

CHAPTER 15: Just in Time & Lean Manufacturing



Just In Time

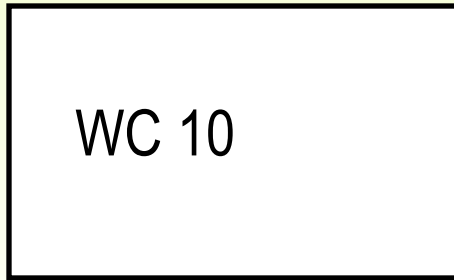
Just in Time (JIT) – a Business Philosophy

- Production system: manufacturing & movement of materials and goods occur just when they are needed, usually in small batches
- JIT operates with very little “fat” (waste)
- Defines waste in terms of customer value

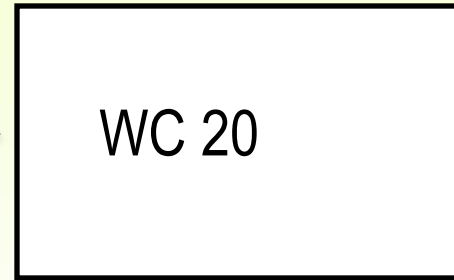
JIT Goals

- Eliminate disruptions
- Make system flexible by reduce setup and lead times
- Eliminate waste, especially excess inventory

Sources of Waste: Waiting



Move

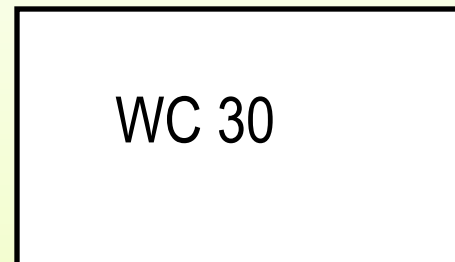


Arrive at WC 20 –wait
to be worked on

After finished in WC 20
wait to move out of WC

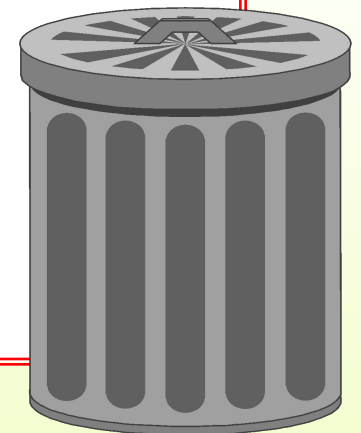
After finished in
WC 10 wait to
move out of the
WC

Large Batch sizes impact Wait times!

