“The Pizza Game”

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The Pizza Game - A VSM Simulation
Session G6
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Learning Objectives of “Pizza Game”

At the end of this session, participants will have fun with:

• Time study analysis
• Cadence
• Work Balance Charts
• Workflow layout
• Theory of Constraints
Overview of “Pizza Game” Process

Description:

to prepare human resources for value stream mapping:
  • Running a “pizza factory” on a table top
  • Intentional problems built in made waste obvious

Overview

• Introduction to lean thinking and value stream
• Provide Instructions for simulation
• Performing simulation
• Tie to Value Stream Mapping
• Always have fun!

Resources Needed for Simulation

Tools

1. Instruction sheets, work orders, case study
2. Sufficient space for teams to work together table tops
3. Grid paper for spaghetti diagram
4. Grid flip charts (layouts)
5. Poker chips (for pizza dough)
6. Tupperware and lids (transport)
7. Masking tape
8. Decals various colors (toppings)
9. Stopwatch and counter
10. Metronome
11. Calculators
12. Train tracks (Current State)
13. Drain-board (Future State)
Worker Balance

A key to success in lean manufacturing is working to the Cadence

To achieve work balance, you must analyze the following:

Work Cells
Cycle Time
Cadence

Worker Balance -- Example

Work Cells - Example of different tasks necessary in the process of producing a product
Cycle Time - The amount of time it takes to complete the entire task within a Work Cell or process

1. Receive order $ 43s
2. Prep food 100s
3. Cook food 480s
4. Plate food 10s
5. Garnish and extra 20s
6. Serve food 10s

Finished Product
## Work Cell Elements - Receive Order

### Time Observation Form

<table>
<thead>
<tr>
<th>Process: Hot Dog Vendor (Receive Order)</th>
<th>Observer: JRF</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step</td>
<td>Operation Element</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Greet Customer</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Tempt with offerings</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Go over special of day</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Ring up order</td>
<td>22</td>
</tr>
<tr>
<td>5</td>
<td>Take Cash</td>
<td>27</td>
</tr>
<tr>
<td>6</td>
<td>Make Change</td>
<td>41</td>
</tr>
<tr>
<td>Cycle Time</td>
<td>41</td>
<td>40</td>
</tr>
</tbody>
</table>

### Worker Balance – Time Study

#### Cycle Time

![Cycle Time Chart](chart.png)

- Greet Customer
- Tempt with offerings
- Go over special of day
- Ring up order
- Take Cash
- Make Change

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Worker Balance

Cadence

The rate that a completed product needs to be finished in order to meet customer demand.

\[
\text{Cadence} = \frac{\text{Net Time Available}}{\text{Customer Demand}}
\]

\[
\text{Cadence} = \frac{(7\text{hrs}) \times (60\text{min/hr}) \times (60\text{s/min})}{210\text{ hotdogs}}
\]

\[
\text{Cadence} = 120\text{ s} \quad \text{(One Finished Product every 2 min)}
\]

Worker Balance – Charts

- Working slower than the Cadence will not meet customer demand.
- Working faster than the cadence results in?

Current State

Time (s/pc)  Cadence  Work cells

Slower  Faster
Worker Balance – Getting Results

How to balance workload to the Cadence:

1. Eliminate
2. Combine
3. Change sequence
4. Simplify

# Operators required = \[
\frac{\text{Total Manual Cycle Time}}{\text{Cadence}}
\]

The Pizza Game Simulation

- You are assigned to a team that makes pizzas and have a complete factory that your team is responsible to operate
- Your customer is “Mom’s Pizza”
- Your supplier is ABC supply
The Pizza Game Simulation

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Personnel Required</th>
<th>Job Requirements</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet</td>
<td>1</td>
<td>Dough</td>
<td>160 / day</td>
</tr>
<tr>
<td>Assembly</td>
<td>3</td>
<td>Toppings</td>
<td>160 / day</td>
</tr>
<tr>
<td>Package</td>
<td>1</td>
<td>Package</td>
<td>2 pizzas / case</td>
</tr>
<tr>
<td>Palletize</td>
<td>1</td>
<td>Palletize</td>
<td>10 cases/pallet</td>
</tr>
<tr>
<td>Inspect</td>
<td>1</td>
<td>Minimum 10% inspection, and tracking of overall FTT</td>
<td>16</td>
</tr>
<tr>
<td>Lean Disciple</td>
<td>1</td>
<td>Workflow diagram</td>
<td>1</td>
</tr>
<tr>
<td>Lean Disciple</td>
<td>1</td>
<td>Worker Balance Chart</td>
<td>7</td>
</tr>
</tbody>
</table>

The Pizza Game – Job Functions

**Sheeting**
- Produce dough for both assembly lines
- Distribute one dough per each assembly line at the same time as fast as you can

**Assembly**
- Obtain raw materials and add topping according to plan
- Slide Pizza’s through the oven (slide down conveyor)
The Pizza Game – Job Functions (Cont’d)

**Packaging**
- Assemble (tape) two pizzas together
- Convey package to Palletizer

**Palletize**
- Place ten cases to a pallet (Tupperware) and move to storage area

**Inspection**
- Perform 10% inspection to assure quality requirements are met.
- Keep track of First Time Through (FTT)

\[
\text{FTT} = \frac{\# \text{ good}}{\# \text{ produced}}
\]

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The Pizza Game – Job Functions (Cont’d)

**Lean Disciple # 1**
- Study the cycle time and determine the time for each operator. For example – taping.

- A work process is divided into elements
- Start timing when work begins and record time when a COMPLETE work cycle is finished
- In some fast paced work environments, studying several work cycles are necessary
Lean Disciple # 1

Study the cycle time and determine the time for each operator. For example – taping.

