sec}}{65 \text{ sec}} = \dfrac{210 \text{ sec}}{65 \text{ sec}} = 3.23 \text{ (round up)} = 4 \text{ oper}$

Chart existing operator cycle times
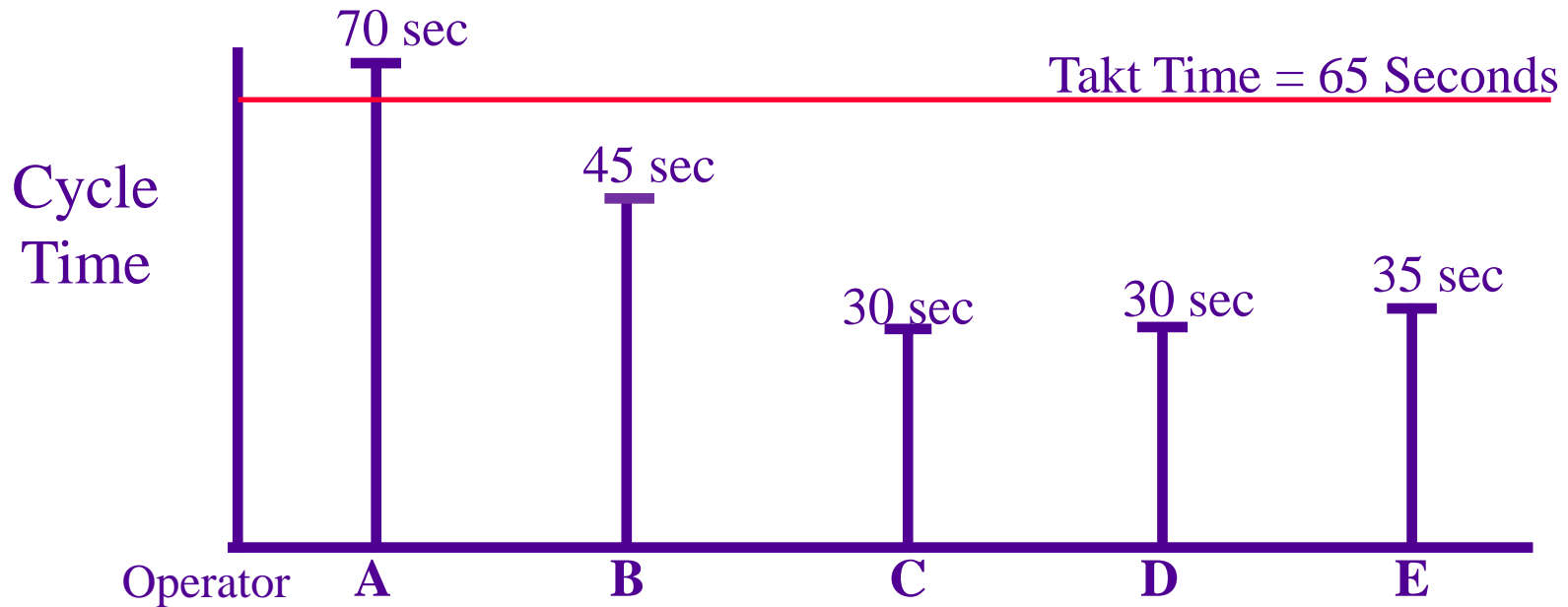
By workload balancing we can free up personnel.

Theory of Constraints 5 Focusing Steps

1. Identify the constraint

2. Exploit the constraint

3. Subordinate to the constraint

4. Elevate the constraint

5. Re-evaluate, go back to step 1

TOC experts see processes and systems as chains. The strength of the chain is dependent upon the strength of the weakest link.

➢ Drum – The pace at which the system is operating

➢ Buffer – A way to protect the constraint from being "starved", to ensure the constraint always has work

➢ Rope – the signaling system that allows work to be put into the system at the appropriate time to support efficient use of the constraint

The aim is to protect the constraint, and therefore the system as a whole, against process variation.

Consider the following set of processes:

- A customer needs 25 units in 15 minutes (900 seconds).

- Order entry takes 20 seconds.

- Delivery takes 10 minutes (600 seconds).

Order Entry 20 seconds	P1 10 seconds	P2 10 seconds	P3 5 seconds	P4 8 seconds	Delivery 600 seconds
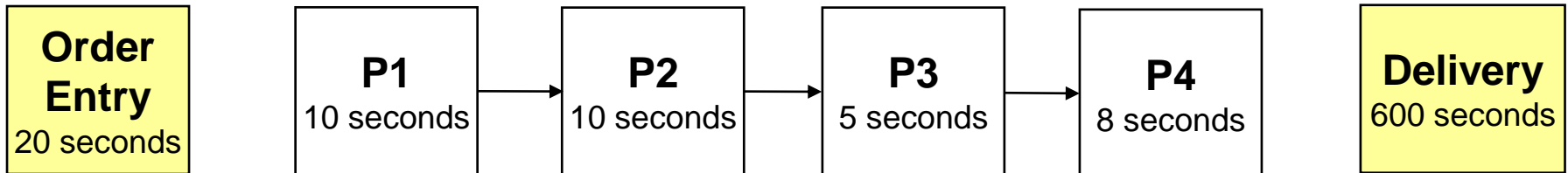
Available process time = _____

Customer demand = _____

Takt Time = _____

Process Cycle Time = _____

What is our exit rate? _____

Lead Time = _____
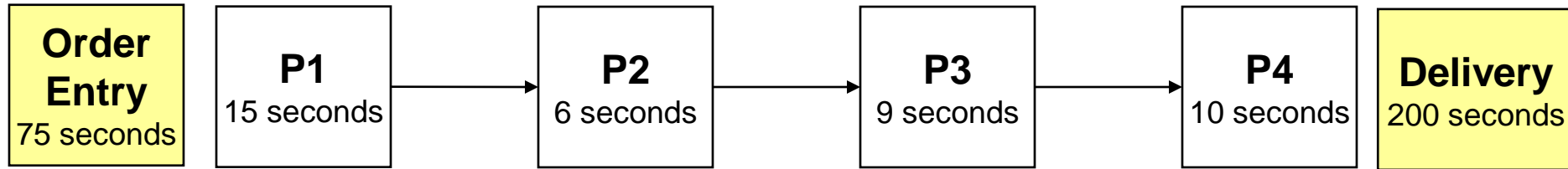
Where is the constraint? _____

Variation happens!