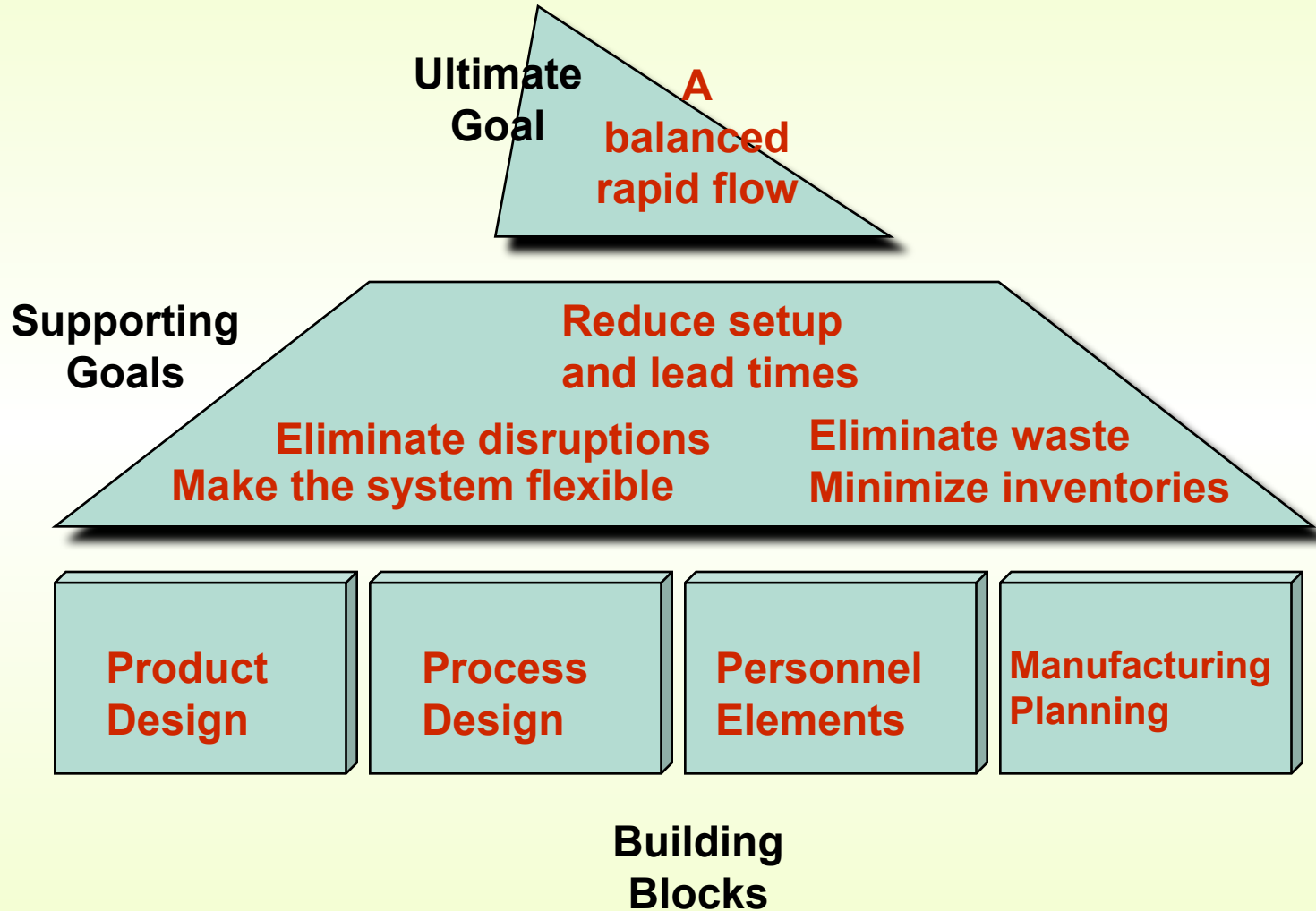


JIT Wastes

- Overproduction – making more than we can sell now
- Waiting time – for the next process
- Unnecessary handling & transportation
- Processing waste
- Inefficient work methods
- Product defects – producing bad quality items