- Not Yet! The job is NOT finished!
- Keep timing until the task you are studying is completed.

- The job is still NOT finished!
- Keep timing until gets back to the starting position
- Round time to the nearest second (otherwise it will drive you nuts!)
The Pizza Game – Job Functions (Cont’d)

Lean Disciple # 1

▶ Study the cycle time and determine the time for each operator. For example – taping.

• Now the job is still finished!
• Glance quickly at the stopwatch, to record the time

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The Pizza Game – Job Functions (Cont’d)

Lean Disciple # 1

▶ Study the cycle time and determine the time for each operator.
▶ For example:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Total # Seconds timed</th>
<th>Total # of Pieces produced</th>
<th>Seconds / Piece</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Sheeter</td>
<td>10</td>
<td>30</td>
<td>(10/30) = 0.33</td>
</tr>
<tr>
<td>2 - Assembler 1</td>
<td>30</td>
<td>5</td>
<td>(30/5) = 6.00</td>
</tr>
<tr>
<td>3 - Assembler 2</td>
<td>30</td>
<td>6</td>
<td>(30/6) = 5.00</td>
</tr>
<tr>
<td>4 - Assembler 3</td>
<td>30</td>
<td>8</td>
<td>(30/8) = 3.75</td>
</tr>
<tr>
<td>5 - Packager</td>
<td>30</td>
<td>3</td>
<td>(30/3) = 10.00</td>
</tr>
<tr>
<td>6 - Palletizer</td>
<td>5</td>
<td>2</td>
<td>(0.5/2) = 0.25</td>
</tr>
</tbody>
</table>
The Pizza Game – Job Functions Continued

Lean Disciple # 1
► Create a work balance chart

[Diagram of a bar graph showing work balance with different sections labeled: Sheeter, Assembler 1, Assembler 2, Assembler 3, Packer, Palletizer.]

Lean Disciple # 2
► Study the flow of materials (pizza) and make a spaghetti diagram of product movement

[Diagram showing the flow of materials from Purchasing to Accounts Payable with spaghetti lines.]
The Pizza Game – Job Functions Continued

Lean Disciple # 2
- The layout is on “Grid” paper one square equates to ten feet
- Trace material flow, count squares for total distance

Constraints

1. Each production order must be signed and dated by the Assembler, Inspector, Packager, and Palletizer
2. Assembly change over time is 20 seconds
3. Clean up time takes four hours per day
4. Customer demand is 160 pizzas per day
5. Your manufacturing plant runs four minutes at each process step
6. The plant is scaled at 1” = 10’
Setting up the Game

Starting with Sheeting
Notice some scrap...

What type of waste is this?
Suggested Next steps

1. Study process cycle times and fill out the cycle time worksheet
2. Measure plant floor for distances traveled (spaghetti diagram)
3. Brainstorm to identify waste
4. Draw a current state VSM
5. Identify Kaizen Bursts add to VSM
6. Prepare a future state VSM as a team

Teams present their vision of the current state (value added and waste)
Kaizen Blitz # 1 – Combine Inspection
• Review and update standard work / safety procedures
• Move inspection pallet closer to sheeting
• Train those affected on new process
• Re-deploy inspector

Kaizen Blitz # 2 – Plant Layout / Packaging Method
• Review and update standard work / safety procedures
• Move pallet to offloading from packaging
• Train those affected on new process
• Re-deploy affected personnel
Kaizen Blitz # 3 – Balance Workload

- Review and update standard work / safety procedures
- Stop using one oven (keep as backup)
- Put in First in - First out lanes
- Rebalance to the Cadence
- Train those affected on new process
- Re-deploy affected personnel

Kaizen Blitz # 4 – Eliminate Product Falling

- Review and update standard work / safety procedures
- Mistake proof product falling defects
- Incorporate First in - First out lanes
- Rebalance to the Cadence
- Train those affected on new process
- Re-deploy affected personnel
Kaizen Blitz # 5 – Pull System for Assembly

- Design and build visual flow racks (SWIP)
- Eliminate order signature requirements
- Review and update standard work / safety proc
- Rebalance to the Cadence
- Train those affected on new process
- Re-deploy affected personnel

Pizza Game Future State Value Stream Map – Apr 15 2008
Box Score – Example from Pizza Game

Expected Benefits

- Reduced process time by 35%
- Reduced lead time by 80%
- Tripled the percent of Value Added Time
- Doubled FTT

Future State

Outcomes of the Activity

Benefits and Results

- An understanding that processes that support the business can be value added, and there is always a better way to do things that will reduce waste
- Pizza Game process is designed to teach participants that any process can be improved
- We tied this to an actual project

Lessons Learned

- Watch the teams at first and be prepared to step in and assist if they get “wrapped around the axel”
- Expect to provide a great deal of instructions at first
- Work on the VSM together as a team on the wall
Thought provoking questions

Questions:
- What is the biggest constraint in the plant?
- How many resources are needed to do the work?

What questions do you have?