P1	P2	P3	P4
10 ± 1 seconds	10 ± 3 seconds	5 ± 2 seconds	8 ± 6 seconds
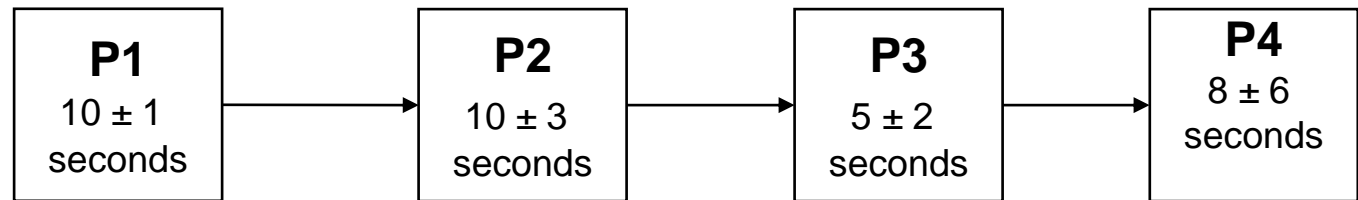
Lead Time = _____

Where is the constraint? _____

Exit Rate = _____

Order Entry 75 seconds	P1 15 seconds	P2 6 seconds	P3 9 seconds	P4 10 seconds	Delivery 200 seconds

What is the total lead time for the above process?

What is the cycle time for P3 in the above process?

Where is the constraint in the process above and why?

What is the formula we use to calculate lead time?

```
┌──────────┐      ┌──────────┐      ┌──────────┐      ┌──────────┐
│   P1     │─────▶│   P2     │─────▶│   P3     │─────▶│   P4     │
│15 seconds│      │6 seconds │      │9 seconds │      │10 seconds│
└──────────┘      └──────────┘      └──────────┘      └──────────┘
```
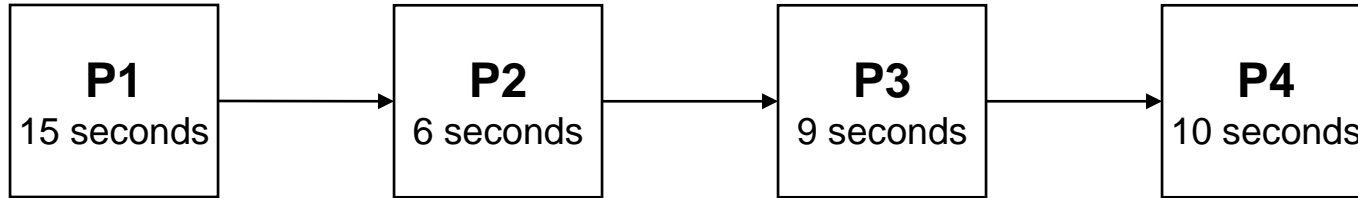
What is the Takt Time for the process above?

What would I need to know to calculate the Takt Time?

There are 5 Lean Principles.

1. **Value** specified from the customer's perspective.
2. The **Value Stream** has been identified for each service.
3. The product / service **Flows** without interruptions.
4. The customer can **Pull** value through the process.
5. Continuous pursuit of **Perfection.**

Pursuit of Perfection

- Begins with understanding Lean Principles & visualizing the "perfect" process at the outset.

- No matter how much you improve a process to make it leaner, there are always ways to continue to remove waste by eliminating effort, time, space and errors.

- Achieving the "Lot Size of 1".

- **Achieving Continuous Flow.**

- Achieving a CPI Culture.
  - Using Change Management

"Perfection is not attainable. But if we chase perfection, we can catch excellence."
— Vince Lombardi

Pursuit of Perfection

To start your pursuit of perfection, start by:

➢ Asking small questions.

➢ Taking small actions.

➢ Solving small problems.
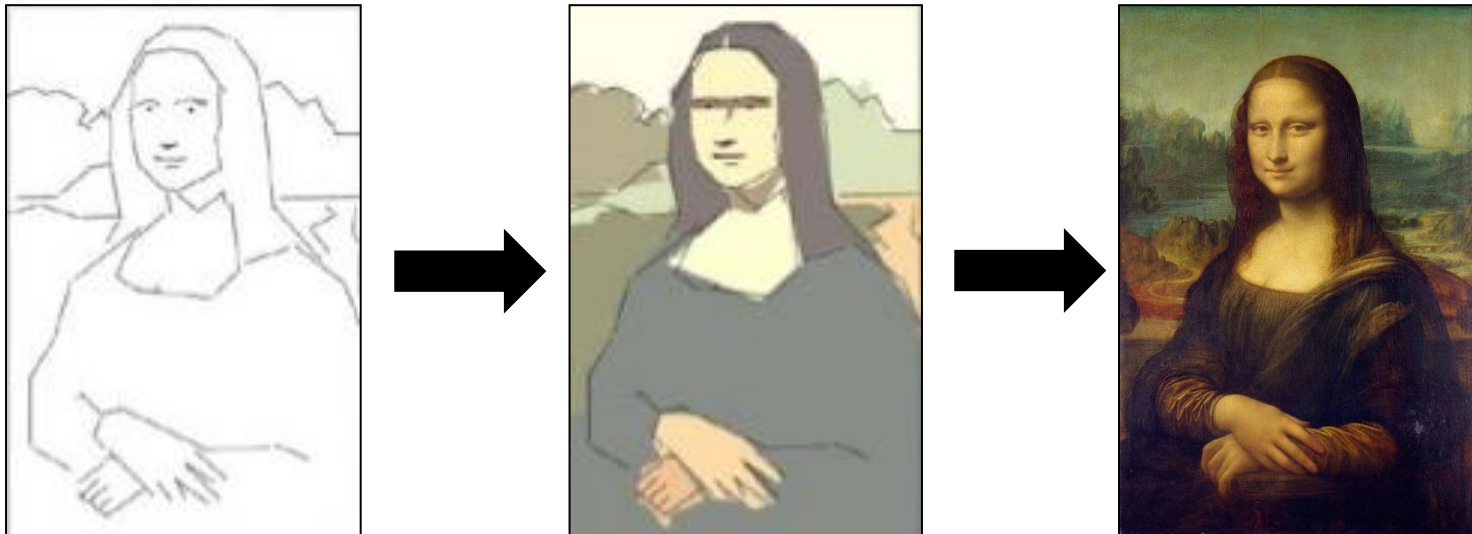
"A journey of a thousand miles begins with a single step." – Lao Tzu

It's Cultural

You Can't Become Lean without Learning

➢ **One Million** – That's how many ideas Toyota *implements* *e*ach year. Do the math: 3,000 ideas a day.

➢ But not just any ideas. Mostly tiny ones by employees that view their role not to be simply doing the work, but taking it to the next level…every day, in some little way.

➢ When an entire organization thinks like that, it becomes unstoppable.

What are the Lean Principles?

What would we use a Takt Chart for?

5S

5S is a process and method for creating and maintaining an organized, clean, and high-performance workplace.

5S enables anyone to distinguish between normal and abnormal conditions at a glance.

5S is the foundation for continuous improvement, zero defects, cost reduction, and a more productive work space.

