4 Types of Problems

Coaching Problem Solving &
Developing People Toyota Style
Learning Session Outline

• 4 Types of Problem Framework
• Type 1 – Troubleshooting
• Type 2 – Gap from Standard
• Type 3 – Target State
• Type 4 – Innovation
• Summary
Background - Lean / Toyota

- Toyota Kamigo Overhead
- Kamigo Entrance
- Taiichi Ohno
- Precision & Machine Intensive
- Lower Volume & Higher Mix
- High Volume & Lower Mix
Other Background - Work

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Other Background - Stuff
TPS Development Timeline

Western Influences:
- Mass Production & moving conveyor lines
- Scientific Principles Of Management
- Standardization Of Parts
- Many Others....

Various parties and key individuals involved over a long period of time
20th Century & Problem Solving

- **1896**: Frederick W. Taylor’s scientific management principles
- **1900s**: John Dewey’s Reflective Thinking
- **1910s**: Vilfredo Pareto introduces 80/20 concept in Italy
- **1920s**: TWI Methods during WWII
  - U.S. DOD standard MIL-P-1629
  - Failure Modes Effects Analysis
  - TRIZ / TIPS
- **1930s**: Walter A. Shewhart’s control chart
- **1940s**: Sarasohn & Protzman
  - CCS Course in Japan & 5 step problem solving
  - Deming SPC lectures & Deming Wheel in Japan
  - JUSE PDCA Cycle
  - Juran Quality Management & Handbook in Japan
- **1950s**: Lean problem solving methods
  - Six sigma methods
  - Design thinking routines
  - Mizen Boushi / GD3
- **1960s**: U.S. DOD 8D Method
  - Kepner Tregoe Rational Analysis Methods
  - JUSE 7 QC Tools
  - 6 step problem solving & shop floor QC circle activities
  - Bell Labs Fault Tree Analysis
- **1970s**: Alex F. Osborn establishes brainstorming routines for creative problem solving
  - Ronald A. Fischer Design of Experiments
  - Shewhart cycle of specify, produce & inspect
- **1980s**: 20th Century & Problem Solving
- **1990s**: Continuing development of lean and six sigma methodologies
- **2000s**: Evolution of problem-solving techniques with the integration of technology and data analysis.
4 Types of Problem Situations

- **Type 1: Troubleshooting**
  - Immediate corrective action oriented with limited root causal analysis

- **Type 2: Gap from Standard**
  - Rapid occurrence oriented with strong root causal emphasis

- **Type 3: Target Setting**
  - Future oriented with a new target state emphasis and creative solutions

- **Type 4: Innovation Oriented**
  - Future oriented with a more open-ended view for problem resolution

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4 Types & Benkei Analogy

Benkei

7 QC Tools

1. Data Collection / Check sheets
2. Cause-and-effect diagram
3. Flow charts
4. Histogram
5. Pareto chart
6. Control chart
7. Scatter diagram

Kaoru Ishikawa

The term “7 QC tools” is named after the seven tools of Musashibo Benkei the famous warrior monk. Benkei owned seven weapons which he used to win all his battles. Similarly from my own experience you will find that you will be able to solve 95% of the problems you face if you properly use the 7 QC tools.

Professor Emeritus
University of Tokyo
4 Types of Problem Situations

- **Type 1: Troubleshooting**
  - Complexity: Lower
  - Time to resolve: Lower
  - Immediate corrective action oriented with limited root causal emphasis

- **Type 2: Gap from Standard**
  - Complexity: Higher
  - Time to resolve: Lower
  - Rapid occurrence oriented with strong root causal emphasis

- **Type 3: Target Setting**
  - Complexity: Higher
  - Time to resolve: Lower
  - Future oriented with a new target state emphasis and creative solutions

- **Type 4: Innovation Oriented**
  - Complexity: Higher
  - Time to resolve: Higher
  - Future oriented with a more open-ended view for problem resolution
Type 1 – Troubleshooting

Condition based trigger
Either human or machine
Andon Response Example

1. Automated process cycling normally

2. Mechanical probe detects broken cutting tool and stops the machine

3. Probe signals an “andon” board for visual display

4. The operator **immediately takes corrective action** and confirms good products to the following process
Type 1 – Troubleshooting

Rapid Problem Solving
- Concern
- Cause
- Countermeasure
- Check

Time & quantity based triggers
Reviewed hourly by supervisor
Minimal (if any) documentation involved. No A3’s. Mainly discussion, thinking, rapid action & follow up.
Yes - 5 Why is the Ideal

Situation: A machine tool has stopped working halting production.

