initiate | investigate | improve | implement
Agenda

Day 2

- Charter Check
- Goal: investigate
- Customer Perspective
- Lean Thinking
- Baseline Data
- Data Collection
- Facilitation
Note on Icons

Look in upper right corner

Ask Questions or Share Ideas
Practice Your Skills
Dive Deep to Learn More
Review Case Study
Ground Rules

- Participate
- Listen
- Ask Questions
- Acknowledge Others
Charter Check

Problem Statement
• Presupposed Solution?
• Questions?
• Supported by metrics?
• Is it compelling? Does it specify impacts and justify resources?

Scope
• Where does your process begin and end?
• What “flavors” of the process are you working on, not working on?

Targeted Outcomes
• Did the solutions sneak back in?
• Are they measurable whenever possible?

Get feedback on your charter.
### GOAL
1. Understand the current state
2. Understand the customer perspective
3. Verify the problem statement
4. Understand root causes of current state issues

### DELIVERABLES
1. Current State Map
2. Customer Perspective tool
3. Root Cause(s) Analysis tool

### ADDITIONAL TOOLS
- **Map Options:**
  1. Process Map
  2. The 8 Wastes
  3. Value Analysis

- **Customer Perspective:**
  1. Empathy Map
  2. Customer Profile

- **Root Cause Analysis Options:**
  1. Cause(s) Map
  2. The 5 Whys
  3. Fishbone
Icebreaker

Think about a customer service experience you had when somebody went above and beyond to help you.
Customer Perspective

Observe and Develop Empathy for Your Customer
Customer Perspective

Customer perspective has 3 specific characteristics:

- Empathy for the customer
- Tools for customer perspective
- Iterative and experimental approach
Customer Perspective Tools

- Empathy Map
- Direct Feedback
- Customer Profile

Think and Feel?
Hear?
See?
Do?
Say?

Focus Groups
Surveys/Interviews
Go and See

GAINS
PAINS
JOBS

Workbook Page: 25
Empathy Map Exercise

Practice creating an empathy map.

Put yourself in the shoes of a young child experiencing an MRI for the first time. Discuss the following in your group:

- What do you think and feel?
- What do you hear, see do and say?
- Use workbook to capture ideas (5 minutes)
- Report out (4-5 minutes)
BREAK TIME

Return in 15 minutes
Direct Feedback - Go and See (aka Gemba walk)

What did you observe?

Elements of a gemba walk

observe, but don’t correct
identify value +/- activities

seek to understand or clarify
ask about challenge & barriers

1. What tools and systems were used?
2. What wasn’t working?
3. What ended up working?
Practice the customer profile using the case study example.

Any questions before we get started?

- 8 minutes to brainstorm in groups
- Assign 1 recorder to report out
- Use workbook to capture ideas
- Report out (4-5 minutes)
CUSTOMER: Commercial airlines

GAINS
- Decrease travel time
- Less Downtime
- Carry more passengers
- Use Less Fuel
- Increase Market Share
- High Reliability
- Maintain Brand Image
- Use reliable aircraft
- Transport passengers from A to B
- Maximize profits
- Ensure Safety

PAINS
- Unable to compete with other airlines
- Upkeep Costs
- Limited passenger capacity
- Training for Pilots and Staff
- Fuel Inefficient
- Maintenance issues
- Limited passenger capacity
- Training for Pilots and Staff
- Fuel Inefficient
- Maintenance issues
LUNCH BREAK
Lean Thinking
Common Sense Uncommonly Applied
Lean Concepts in ci4i

- Focus on the customer’s perspective
- Engage those closest to the work
- Prioritize "doing" over planning
- "Go and see" approach (aka gemba walk)
- Identify and eliminate waste
- Data driven decision making
Lean Core Tools

**Process Maps**

**8 Wastes**

<table>
<thead>
<tr>
<th>8 Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting</td>
</tr>
<tr>
<td>Motion</td>
</tr>
<tr>
<td>Overprocessing</td>
</tr>
<tr>
<td>Inventory</td>
</tr>
<tr>
<td>Overproduction</td>
</tr>
<tr>
<td>Transportation</td>
</tr>
<tr>
<td>Defects</td>
</tr>
<tr>
<td>Employee Skills (Unused)</td>
</tr>
</tbody>
</table>

**Value Analysis**

- **Value Added**
- **Non - Value Added**
- **NVA - Required**

**Root Cause Analysis**

- **Why?**
  - **Why?**
    - **Why?**
      - **Why?**
        - **Why?**
The purpose of process mapping during the investigate phase is to:

- Document the steps in the process
- Define process scope (start & end)
- Establish process ownership and responsibilities
- Identify bottlenecks, repetition, waste
- Identify improvement opportunities
Case Study: Boeing Then and Now

Practice creating a 9-step process map using the case study video.