5S is a systematic way to improve the workplace, our processes and our products through employee involvement.

5S Workplace Organization

Sort	**Clearly distinguish needed items from unneeded items and eliminate the latter.**
Simplify (Set)	**Keep needed items in the correct place to allow for easy and immediate retrieval.**
Systematic cleaning (Shine)	**Keep the workplace orderly and clean.**
Standardize	**Standardize cleanup. This is the condition we support when we maintain the first 3 S's.**
Sustain	**Discipline, stick to the rules / continuous improvement of all principle.**

…some have added Safety to 5S and called it 6S or 5S + 1.

Establish criteria for determining what is and <u>is not</u> needed in the area based on:

- Usefulness of the item / equipment.
- Frequency of use.
- Quantity needed.

Red Tag evaluation.

- Keep in existing area.
- Move to different spot within area.
- Hold in red tag area.
- Get rid of it.

Ask the people who use the material / equipment for help – We don't want to throw anything out that we actually need!

Determine the location for needed items and how they should be kept.

- Consider how to store tools and jigs.
- Consider principles of motion waste.

Identify best locations.

- Labels, signboards, maps, shadows.
- 5S Map: shows location of equipment in the area.
- Color-Code Strategy: distinguish use of tools / parts by color.
- Outlining work areas and locations.
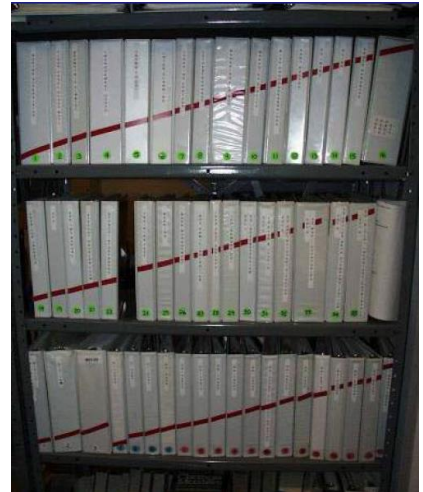
Creating a place for everything and everything in its place!
Make it obvious at a glance!

Systematic Cleaning or Shine (Seiso)

Determine Target

– *What needs to be cleaned?*

Determine Assignments

– *Who is responsible?*

Determine Methods

– *How will it be done?*

Determine Tools

– *What is needed?*

Implement Shine

– Everyone's responsibility.

**Create and maintain a neat and clean environment.
Make it a habit!**

Standardize (Seiketsu)

- Establish guidelines for sort, set and shine conditions.

- Bring the condition of the area up to those standards.

- Make the standard guidelines visible.

- Maintain and monitor first 3S's.

- Assign responsibilities and monitor through self audit and evaluation.

Create a consistent way to carry out tasks and procedures.

- Development of new awareness and skills.
- Support from management.
- Ongoing, company wide communication.
- Making 5S standards part of daily work.
- Total employee involvement.
- Implement Sustainment Checklist.

Managers Committed

Training
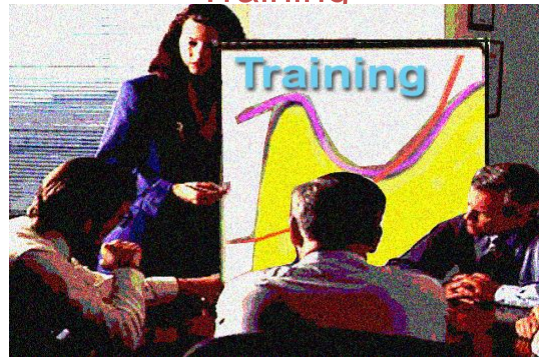
"Buy-in" from all workers

Sustain to maintain success!

P&I 5S Audit Form

Purpose: To audit administrative supply areas ensuring workplace organization and standards are being met.

Who should fill it out: LSS Specialist or P&I Leader

Directions: The best way to use this tool is to follow these steps:

1. For each statement, circle the appropriate score.
2. Total the score, review with the process worker and/or departmental manager.

Area: P&I   Audit Date: _____   Auditor: _____

Sort	Very Poor	Poor	Good	Very Good	Excellent
1. Are supply areas clear of excess supplies?	1	2	3	4	5
2. Are supply areas clear of out-of-date forms, lists, maps or checklists?	1	2	3	4	5
3. Are supply areas clear of excess personal items?	1	2	3	4	5
4. Are records file cabinets clear of out-dated records?	1	2	3	4	5
5. Is the LSS supply area free of unused items?	1	2	3	4	5
				Total Sort:	

Set					
1. Are supplies located in correct location?	1	2	3	4	5
2. Are supplies properly identified and labeled?	1	2	3	4	5
3. Are Records properly stored?	1	2	3	4	5
4. Are all LSS training cases properly labeled and stored (if not in use)?	1	2	3	4	5
5. Are all supply items provided a completed Supply Reorder Cards?	1	2	3	4	5
				Total Set:	

Shine					
1. Are supply areas clean and neat, free from clutter?	1	2	3	4	5
2. Is the LSS training case area clean and neat, free from clutter?	1	2	3	4	5
3. Are easels stored neatly in the conference room?	1	2	3	4	5
4. Is printer paper staging area stocked? (At least one ream present?)	1	2	3	4	5
5. Are all Records properly labeled with a information provided?	1	2	3	4	5
				Total Shine:	

Standardize					
1. Is the Paper Records Index up-to-date? (Within one month of audit)	1	2	3	4	5
2. Are blank 5S Audit Sheets and Supply Reorder Cards available?	1	2	3	4	5
3. Are supply cabinet maps up-to-date?	1	2	3	4	5
4. Are supply, records, and LSS SOPs reviewed regularly? (Check 1)	1	2	3	4	5
5. Are 5S Rules posted and clearly visible?	1	2	3	4	5
				Total Standardize:	

Sustain					
1. Are 5S audits being conducted on a regular basis? (Monthly)	1	2	3	4	5
2. Is the Records Management SOP being followed?	1	2	3	4	5
3. Is the Office Supply Procurement SOP being followed?	1	2	3	4	5
4. Are supplies with no current inventory in process of being reordered?	1	2	3	4	5
5. Can each employee explain the value of 5S? (Ask 1)	1	2	3	4	5
				Total Sustain:	

Total of all 5 categories: _____

100 - 125: Great. Doing Well.   75 - 99: Caution. Could Do Better   <75: Concern: Minimal Effort Shown