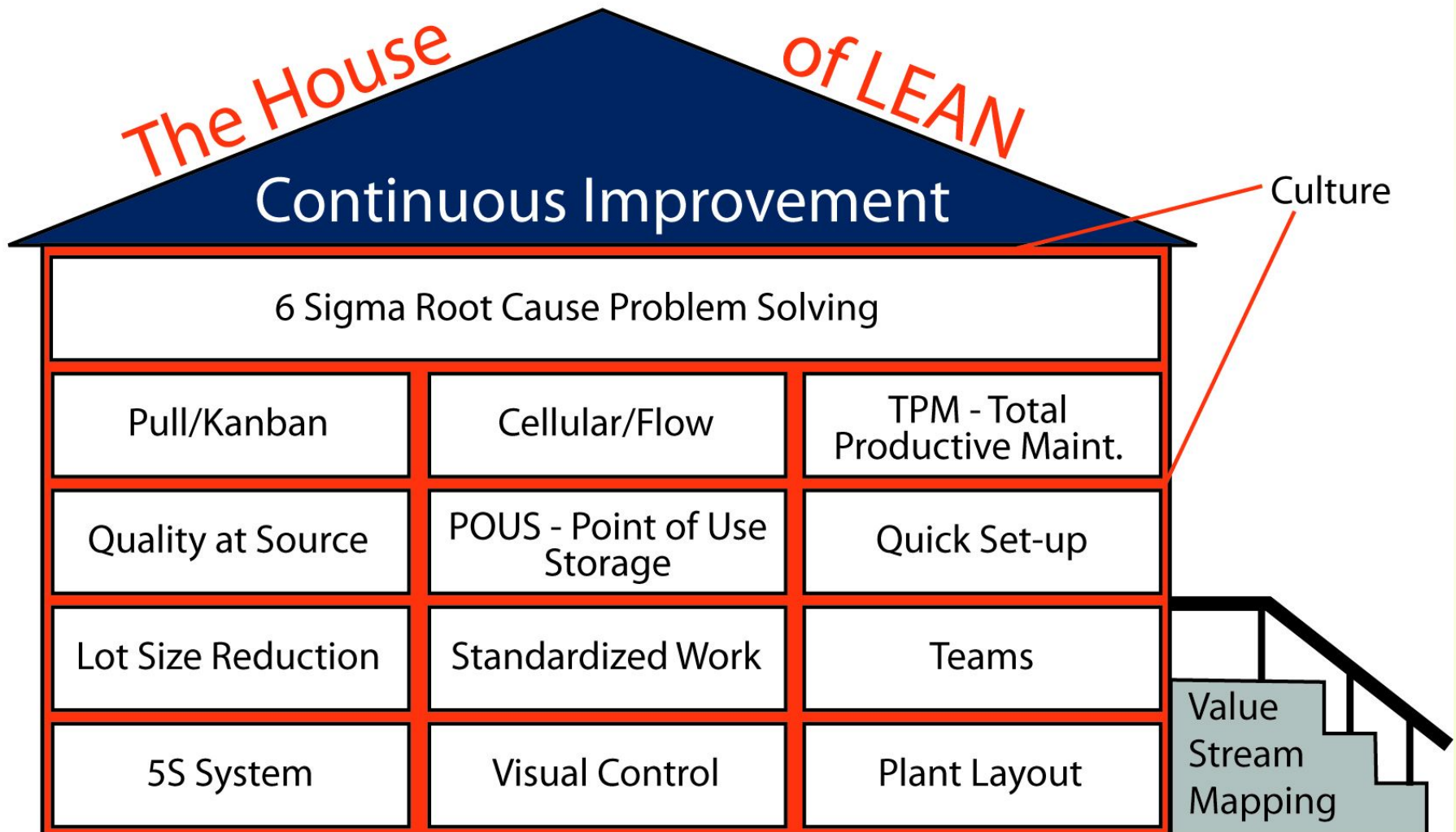
JIT Goals and Building Blocks



Production Flexibility

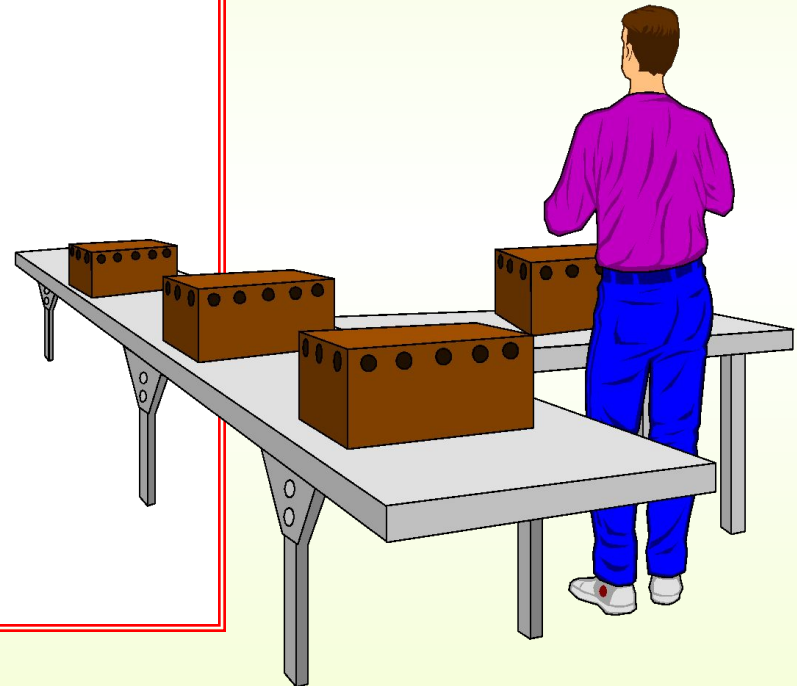
- Reduce downtime by reducing change-over time
- Use preventive maintenance to reduce unexpected breakdowns
- Cross-train workers to help clear bottlenecks – workers skilled in many different work processes
- Reserve capacity for important customers Ex. Operate at 90-95% capacity – **is this a good strategy?**