1) “Why did the machine stop working?”
   • “Because the machine overloaded blowing the fuse in the control panel.”

2) “Why did the overload condition result?”
   • “Because there was insufficient lubrication to the spindle bearing.”

3) “Why was there insufficient spindle bearing lubrication?”
   • “Because there was insufficient lubrication drawn up by the pump.”

4) “Why was there insufficient lubrication draw from the pump?”
   • “Because the pump shaft was worn and rattling.”

5) “Why was the pump shaft worn?”
   • “Because there was no strainer on the lubrication device inlet port, and small metal cutting chips entered the system causing damage.”
Key Point is the Countermeasure!

**First Why**
- Q: WHY has the machine stopped?
  - A: There was an overload and the fuse blew.

**Second Why**
- Q: WHY was there an overload?
  - A: The bearing was not sufficiently lubricated.

**Third Why**
- Q: WHY was it not lubricated?
  - A: The lubrication pump was not pumping sufficiently.

**Fourth Why**
- Q: WHY was it not pumping sufficiently?
  - A: The shaft of the pump was worn and rattling.

**Fifth Why**
- Q: WHY was the shaft worn out?
  - A: There was no strainer attached and metal scraps got in.

**Recurrence Prevention Countermeasure:**
Add fine mesh strainer to inlet port to prevent cutting chips from entering the system.
Toyota Supervisor Image

Rapid response to problems and abnormal conditions by production
- Team Member
- Team Leader
- Group Leader
- Manager
- Plant Manager

“All Mighty” Supervisor Image
1. Safety
2. Job Ability
3. Team Leadership
4. Kaizen Skills / Problem Solving
5. Technical Knowledge
6. Human Relations
Exercise & Discussion

• Small Groups
• Create hourly surfacing example
• Create trouble shooting examples 1 per person
• Frame them in the language of 4C’s
• Vote and decide on best one for sharing
• Prepare flip chart presentation
• Present to audience
4 Types of Problem Situations

Type 1: Troubleshooting
- Immediate corrective action oriented with limited root causal analysis

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- Future oriented with a new target state emphasis and creative solutions

Type 4: Innovation Oriented
- Future oriented with a more open-ended view for problem resolution

Complexity of problem
- Lower
- Higher

Time to resolve
- Lower
- Higher

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Type 2 – Gap from Standard

Vague Problem Understanding

- Step 1: Clarify the Problem Background
- Step 2: Define the Problem
- Step 3: Establish a Goal
- Step 4: Root Cause Analysis

- Step 5: Implement Countermeasures
- Step 6: Check Results
- Step 7: Follow Up & Standardized

5W 1H & 5th Why Emphasis
KPI’s & Problem Solving
Daily Meeting

Start of 8 hour shift
Daily performance trend
Major problem communication
Departmental coordination
Priority alignment & clarification
Hop topics, etc.
May or may not have problem type A3’s posted here
Shop Floor Management Board

<table>
<thead>
<tr>
<th>Safety</th>
<th>Quality</th>
<th>Productivity</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D&amp;O</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Check</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Act</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Safety**
  - Trend
  - [Graph]

- **Quality**
  - [Bar Chart]
  - [Graph]

- **Productivity**
  - [Graph]
  - [Table]

- **Organization**
  - [Diagram]
# Problem Solving Report / A3

<table>
<thead>
<tr>
<th>Problem Background</th>
<th>Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Definition</td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>Check Results</td>
</tr>
<tr>
<td>Root Cause Analysis</td>
<td>Follow Up &amp; Standardize</td>
</tr>
</tbody>
</table>
Clarify the Problem Background
Define the Problem

The graph shows the number of defects over time from August to November. The standard is represented by a horizontal line at the defect level, while the current trend is shown as a line graph. The graph highlights a problem by indicating a gap between the current situation and the standard.
Define the Problem