Last Update: 11/17/2016

Item No.	Description	Rating Scale: 0-5 (0 = No 5S Evident, 5 = Out of the Box)	Score (0-5)
1	Unnecessary items are not stored in the area	5 – No unnecessary items are in the work area 1 – Personal items are mixed with and may interfere with accomplishment of required work	
2	Storage of cleaning material	5 – All required cleaning material is stored, visually marked, readily available 1- Cleaning material is shared between multiple work areas	
3	General tidiness of work area	5 – Work area is kept clean at all times 1 – Work area is cleaned once a shift	
4	Bulletin Boards	5 – Bulletin Boards are current and have no outdated material on them 1 – Bulletin Boards have outdated or torn or soiled material on them	
5	Emergency Exits	5 – Emergency Exits marked and exit plans posted 1 – Emergency Exits not clearly marked or exit plans outdated, missing or soiled	
6	Process layout	5 – General items carts, movable fixtures, etc required to perform work are labeled, have assigned places and are stored in those places when not in actual work 1 – No apparent storage location for movable items	
7	Aisle marked	5- Aisle clearly marked 1- Aisle are not marked or markings are worn-out	
8	Aisle maintained	5- Aisle are kept clean and free of clutter, use for transportation of material or personnel and not as a storage place 1- Aisle are not kept clean or used as extended work area	
9	Storage of tools	5 – All tools have clearly marked locations with positive control 1 – Not all tools have clearly marked locations limited control over access	
10	Storage of technical manuals	5 – Technical manual or publications are stored close to normal point of use and in a manner that quickly allows for inventory at anytime 1 – Technical manuals or publications are not stored close to point of use and/or required more than 30 seconds to verify all are present	
11	Equipment / Tooling cleanliness	5 – Equipment / Tooling are kept clean at all times 1 – Equipment / Tooling are not cleaned after each use or maintenance cycle	
12	Equipment / Tooling maintenance	5 – Periodic maintenance requirements are clearly understood, and a means of recording maintenance actions is utilized 1 – Periodic maintenance requirements are not know by the user	
13	Equipment / Tooling Controls ID	5 – Operating restrictions or instructions if required are clearly marked all operators are licensed 1 – Operating restrictions are not posted unlicensed operators are using items	
14	Shelves, Benches, Desks Arrangement	5 – Work area is organized in a manner that allows for flow and are clearly marked as to work performed in the area 1 – Work area is not organized in a manner that promotes flow	
15	Shelves, Benches, Desks Control	5 – Kept clear of unnecessary materials 1 – Work surfaces are clutter or have items not required for maintenance	
16	5S Control and Sustainment Plan	5- Visual controls are in place to facilitate maintaining organization Check sheets are available and utilizes to maintain 5S process 1- Visual controls or check sheets are not available or used or maintained	

- Include Safety in all your Improvement Projects.
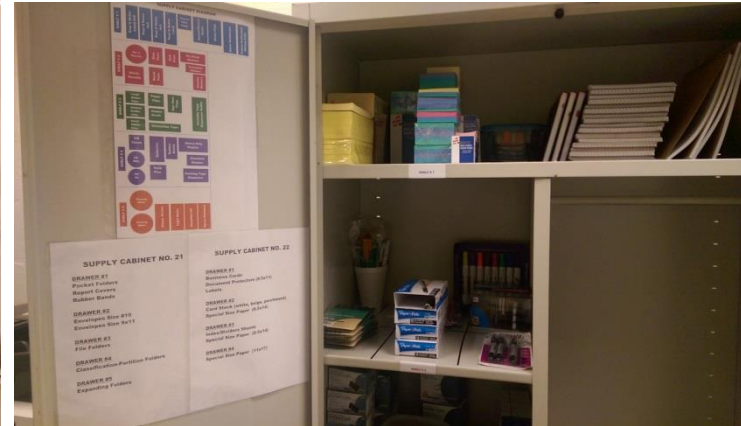
Can you identify the safety issues?

BEFORE

AFTER

Before

After

Five Levels of Excellence

	Sort	Simplify	Systematic Cleaning	Standardize	Sustain
Level 5 Focus on Prevention	Employees are continually seeking improvement opportunities.	A dependable, documented method has been developed to provide continual evaluation, and a process is in place to implement improvements.	Area employees have devised a dependable, documented method of preventive cleaning and maintenance.	Everyone is continually seeking the elimination of waste with changes documented and information shared.	There is a general appearance of a confident understanding of, and adherence to the 5S principles.
Level 4 Focus on Consistency	A dependable, documented method has been established to keep the work area free of unnecessary items.	A dependable, documented method has been established to recognize in a visual sweep if items are out of place or exceed quantity limits.	5S agreements are understood and practiced continually.	Substantial process documentation is available and followed.	Follow-through with 5S agreements and safety practices is evident.
Level 3 Make it visual	Unnecessary items have been removed from the workplace.	Designated locations are marked to make organization more visible.	Work and break areas and machinery are cleaned on a daily basis. Visual controls have been established and marked.	Working environment changes are being documented. Visual control agreements for labeling and quantity levels have been established.	5S agreements and safety practices have been developed and are utilized.
Level 2 Focus on Basics	Necessary and unnecessary items are separated.	A designated location has been established for items.	Work and break areas are cleaned on a regular, scheduled basis. Key items to check have been identified.	Methods are being improved but changes haven't been documented.	A recognizable effort has been made to improve the condition of the workplace.
Level 1 Just Beginning	Needed and not needed items are mixed throughout the work place.	Items are randomly located throughout the workplace.	Work place areas are dirty, disorganized and key items not marked or identified.	Work place methods are not consistently followed and are undocumented.	Work place checks are randomly performed and there is no visual measurement of 5S performance.
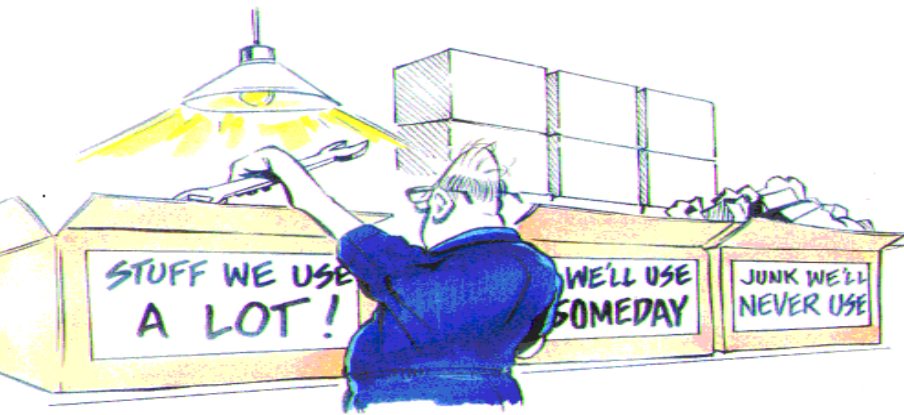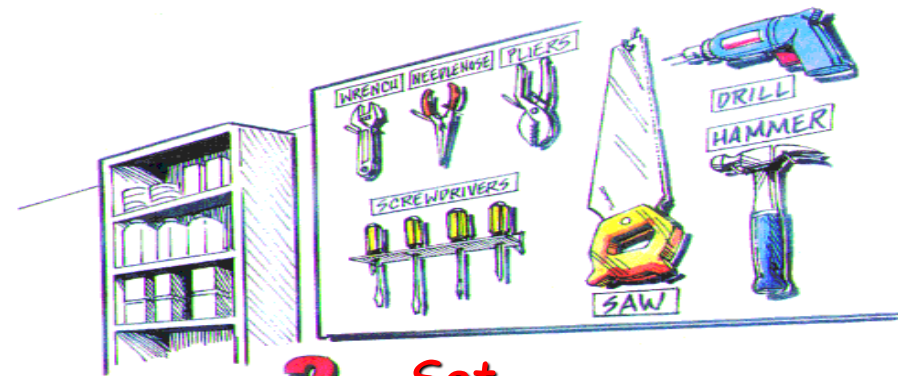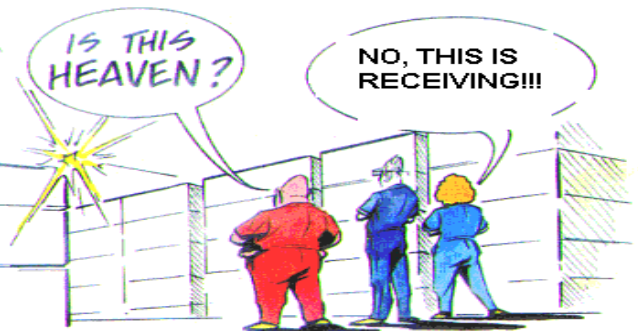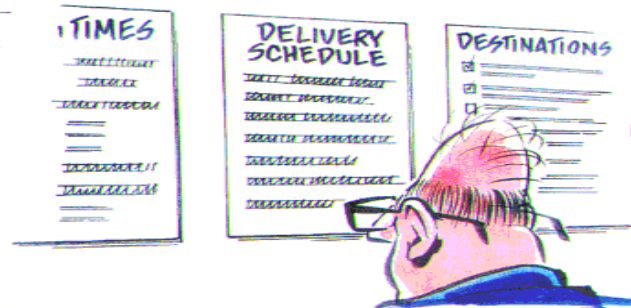
Name the 5S's in order.

