Cost Reduction Practices

Workplace Organization and Visual Control

Waste Reduction: Visual Control

• “Visual control means making it possible for everyone to see whether the situation is right or wrong and wherein lies the waste” (Hirano & Black, 1987, p. 174)

• Many techniques exist for identifying non-value-added manufacturing practices: 5S, Kanban and Value-Stream Mapping (VSM). All rely on visual communication.

Visual Control: 5S

• 5S/6S is the start of process improvement

• “The 5S system is designed to create a visual workplace – that is, a work environment that is self-explaining, self-ordering, and self-improving. In a visual workplace, the out-of-standard situation is immediately obvious and employees can easily correct it” (Hirano, 2003, p. 18)

• “The 5S’s are the start in identifying problems and wastes” (Hirano, 2003, p. 18)

• Identifying non-value-added practices can be viewed as an activity.

Waste Reduction: Visual Control

• VC Communicates information such as:
  – 1. Where items are needed
  – 2. How many items are needed
  – 3. Standard procedures for doing something
  – 4. Status of work process
  – 5. Information about work flow activities
  – 6. Identify standards – indicate whether something is normal or abnormal

5S

• Seiri, Seiton, Seiso, Seiketsu, and Shitsuke. 5S is described as proper arrangement, orderliness, cleanliness, cleanup, and discipline.

• Japanese terms are often referred to as Housekeeping (5S).

• According to Majima (1992), when implemented properly, the 5S’s reveal other opportunities for improvement.

• 5S is viewed as one of the most inexpensive lean techniques – reveals problems
5S
• Seiri = Sifting or Sorting out what is necessary and discarding what is not (Feld, 2000, Black & Black, 1988)
• Seiton = Orderliness, or assigning locations for everything (Feld, 2000)
• Seisou = Cleanliness or making the workplace as clean as possible (Feld & Black, 1988)
• Seiketsu = Standardizing operations (Feld, 2000) or keeping the workplace clean and organized (Feld & Black, 1988)
• Shitsuke = Concerned with Sustaining orderliness and cleanliness or making them habit (Feld, 2000, Black & Black, 1988)

Waste Reduction: 5S
• 5S includes sorting out what is not needed, setting necessary items in an orderly manner, shine – cleaning the area, standardize – making guidelines for keeping the area clean and organized, and sustain – educating and communicating the standards (Feld, 1997). An uncluttered, well-organized, and understandable workplace is an essential foundation for lean, low-inventory production, total quality management, total productive maintenance, or any other advanced change initiative or improvement approach (Dennis & Hirano, 1997).

1S: Sort
• Theme for Sort = “When in doubt, move it” (PPDT: “The 5S System”, 1997)
• “…Sort means that you remove all items from the workplace that are not needed for current production (or clerical) operations” (Feld & Black, 1988)
• Problems targeted:
  – 1. Crowded work areas difficult to work in
  – 2. Storage areas for unneeded items that block communication
  – 3. Time wasted searching for needed items
  – 4. Unneeded inventory or machines that need maintaining
  – 5. Unneeded machines that hide process problems
  – 6. Unneeded items that prevent flow
  – 7. Safety problems/hazards

1S: Sort
• Questions Asked:
  – Is the item needed?
  – Is the item needed in this quantity?
  – Is the item needed in this location?
• Items are red-tagged for various treatments:
  – Disposal
  – Sell (tools, machinery, parts, material, scrap, recycle)
  – Return (to owner, supplier, customer)
  – Lend out or rent (to other companies)
  – Distribute (to other parts of company in need)
  – Give away (to employees, companies, institutions)

2S: Set in Order
• Companies need to understand that physical system design affects performance (output)
• Welder
  – Looking for tool/essential at station = average 3 minutes
  – Frequency for looking = 10 times/8 hour shift
  – Work time = 1880 hrr/year (47 weeks)
  – Rate looking for tools/essentials
  – Pay rate = $27/hr
  – Cost of looking for tools/essentials =
• If have 8 welders doing this =
• (management is worse) – this can be analogous to the business processes found in the office

2S: Set in Order
• Themes for Set in Order = “A place for everything, and everything in its place” (PPDT: “The 5S System”, 1997)
• Determine arrangement, accessibility, and order of use (sequence) – “Look for areas where flow is restricted (for example, where work is process is delayed; where people, materials, and machines get in each other’s way; or where movement isn’t smooth)” (Feld & Black, 1988)
• Obvious organization is a theme (KISS–Keep it simple stupid) – 30 second rule to find an item/tool
• “…you arrange needed items so that they are easy to use and label them so that anyone can find them and put them away. The key word in this definition is “anyone”” (PPDT: “The 5S System”, 1997)
• Ergonomics requirements observed
2S: Set in Order (system design)

- Wastes targeted:
  1. Motion waste (walking, bending, reaching)
  2. Waste of human energy/searching waste/returning waste [e.g., “it is not unusual for a three-hour changeover routine to include 30 minutes of searching” (PPDT: “5S” 1996, p. 47) include 30 minutes of searching (PPDT: “5S”, 1996, p. 47)]
  3. Waste of excess inventory
  4. Waste of defective products/obsolete parts
  5. Waste of unsafe conditions – e.g., trip hazards, slippery surfaces