Follow along with the video to capture the process of assembling a Boeing 737 airplane.

- ✔ Listen carefully
- ✔ Write down all steps
- ✔ Use 1 box for each day
How Boeing Builds a 737 in 9 Days
Day 1: Installation of internal components
Day 2: Installation of internal components
Day 3: Installation of internal components
Day 4: Install main cabin, wings, tail and landing gear
Day 5: Installation of stabilizer & start of functional tests
Day 6: Installation of “power” and large-scale tests begin
Day 7: Installation of engines
Day 8: Testing of flight control systems
Day 9: Customer completes inspection
Case Study: Boeing Then and Now

Practice documenting waste using the case study example.

As a team, you are assigned responsibility for analyzing wastes in Boeing’s 737 assembly process.

Did you identify any of the 8 wastes?

- 5 minutes to brainstorm in groups
- Assign 1 recorder to report out
- Use workbook to capture ideas
- Report out (4-5 minutes)
How does the Customer define value?

- The customer must recognize the task as important.
- The task is done right the first time.
- The product or service must physically change or transform.

**8 Wastes**

<table>
<thead>
<tr>
<th>Waste</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting</td>
<td>Motion</td>
</tr>
<tr>
<td>Over processing</td>
<td>Inventory</td>
</tr>
<tr>
<td>Overproduction</td>
<td>Transportation</td>
</tr>
<tr>
<td>Defects</td>
<td>Employee Skills (Unused)</td>
</tr>
</tbody>
</table>
# What are the 8 Wastes?

<table>
<thead>
<tr>
<th>W</th>
<th>O</th>
<th>O</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Waiting</strong>: People waiting on material or equipment. Ex: Waiting for inbox to fill up before processing paperwork.</td>
<td><strong>Motion</strong>: Unnecessary, repetitive movement of people, equipment or machinery. Ex: Walking, lifting, reaching.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overproduction</strong>: Creating something before it is asked for or required. Ex: Too many copies, reports that no one reads.</td>
<td><strong>Inventory</strong>: Producing more than the customer needs. Ex: Purchasing too many supplies, unused files in a database.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overprocessing</strong>: Doing more work, adding components or steps. Ex: Using higher precision than necessary.</td>
<td><strong>Transportation</strong>: Movement of people, inventory, equipment. Ex: Sitting far away from those you interact with frequently.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Defects</strong>: Errors that make product or service unusable or result in rework. Ex: Forms with missing information.</td>
<td><strong>Employee Skills (Unused)</strong>: Waste of human talent or ingenuity. Ex: Not asking for employee feedback.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Goal**: Reduce or eliminate non-value added steps.
Process Mapping in Real Time

Practice creating a process map.

Draw a map that explains the process of planning a trip that requires air travel from SEA – NYC.

Work on creating a process map in your breakout groups.

✓ What do you do first/last?
✓ What 3-5 steps happen between the beginning and the end?
**Value Added Analysis**

**Value Added**

- The customer must recognize the task as important.
- The product or service must physically change or transform.
- The task is done right the first time.

**Non-Value Added**

- Waste. A process step that adds no value to the product or service.
- Does the customer want to pay for this?

**Non-Value Added, but Required**

- A process step that adds no value to the product but is currently required to produce the product or service. A required law, regulation, rule etc. Internal or external.
Detailed Process Mapping

Practice adding details to your process map.

Supplement your original process map by adding important details.