What is the purpose of implementing 5S?

Jidoka & Poka-Yoke

Jidoka

Sakichi Toyoda first introduced the Japanese concept of Jidoka (pronounced jee-DOH-kah).

In conjunction with Poka-Yoke, comes the concept of Jidoka.

- Jidoka has been defined by Toyota as "**automation with a human touch**."

- It implies intelligent workers and machines identifying errors and taking quick countermeasures.

- No product moves into the next step of the process if it contains errors (AKA: quality at the source).

The Evolution toward Jidoka

Manual feed and watch machine cycle.

Watch machine cycle.

automatic feed — automatic feed — andon light — automatic ejection — Self-monitoring machine.
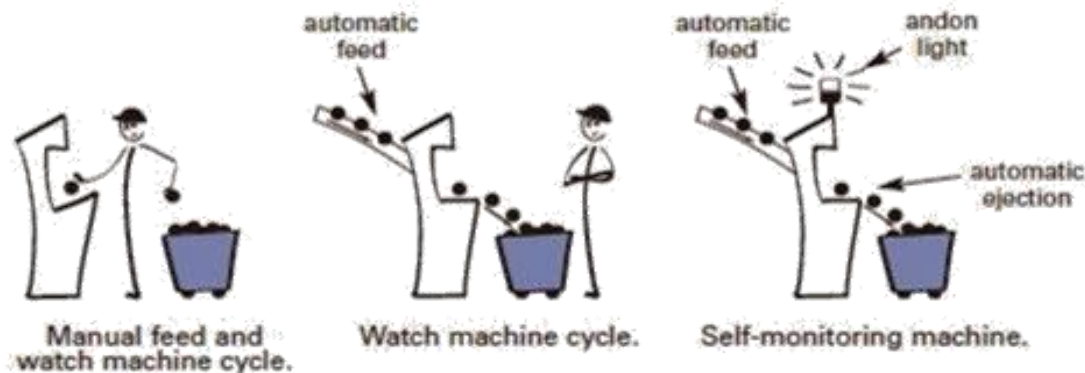
Jidoka Examples

Office Examples:

- SharePoint Workflow (rejected workflow stops automatically).

- Circuit Breakers / GFCI (closes circuit if overloaded / short).

- Copier / Printer (notifies when out of paper / ink / jammed).

- Deletion Prompt (Ask user if they are sure they want to delete).

Manufacturing Examples:

- Use of switches and sensors to stop machines.

- Automatic ejection
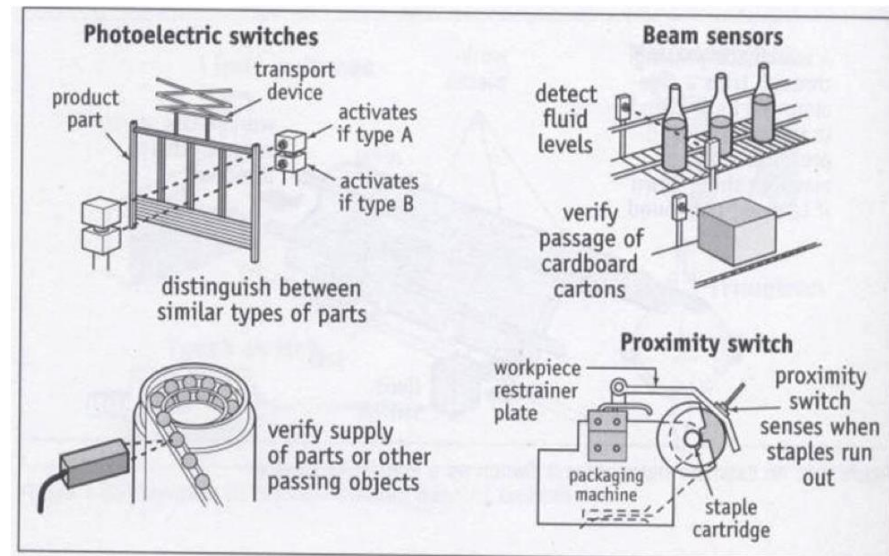
Mistake vs. Defect

MISTAKE

An incorrect, unwise, or unfortunate act or decision caused by bad judgment or a lack of information or care.
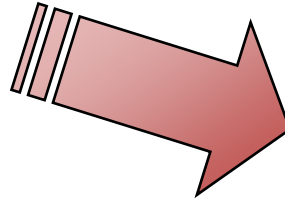
DEFECT

A failing, or flaw, especially one that still allows the affected item to function, however imperfectly.

$$$
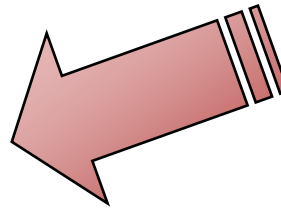
Mistakes, however small, can lead to defects which lead to rework or scrap and increased cost.