2S: Ergonomics

AKA human engineering

- Ergo = work, Nomics = management
- “The study of human abilities and characteristics which affect the design of equipment, systems, and jobs”
- Deals with social, physical, and mental requirements for the design of work, accommodates human limitations
- Goals:
  1. Maximize quality/efficiency of work
  2. Maximize human values (safety, comfort, satisfaction)
  3. Minimize fatigue and stress

2S: Ergonomics

- Key Factors in Ergonomics: Employee size, area of reach, area layout, blood circulation, vision, lighting, adjustable work aids
- Questions:
  1. Are machines/working surfaces designed for common height?
  2. Are operations designed to minimize lifting?
  3. Are transfer devices designed for ease of sliding parts on/off?
  4. Are there signals to inform, interrupt, or monitor the process?

2S: Ergonomics

- Machine design considerations:
  - Uniform loading heights
  - Location of walkaway switches
  - Minimum reach (bending) into a machine
  - Eliminating machine obstructions in an aisle
  - Providing access to machine from the back
  - Position of load/unload decoupler (when part requires two-hand load)
  - Part weight, size, shape, burrs, finish, etc.

(DeGarmo, Black & Kohser, 2003, p. 1116)

Employee Size Dimensions

Employee Size

- Sit, Stand, Sit-Stand
  - Sit-stand: most desirable, allows individuals to shift posture and reduce stress, strains, fatigue
- Height & width
  - More room for larger people
- Strength
- Chair/work area adjustments

(www.strategosinc.com)
Reach

- Maximum Zone - rarely used components
- Optimum Zone - less frequently used components
- Both Hands Zone - frequently used components

Vision

- Frequently used components should be placed within 15 degrees from the centerline of the employee's face (Wojcikiewicz, 2003)

Container Layout

- Frequently used containers (within optimum work, within 15 degree vision area)
- Less frequently used containers (within optimum, within 35 degrees of peripheral vision)
- Hardly used containers (place in maximum reach, no further than 94 degrees of peripheral vision)

Blood Circulation, Lighting, & Work Aid Adjustments

- Blood circulation - work surface should not be higher than the heart (causes fatigue)
- Lighting - proper lighting reduces errors, increases productivity, reduces eye strain (constant re-focusing) (Wojcikiewicz, 2003)
- Work Aid Adjustments - Adjustable chairs, armrests, footrests, swinging stools make employees more comfortable. Use of jigs, fixtures, vises to help hold work

Musculoskeletal Disorders

- Disorders of muscles, nerves, tendons, joints, cartilage, and spinal disks that are not caused by car accidents, slips, trips, or falls (Monroe, 2006)

<table>
<thead>
<tr>
<th>Disorders</th>
<th>Occupational risk factors</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendonitis/racemone</td>
<td>Repetitive strain</td>
<td>Pain, weakness, swelling, burning</td>
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<tr>
<td>Elbow tendinitis</td>
<td>Repetitive strain</td>
<td>Pain, weakness, swelling, burning</td>
</tr>
<tr>
<td>Carpal tunnel syndrome</td>
<td>Repetitive strain</td>
<td>Pain, weakness, swelling, burning</td>
</tr>
<tr>
<td>DeQuervain's disease</td>
<td>Repetitive strain</td>
<td>Pain at the base of the thumb</td>
</tr>
<tr>
<td>Rotator cuff syndrome</td>
<td>Repetitive strain</td>
<td>Pain, weakness, swelling, burning</td>
</tr>
</tbody>
</table>

Other Ergonomic Factors

- Bending more than 20 degrees
- Raising an arm more than 45 degrees
- Bending the neck more than 30 degrees (Heston, 2006)
2S: Set in Order

• Principles for (human) Motion Elimination:
  - 1. Start and end each motion with both hands moving at once.
  - 2. Both arms should move symmetrically and in opposite directions.
  - 3. Keep trunk motions to a minimum.
  - 4. Use gravity instead of muscle.
  - 5. Avoid sagging motions and sudden changes in direction.
  - 6. Move with a steady rhythm.
  - 7. Maintain a comfortable posture with comfortable motions.
  - 8. Use feet to operate on and off switches for machines.
  - 10. Arrange materials and tools in the order of their use.
  - 12. Keep operators at a proper height for the work to be done.
  - 13. Make materials and parts easy to pick up.
  - 14. Make handles and grips in efficient, easy to use shapes and positions.