LEAN Manufacturing



Product Design

1. Standardized parts
2. Modular design
3. Quality
4. DFM (Design for Manufacturing)
5. Mistake-proofing design

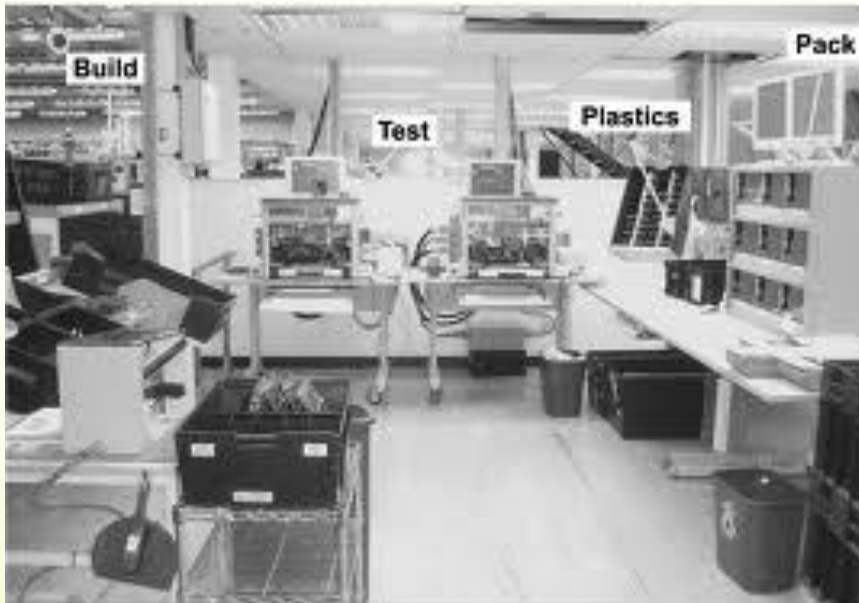


Process Design

- Smaller production lot sizes
- Setup time reduction
- Manufacturing cells
- Quality improvements –preventive actions
- Reduced inventory



Work Cells



Examples

Benefits of Small Lot Sizes

- Reduces on-hand inventory - raw materials
- Less rework – due to quality issues
- Less storage space (warehouse) needed
- Problems become more apparent
- Increase production flexibility
- Easier to balance operations to changing customer demand

Setup Time Reductions

- Small batch sizes and changing product mixes require frequent machine setups
- Workers are trained to do their own setups
- Do as much of the set-up external from the manufacturing process
- Group Technology may be used to reduce cost and setup time (group similarly-made products)

Quality Improvement

Prevent Defects from occurring using:

- Six Sigma to reduce process variability
- Poka Yoke to mistake-proof

Automation:

- Automatic detection of defects during production
Ex. Laser beams to check fill amounts of bottles

Personnel/Organizational Elements

- Workers as assets
- Cross-trained workers
- Train workers in problem-solving
- Form work cell teams



Manufacturing Planning and Control

- Level loading – keep consistent amount of production
Example – always produce batches of 5 pieces
- Use Pull Systems and Kanban (card signal system) – automate production control
- Close supplier relationships with key suppliers
- Visual systems – easy to see problems. Example – green light when machine running, red light when broken down
- Preventive maintenance – to reduce unexpected machine breakdowns

Visual Controls



Pull/Push Systems and Kanban

Pull system:

- System for moving work where a workstation pulls output from the preceding station as needed. (e.g. Kanban)

Push system:

- System for moving work where output is pushed to the next station as it is completed

Kanban:

- Card or other device that communicates demand for work or materials to the preceding station
- Kanban: Japanese word meaning “signal” or “visible record”
- Paperless production control system
- Authority to pull, or produce comes from a downstream process.

Push vs. Pull

Because of Wastes inherent in a PUSH system we tend to produce more to offset waste (including quality)