Cost of Poor Quality (COPQ)

PREVENTION

Before it Happens

IN-PROCESS DETECTION

Before It Escapes Your Process Step

END OF PROCESS INSPECTION

After the Fact Before it Gets to Your Customer

CUSTOMER REJECTION

Too Late

➢ The sooner we can catch errors, the easier and less costly it is to fix them.

➢ CPI helps minimize COPQ.

➢ A method to reduce COPQ is to develop standard work / processes.

Poka-Yoke

- Shigeo Shingo invented the Japanese concept called **poka-yoke** (pronounced POH-kah YOH-kay).

- Poka (Inadvertent Errors) Yoke (Avoid) means to mistake proof the process.

  - The essential idea of poka-yoke is to design your process so that mistakes are impossible or at least easily detected and corrected.

Shigeo Shingo

Used to be called fool-proofing (Baka-Yoke), but Toyota employees got upset that they were considered a fool.

Mistake Proofing

Benefits

- Easy to do the right thing the first time.

- Makes it easy to do the right things in the right order in the right way.

- Prevents accidentally doing the wrong things in the wrong order in the wrong way.

Results

- Eliminates defects

- Improves quality

- Reduces variation

- Improves on-time delivery

- Reduces or eliminates accidents

- Improves morale

"Amateurs work until they get it right. Professionals work until they can't get it wrong." - Anonymous

Shingo suggested a solution that became the first Poka-Yoke device.

- In the old method, a worker began by taking two springs out of a large parts box and then assembled a switch.

- <u>Problem</u>: Sometimes the worker failed to put both springs in the switch.

- In the new approach, a small plate is placed in front of the parts box and the worker's first task is to take two springs out of the box and place them on the plate.

- Then the worker assembles the switch. If any spring remains on the plate, then the worker knows that he or she has forgotten to insert it.

The new procedure completely eliminated the problem of the missing springs.

Empty plate
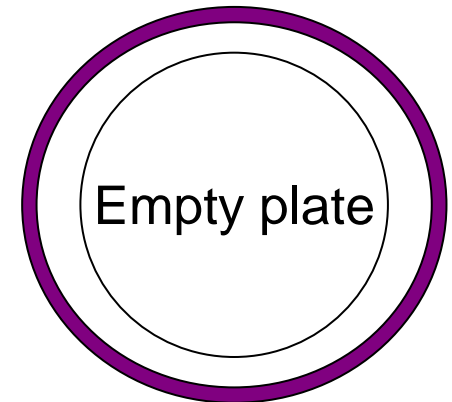
Mistake Proofing Discussion

What are some examples of Mistake Proofing?

Before

After

Gas cap is lost when driver forgets to reinstall after refueling.

Older Style Gas Cap

Cord prevents lost cap

"Cone" guides nozzle insertion

Nozzle Restriction
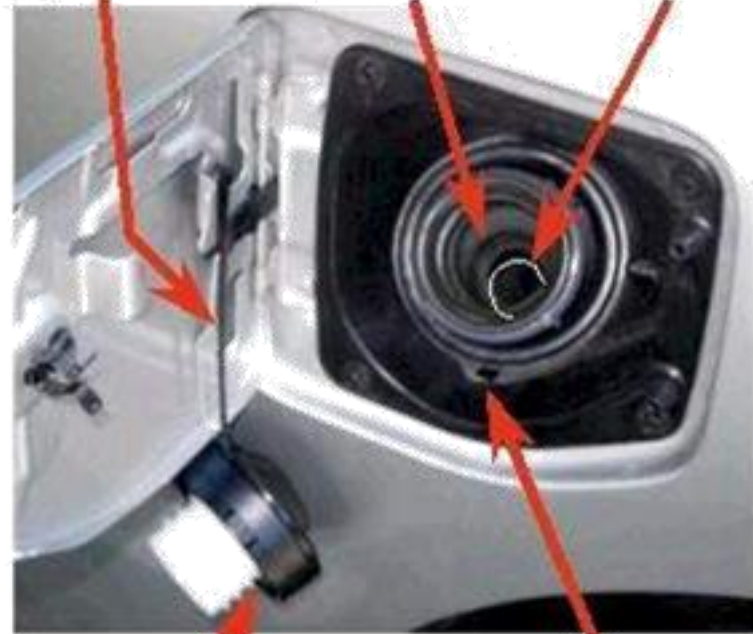
Ratchet limits torque

Drain prevents paint damage

Gas pumps are equipped with hose couplings that break-away and quickly shut-off the flow of gasoline.

Light sensors turn sink off when not needed.

Forms

- Provides specific options for each field.

- Telephone Number Formatting (ex. (XXX) XXX-XXXX).

- Limits zip codes to 5 or 9 digits.

Technology

- Cable ends (computers)

- SD Card Shape

- Printer ink cartridges

Recreational

- Golf swing trainers

Definition:

A mistake-prone situation exists when it is possible to err during the performance of work because the process being used is unreliable, unstable or prone to human error.

Examples:

- Critical specification or dimensional requirements.
- Ineffective standard procedures and processes.
- Multiple parts, processes, or steps.
- Repetitive, fast-paced operations.
- Short-cuts and work-arounds.
- New products, processes, or people.
- Multiple suppliers.

What does Poka-yoke mean?

What are the benefits of implementing Poka-Yoke?

Standard Work

Standard Work is…..

➢A prescribed *sequence* of production steps.

➢Assigned to a *single* person.

➢Balanced to the *Takt Time.*

The principles, tools, and techniques used to ensure process standardization in a JIT environment.

- Developed by the people who do the work.

- Focused on efficient use of resources through waste elimination.

- Establishes the foundation for CPI.

"Where there is no Standard, there can be no Kaizen."
- Taiichi Ohno

Quality: Standard processes produce
(Better)   predictable results due to
       the documentation of best practices.

Time: Documented process reduces
(Faster)   confusion and mitigates bad habits.

Cost: Best practices minimizes defects
(Cheaper) and unnecessary rework.
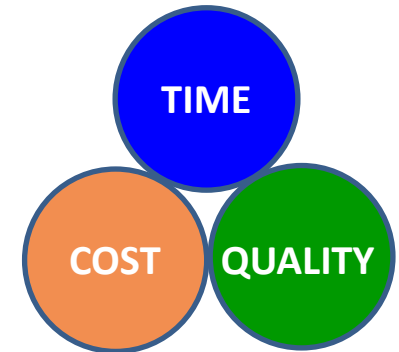
Locks in improvement and establishes a new baseline.