- How long does each step take?
- Should certain tasks be prepared ahead of others?
- What is the value added by each step?
- Are there decision points that impact the process?
Root Cause(s) Analysis

Concept

• Since every effect has causes (plural), there isn’t a cause (one cause) to any issue or event
• Getting to the root of an issue is the process of identifying all the causes by digging into the details

Execution

• Focus on impacted goals
• Rely on evidence and facts (what, when, where)
• Start with what you know—using 5 Whys
• Facilitate a group with those closest to the work
Why did Boeing encounter barriers entering the civil aviation market?

**Why?**
- *Excuse*
  - Why?
    - *Easy Answer*
  - Why?
    - *Thinking harder*
  - Why?
    - Getting closer
  - Why?
    - Real reason

Why 1: Customers could not afford the price of airfare—2,800-3,800 today’s $

Why 2: Cost per flight were very high

Why 3: Carry less than 100 passengers

Why 4: Plane lacks space for more seats

Why 5: Double decker design based on wartime Stratofreighter
ci4i Project Journey

- Project Charter
- Customer Perspective Tools
- Process Map + Details
- 8 Wastes
- Value Analysis
- 5 Whys
- Root Cause(s) Map
- Baseline Data

CONTINUOUS IMPROVEMENT
5 Whys—Root Cause(s) Analysis

Why did Boeing encounter barriers entering the civil aviation market?

- Customer could not afford
- Cost per flight too high
- Can only carry less than 100
- No space for more seats
- Double decker freighter

Why?

- Flight is long (9 hrs SF-HI)
- Plane is slow
- Engines aren't strong enough

Why?

- Trips were long (distance)
- Not a lot of airports
- Commercial air just taking off

Why?

- Engines built off wartime technology

Why?
Fishbone Diagram Use Case

Fishbone Diagram: Boeing 1946-47
Why are our passenger aircraft not selling?

People
- Military leaders
  - Army
  - Navy
- Workforce transition
- Obsolete designs
  - R&D limitations (civilian focus)
- Retooling

Method
- Government Requirements
  - Wartime demands
    - Target types
    - Enemy Defenses
- Small Civilian Market
  - Production restrictions
  - Railways

Environment
- Post-war recession
  - Low demand

Measurement
- Units Produced
  - Aircraft Specs
    - # of Seats
    - Range Payload
- Poor Quality
  - Material unavailability
  - Surplus
  - Military
  - Aircraft Components

Problem (Poor Passenger Aircraft Sales)
BREAK TIME

Return in 15 minutes
Data

Measure It and Prove It
“Without data you are just another person with an opinion.”

W. Edwards Deming
CUSTOMER: Commercial airlines

GAINS
- Decrease travel time
- Less Downtime
- Carry more passengers

PAINS
- Unable to compete with other airlines
- Upkeep Costs
- Limited passenger capacity
- Training for Pilots and Staff
- Fuel Inefficient
- Maintenance issues

JOBS
- Maintain Brand Image
- Use reliable aircraft
- Transport passengers from A to B
- Maximize profits
- Ensure Safety

Positive Brand Image
Use Less Fuel
Increase Market Share
High Reliability
Measure It and Prove It

**Data Collection**

- **Select meaningful data** - Know how it relates to your targeted outcomes.
- **Identify the pieces** - List all components needed to form your measures.
- **Identify sources** - Where you will get the data? Who will provide or generate it?
- **Start with a baseline** - Ensure what you measure now can be consistently measured in the future.

**Data Analysis**

- **Form a hypothesis** - Take a proposed solution and make a prediction about the outcome.
- **Make an improvement** - Conduct interviews or surveys, run a pilot program or design a prototype.
- **Collect more data** - Be sure to use the same measures you identified in your baseline.
- **Compare** - Did you get the results you expected? Were you able to prove or disprove your hypothesis?
You are assigned responsibility for designing a new aircraft. Your design must be faster and more profitable than the Boeing 377 Stratocruiser.

Brainstorm baseline data points using the case study.

What data would you want to know in order to measure the impact of proposed improvements?

- 3 minutes to brainstorm
- Use workbook to capture ideas
- Report out (4-5 minutes)
What do I want to know?

What are the measures I need?

Where does the data live?

How will it be collected?

Fuel consumption

Miles traveled?

Total fuel used?