Kanban Thinking

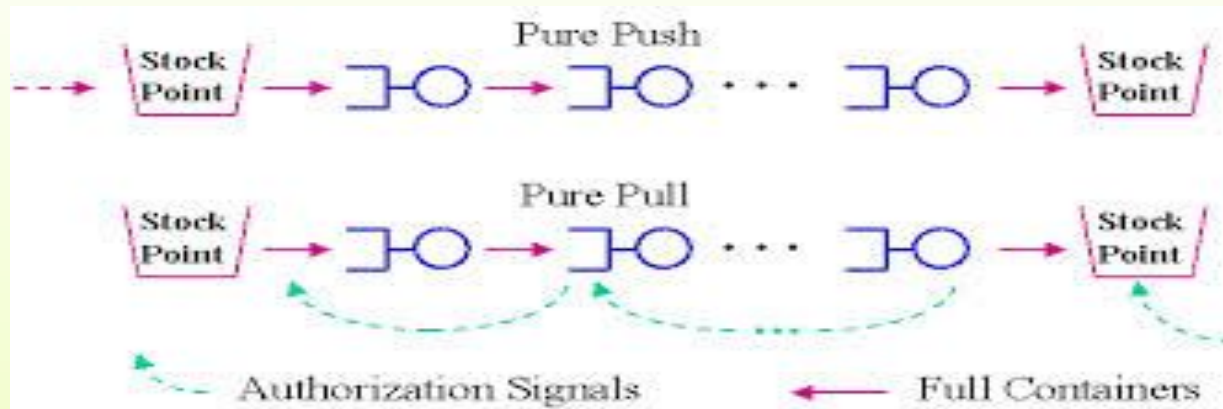
► Push vs Pull System

Push vs. Pull



- Production Approximation
- Anticipated Usage's
- Large Lots
- High Inventories
- Waste
- Management by Firefighting
- Poor Communication

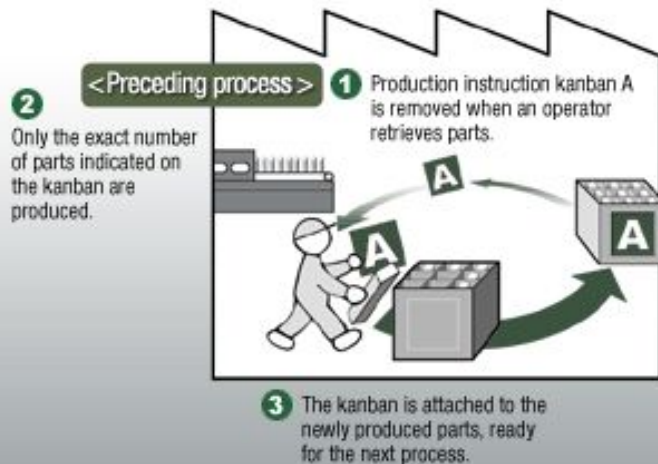
- Production Precision
- Actual Consumption
- Small Lots
- Low Inventories
- Waste Reduction
- Management by Sight
- Better Communication



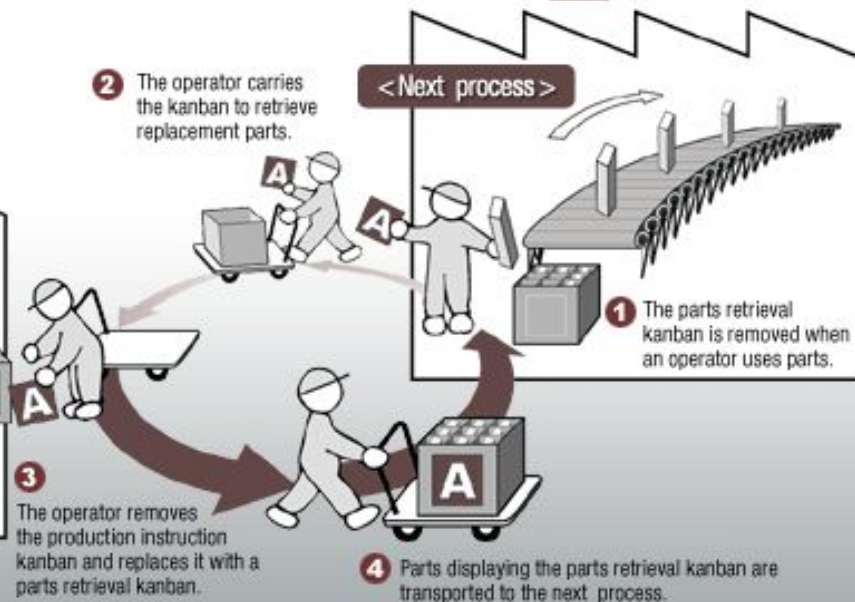
Kanban Example

Conceptual diagram of the Kanban System

Operational Flow of Production Instruction Kanban **A**



Operational Flow of Parts Retrieval Kanban **A**



Kanban Examples



Two bin system – **RED** means empty – Stores to replenish

Empty means – bring another!