K = Kaizen
S = Standardization
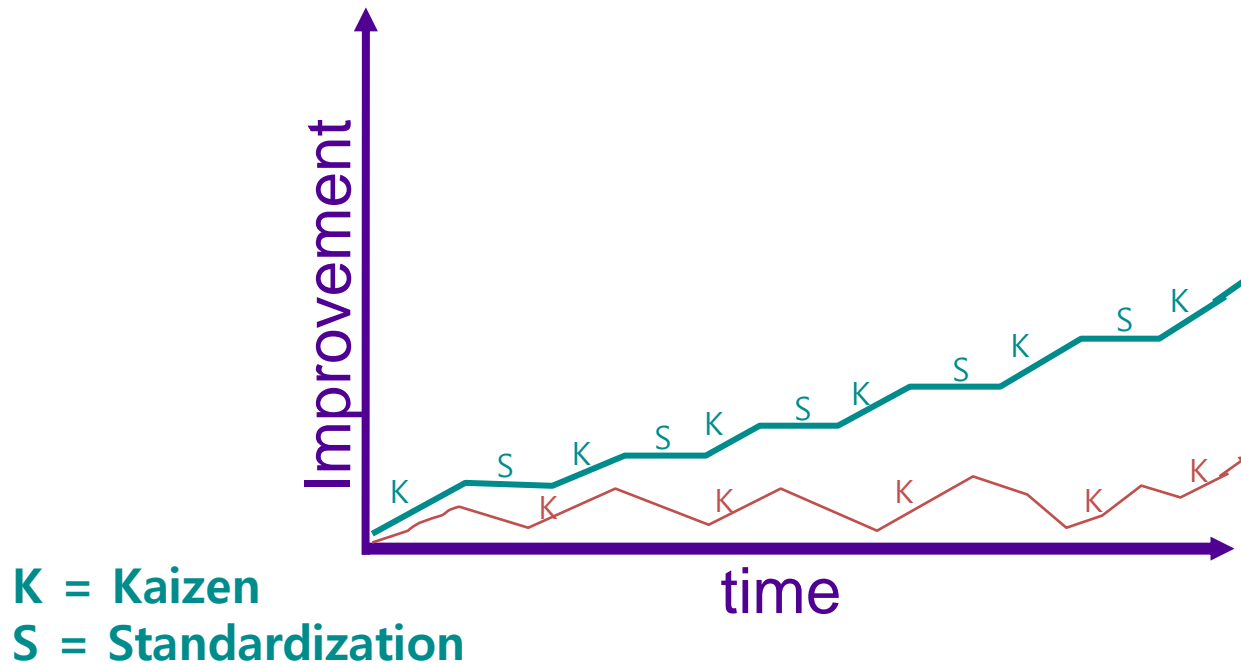
time

Improvement

Without Standard Work, improvements tend to dissipate over time!

Standard Work Example

Standard Work Example

Multiple Door Work Pallet

Pictures that demonstrate each step on how to pack and unpack doors

Clearly written instructions that tell you what to do

What are the benefits of implementing Standard Work?

Visual Workplace

When anyone can walk into a workplace and visually understand:

- The current situation.

- The work process.

- Ahead, behind or on schedule.

- When there is an abnormality.

Use signals, lights, diagrams, charts and signs to:

- Clearly **define** the **normal** condition or a **required action.**

- **Expose** the **abnormal** undesired condition - **real time.**

Visual Controls are communication devices used in the work environment that tell us at a glance how work should be done.

- ➢ Communicate information quickly and clearly.

- ➢ Locate things and places.

- ➢ Highlight defects, over-production and / or under-production.

- ➢ Provide instruction.

- ➢ Spotlight abnormal conditions.

- ➢ Communicate status to all.

Types of Visual Controls

- Red Tags - identify items to be scrapped.

- Signs / labels - to position tools, inventory, etc.

- White Lines - mark pathways, inventory locations.

- Alarm Lights - alert team members / supervisors.

- Kanbans - "pull production", minimize WIP.

- Production boards - show required / actual output.

- Standardized Work Charts - process maps.

- Defective Item Displays - display defects, information on defect cause and solution.

Examples of Visual Controls

Display – Broadcast data

Signals – Grab your attention!

Controls – Limit behavior

Guarantees – Allows for correct response.

P&I LSS Visual Controls

Before removing or returning a LSS Training Case for Training Use

STOP

Read instructions and/or flip the Restocking / Verification Card

Case Ready for Use
The BOB Check-out Instructions:
1. Pull BOB from home location.
2. Rotate restocking card to 'Needs Restocking'.

LSS TRAINING CASE

Needs Restocking
The BOB Restocking Instructions:
1. Pull BOB Checklist from case.
2. Review checklist and case to ensure each item and designated quantity is present.
3. Add items when determined lower than checklist quantity.
4. Return BOB to home location.
5. Rotate restocking card to 'Case Ready'.

LSS TRAINING CASE

Needs Restocking

The BOB Restocking Instructions:
1. Pull BOB Checklist from case.
2. Review checklist and case to ensure each item and designated quantity is present.
3. Add items when determined lower than checklist quantity.
4. Return BOB to home location.
5. Rotate restocking card to 'Case Ready for Use'.

The BOB Check-out Instructions:
1. Pull the BOB from home location.
2. Rotate restocking card to 'Needs Restocking'.

Case Ready for Use

5 seconds or less – what is out of place and missing?

➢ Tell how many people are needed.

➢ Tell who does what.

➢ Makes problems visual.
- Ahead or behind Takt Time.
- Quality issues.
- Missing parts, materials, information, people.
- Down time.

➢ Triggers the problem solving process.

Production Control Boards

➢ Low maintenance.

➢ Easy to understand.

➢ Information visible at a glance.

➢ Priorities are readily apparent.