Flight records

Flight records

Total miles in service before and after flight

Fuel level before and after flight

Breaking Down Data
## Case Study: Boeing Then and Now

### Baseline Data Example

<table>
<thead>
<tr>
<th>Boeing Stratocruiser (377)</th>
<th>Fuel consumption (kg/hr)</th>
<th>1512</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Passenger Capacity</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Speed (mph)</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Range (miles)</td>
<td>4200</td>
</tr>
</tbody>
</table>

![Image of Boeing Stratocruiser (377)](image_url)
Case Study: Boeing Then and Now

How would Boeing know if the new design was a success?
What changes were prioritized in the 707?

Boeing 377 and 707 Passenger Aircraft Specifications

- **Fuel consumption kg/hr**: 1512 (707), 600 (377)
- **Passenger Capacity**: 174 (707), 100 (377)
- **Speed (mph)**: 600 (707), 350 (377)
- **Range (miles)**: 3600, 4200

The chart above compares the specifications of the Boeing 707 and the Stratocruiser (377). The changes prioritized in the 707 include increased range and passenger capacity, with a significant decrease in fuel consumption per hour compared to the Stratocruiser.
The 707 used almost 4 times as much fuel to operate.

Boeing 377 vs 707 Aircraft Fuel Consumption

Fuel consumption kg/hr

<table>
<thead>
<tr>
<th>Fuel consumption kg/hr</th>
<th>707</th>
<th>Stratocruiser (377)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2000</td>
<td>7200</td>
<td>1512</td>
</tr>
</tbody>
</table>
The 707 had room for 74 additional passengers.
The 707 speed increased by 71% or 250 miles per hour.
The 707 range decreased by 15% or 600 miles.
Summary

What changes did Boeing prioritize in the 707?

Compared to the Boeing 377, the 707:

- Required a lot more fuel
- Could not go as far per trip but, allowed carriers to transport more passengers
- Was faster and had less downtime
Change in Customer Expectations

Boeing Long-range Passenger Aircraft Specifications Over Time

- **Fuel consumption kg/hr**
  - 787: 1512
  - 737-600: 2400
  - 707: 4900
  - Stratocruiser (377): 4900

- **Passenger Capacity**
  - 787: 360
  - 737-600: 110
  - 707: 174
  - Stratocruiser (377): 100

- **Speed (mph)**
  - 787: 600
  - 737-600: 544
  - 707: 350
  - Stratocruiser (377): 350

- **Range (miles)**
  - 787: 3510
  - 737-600: 3600
  - 707: 4200
  - Stratocruiser (377): 4200

Range (miles) | Speed (mph) | Passenger Capacity | Fuel consumption kg/hr
--- | --- | --- | ---
7000 | 7355 | 7200 | 787
6000 | 600 | 100 | 737-600
5000 | 544 | 174 | 707
4000 | 350 | 100 | Stratocruiser (377)
Where Do You Get Data?

**ASK FOR IT**
- Stories are a start…
- Customer interviews
- Focus Groups

**FROM IT SYSTEMS**
- SAP
- Custom databases
- Exports from software

**CREATE IT**
- Document processes
- Manual data entry
- Performance measures

**BORROW IT**
- Federal data
- Academic research
- Industry benchmarks
Facilitation
### Roles of a Facilitator

<table>
<thead>
<tr>
<th>✅</th>
<th>❌</th>
</tr>
</thead>
</table>
| • Focused on the **process** of problem solving  
• Equipped with **tools** for exploring tough issues  
• Invested in the team’s **success**  
• Dependent on the team for subject matter expertise and participation  
• Working for the whole team  
• Going to ask a lot of **obvious** questions | • A **Subject Matter Expert**  
(Doesn’t have “the answer”)  
• Invested in a **particular** outcome  
• Going to let the team “fail” |
Why Do Teams Get Stuck?

What can you do as a facilitator to get them unstuck?

• Revisit the basics – team charter, purposes, roles & responsibilities, ground rules
• Parking lot the “sticking” issue and work on another problem
• Go for small wins
• Inject new information and approaches
• Change the team’s membership, including the leader
Homework

- Complete Project Deliverables for investigate phase (Ex: Process Map, Root Cause Analysis)
- Schedule office hours to discuss your project with CI staff
- Review case study for Day 3