Preventive Maintenance and Housekeeping

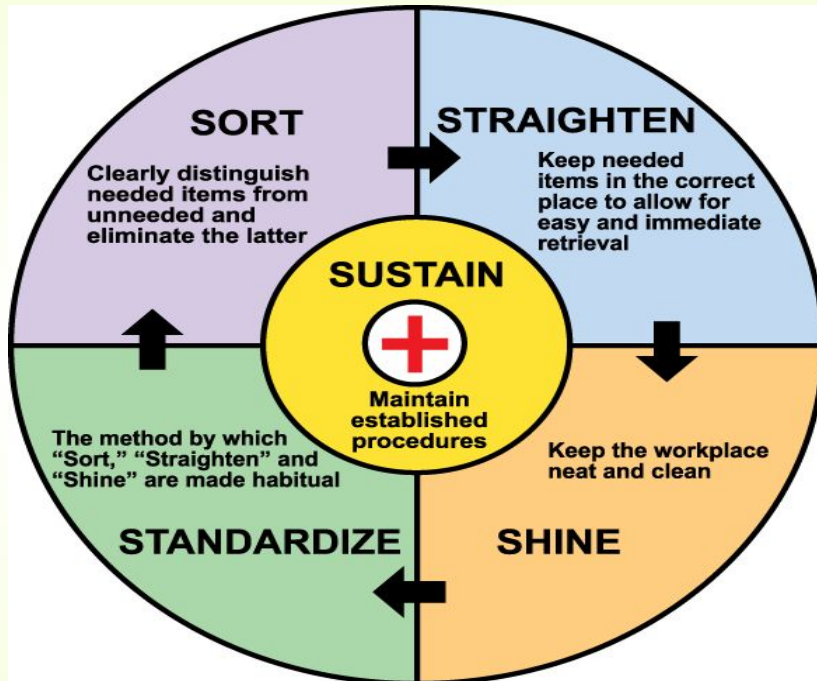
Preventive maintenance

- Maintaining equipment in good operating condition and replacing parts that have a tendency to fail before they actually do fail

Housekeeping

- Maintaining a workplace that is clean and free of unnecessary materials (**5S program**)
 - Sort
 - Straighten
 - Shine
 - Standardize
 - Sustain

Housekeeping: 5S Program



The 5 S



SORT / CLEARING

Throw away unnecessary and unrelated materials in your workplace.



SET / ORGANIZE

Set everything in proper place for quick retrieval and storage



SHINE & SWEEP

Clean the workplace; everyone should be a janitor



STANDARDIZE

Standardize the way of maintaining order and cleanliness

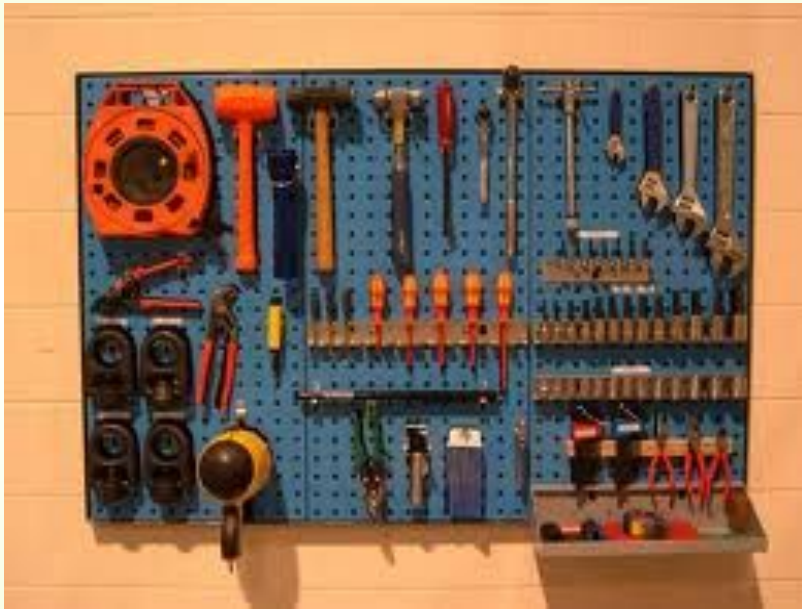


SUSTAIN

Practice '5 S' daily - make it a way of life; this also means 'commitment'



Housekeeping – 5S Program



Tool Board



Work Station