➢ Bottlenecks and WIP levels are obvious.
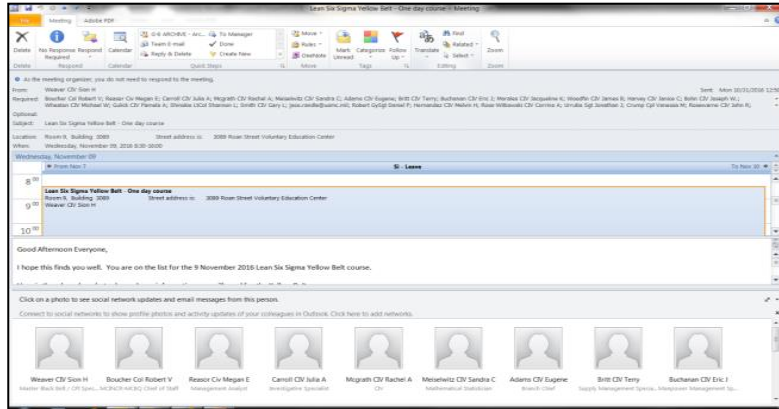
➢ Actual status of production vs. plan is evident.
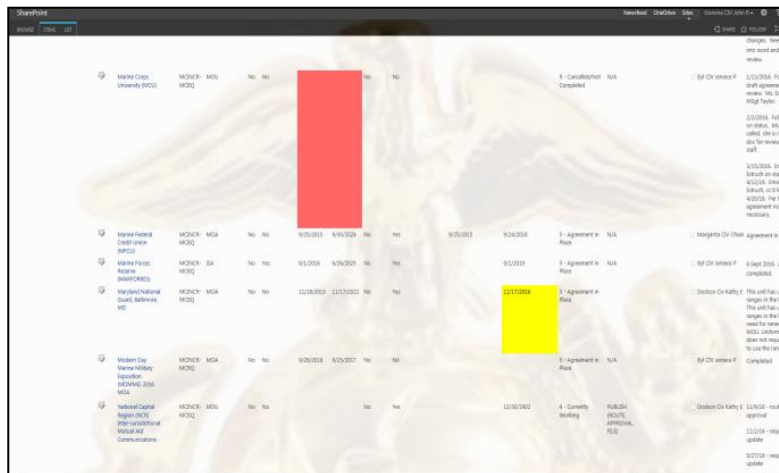

Production Control Board

Electronic Control Board

Production Visual Controls Examples

Outlook Meeting Notice. Helps to control and ensure maximum attendance.

Support Agreement Status on SharePoint – Uses Status Data to develop up-to-date metrics on performance.

Support Agreement Status on SharePoint – Color-coding identifies missing data or required action.

Can you distinguish between normal and abnormal conditions in the above photos?

Abnormal conditions should be visually obvious in 5 seconds or less!

Create a work environment that is…

Self – explaining
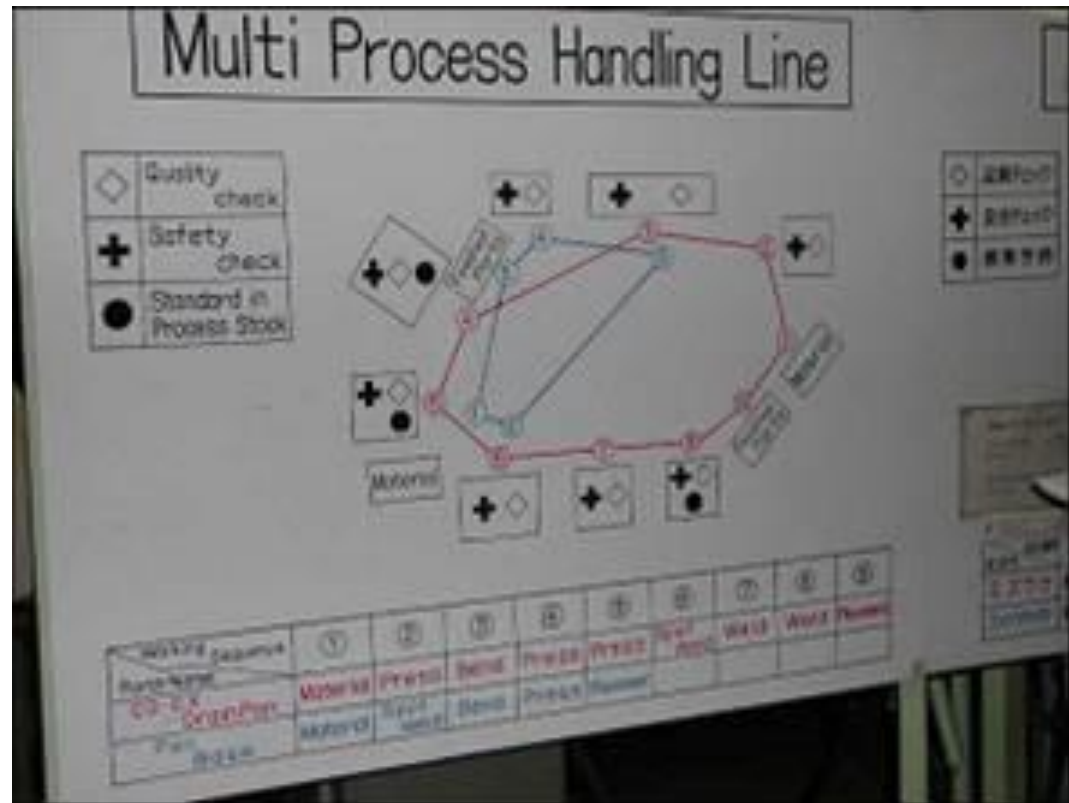
- Shows all aspects of process.

Self – ordering

- Shows process layout

Self – regulating

- Displays quantity of work in process

Self – improving

- Shows were waste can be eliminated

Multi Process Handling Line

Daily Board Walk

➤ Managers review as employees update.

➤ Issues are identified, addressed, and corrective actions established.

➤ Exceptions can be identified clearly (priorities).

➤ Targets must be clearly defined.

Weekly Meetings

• A venue for the cell to discuss general operational issues and continuous improvement.

Agendas

• Keeps a meeting focused on its purpose.

• Allows participants to prepare.

What is a Visual Workplace?

What are the characteristics of good Visual Controls?

Implementation

Pilots allow us to:

- Test run the solution in a small part of the organization.

- Evaluate the process measures for the improvement.

- Improve the proposed solution.

- Increase organizational buy-in.

Mitigate Unintended Consequences:

- See where possible failure points exist.

- Validate and refine cost and benefit estimates.

- Modify the implementation plan.

Overall benefit is a better solution with fewer surprises

➢ **What** – Needs to be piloted.

➢ **Where** – Will the pilots be run.

➢ **Who** – Will be involved.

➢ **When** – (How long) will the pilots run.

➢ **How** – Will the pilots be conducted.

Pilot Implementation Plan.

- Run pilot trials.

- Monitor set-up times and idle times closely.

- Don't let large transportation lots throw away the benefits of smaller process lots.

Piloting Improvement.

- Develop a good work release plan.

- Monitor interactions with lot sizing.

Make careful observation of all activities, effects, and interactions during the pilot and continue pilot long enough to establish reliable baseline.

➢ **Manage expectations and perceptions.**

- Customers
- Management
- Staff

➢ Refine the improvement if the pilot demonstrates any weaknesses.

- Often the pilot will show a few opportunities for improvement.

Lessons Learned

At the completion of the pilot, capture what worked and what needed improvement.

Include lessons learned in the full roll out of the new process:

- Compile lessons learned.
- Categorize by type; by defect type, key analysis used, key words, problem / opportunity statement, root causes, etc.
- **Communicate lessons learned to others**.

Source: ASQ LSS Training Material

What questions do you have about any area of the Improve Phase?