2S: Set in Order

• Process:
  - 1. Analyze current state (scan, map, photograph)
  - 2. Target improvement areas (storage, large items, small items, access to tools/parts, and problems with flow)
  - 3. Determine where to place items (everything will have a place, make easy to see, keep items off of floor)
  - 4. Make item locations obvious (use lines, labels, signboards)

2S: Set in Order

• So, in 2S, improvements are made to:
  1. Access and retrieval of parts/tools (spring assists, lifts, tilt mechanisms – for flow)
  2. Layout of areas (for flow)
     • Location of processes, machinery, other equipment
     • Work & safety zones (outlines, color coding)
     • Tooling (outlines, color coding)

2S: Set in Order

In 2S, improvements are made to:

3. Communication of information (for flow)
   • Labels, signals, and instructions for the work area, symbols/arrows for direction, colors for FIFO lane buffers
   • Signboards, providing directions, location of areas, inventory quantities, status, etc.

4. Safety
2S – Set in Order

- Utilize arrow diagrams, spaghetti diagrams, operational analysis tables or process flow diagrams to determine arrangement

- Process Flow Diagram Example

3S - Shine

- Theme for Shine = “Look good and be able to spot problems”

- Action → (Result)
  - Clean everything inside/out (leads to more satisfying workplace, reduced hazards and a safer workplace)
  - Inspect equipment while cleaning (locate potential equipment malfunctions or breakdowns, prevent breakdowns)
  - Prevent dirt/contamination from occurring (leads to consistent product quality/customer satisfaction)

(Paradyne, “The 5S System”, 1997)

3S - Shine

- Benefits:
  - Fewer equipment breakdowns (deterioration will be obvious) → more reliable system
  - Better product quality → increased customer satisfaction
  - Better place to work → more effective in work
  - Safer place to work, fewer hazards → more effective in work

(Paradyne, “The 5S System”, 1997)

4S: Standardization

- Making standards: “Standardization means creating a consistent way that tasks and procedures are carried out. When we think “standardization,” we should think “anyone.” Machinery standardization means anyone can operate the machinery. Operation standardization means anyone can perform the operation”


- 1) Achieve standards (through 3S)
- 2) Make standards permanent (4S) – paint areas to protect and visualize cleanliness, put in permanent signboards, use color coding

4S: Standardization

- Sort, Set in Order, and Shine become habitual
  - 1. Integrate 3S into normal work responsibilities - Assign responsibilities/guidelines for maintaining 3S
  - 2. Make any standard guidelines visible
  - 3. Check on the maintenance of 3S

(Paradyne, “The 5S System”, 1997)

4S: Standardization

- Themes for Standardization = “Maintaining” & “Preventative”

- Maintaining:
  - Maintaining only the items needed are there
  - Maintaining there is a place for everything, and everything is in its place (visually easy to locate/use/replace)
  - Maintaining cleanliness and inspection of equipment
4S: Standardization

- Preventive:
  - Put in preventative measures to preserve 3S (automatically happen – do not wait – items do not accumulate – do not get filthy)
  - Put in tools/mechanisms/devices to design-out (reduce/eliminate) operations
  - (e.g. “make it difficult to put things in the wrong place” and “make it impossible to put things in the wrong place”)

5S: Sustain

- The themes for Sustain is “Communicating” and “Discipline”
- Establish a 5S board, newsletter, spread information about 5S
- 5S part of daily work
- 5S supported by management/leadership
- Total employee involvement – Train every employee about 5S, purpose and standards

5S: Sustain

- Tools/Techniques for Sustain:
  - 1. Slogans/Posters
  - 2. Before/After photos of areas
  - 3. Newsletters, reports
  - 4. Suggestion boxes
  - 5. Pocket/training manuals
  - 6. Tours of other areas (for understanding – modeling)
  - 7. Assigning time slots (e.g. specific month) for seminars, training, retraining, promoting improvement programs

4S: Standardization

- Preventive:
  - Prevent items from having to be put back (replaced)
  - Suspended tools that automatically return to proper storage
  - Gauges/devices/measuring instruments fixed in place where needed
  - Tool Unification – combining functions of separate tools into one (design)
  - Tool Substitution – design change to eliminate one tool
  - Method Substitution – design techniques to eliminate tools altogether

5S: Sustain

- Conditions that promote sustain:
  - 1. Awareness – by everyone
  - 2. Time – to schedule/perform 5S implementation
  - 3. Structure – for when and how 5S activities are implemented
  - 4. Support – from management/leadership and resources to carry out initiatives
  - 5. Rewards/Recognition – for everyone involved
  - 6. Satisfaction/Excitement – achieved when everyone is involved

Notes on 5S

- Only through standardizing and sustaining will 5S/6S work
- Normal checks at normal intervals is recommended
- Making checks routine in ones work is recommended
- Internal audit checks by personnel from different areas is one method to sustain
- 3S will yield some improvements, but transitioning people to different areas with differing standards can lead to variance
- Most companies practice 3S – some do not understand how standardizing work areas can lead to variation reductions
- Without sustain, 5S practices will revert back to initial practices

(PPT: "The 5S System", 2013)
Notes on 5S

- Examples used were manufacturing examples – this knowledge transfers to other fields
- Standardize is different from Work Standards
- How do you think the principles of 5S apply to other fields?
  - Healthcare?
  - Restaurant/Food management?
  - Large scale residential construction companies?
  - Finance?
  - Business processes/office?
  - Retail?
  - ....

References