BIG PROBLEM

- Too Large
- Still Large
- Focus Here First and Prioritize for Impact

MEDIUM PROBLEM

- 1st Priority
- 2nd Priority
- 3rd Priority

SMALLER PROBLEM
Problem Investigation

A. Immediate abnormality signal

B. Go to actual machine and see status

C. Ascertain actual problem situation

D. Problem Investigation Sequence

1. Measure actual dimensional extent of problem
2. Look for obvious contamination or abnormalities
3. True and re-dress grinding wheel and observe status
4. Check actual grinding wheel (check “pores”)
5. Confirm actual (not theoretical) stock removal
6. Send part to QC Mat’l lab for hardness and HT depth check
7. Check actual cutting conditions
   • Wheel RPM
   • Feed Rate, Depth of Cut, etc.
   • SFPM
8. Confirm status of datum features
9. Measure spindle run out
10. Coolant check
    • Flow rate / pressure
    • Nozzle condition and direction
    • Temperature
    • Concentration

Cpk 1.15

Cpk 2.33
Dig Deeper! 8G’s

- Genba  
  現場  
  Actual Place
- Genjyou  
  現状  
  Actual Condition
- Genchi  
  現地  
  Actual Location
- Genbutsu  
  現物  
  Actual Object
- Genjitsu  
  現実  
  Actual Facts
- Genji  
  現時  
  Actual Time
- Genpō  
  現法  
  Actual Method
- Genin  
  現因  
  Actual Cause
## Dig Deeper! Plain English

<table>
<thead>
<tr>
<th>5W 1H</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who?</td>
<td>Site</td>
<td>Department</td>
<td>Group</td>
<td>Team</td>
<td>Individual</td>
</tr>
<tr>
<td>When?</td>
<td>Day</td>
<td>Shift</td>
<td>Hour</td>
<td>Minute</td>
<td>Actual instant of occurrence</td>
</tr>
<tr>
<td>Where?</td>
<td>General area</td>
<td>Specific production line level</td>
<td>Specific process</td>
<td>Actual location in the process</td>
<td>Actual point of occurrence</td>
</tr>
<tr>
<td>What?</td>
<td>Occurrence</td>
<td>Symptom</td>
<td>Broad problem</td>
<td>Categorical problem</td>
<td>Specific problem</td>
</tr>
<tr>
<td>Why?</td>
<td>1(^{st}) cause</td>
<td>2(^{nd}) cause</td>
<td>3(^{rd}) cause</td>
<td>4(^{th}) cause</td>
<td>5(^{th}) cause</td>
</tr>
<tr>
<td>How / How much?</td>
<td>Non-conformance issue</td>
<td>Dimensional variation</td>
<td>Above standard allowed</td>
<td>Comparison to actual Standard</td>
<td>Gap from actual standard: e.g., .001 mm</td>
</tr>
</tbody>
</table>
Set a Goal

3 Factors
From what level?
To what level?
By when?

SMART
Specific?
Measurable?
Attainable?
Relevant / Realistic?
Time bound?

Poor examples include:
1) Find the root cause! (This is the next step of the process)
2) Implement lean tools like 5S or Standardize Work, etc. (This is an action item)
3) Train the employee (This is jumping to conclusions)
Analyze the Problem

- Convergent
- Focused
- Analytic

C&E Relationship
- Standard attainment
- Scope control

- Logic
  - Inductive
  - Deductive
  - Abductive

- OVAT
  - One Variable At A Time
  - Statistical methods aimed at process control or measures of capability
  - Supervisors & Engineers

- MVAT
  - Multiple Variables At A Time
  - Statistical methods aimed at advanced problems and study of multiple variables at a time in an experiment
  - Supervisors & Design / Development

- Qualitative logic such as the 5 Why’s or Cause and Effect Diagrams
  - Lower

- Complexity of analysis
  - Higher

- Time to resolve
  - Lower
  - Higher
Fishbone is the common name for a structured Cause & Effect diagram. You do not “brainstorm” a fishbone. Distinguish between critical thinking and creative thinking. Simply writing down random opinions = Wishbone diagram.
Logic Based – 5 Why

Situation: A machine has stopped working halting production.

1) “Why did the machine stop working?”
   • “Because the machine overloaded blowing the fuse in the control panel.”
2) “Why did the overload condition result?”
   • “Because there was insufficient lubrication to the spindle bearing.”
3) “Why was there insufficient spindle bearing lubrication?”
   • “Because there was insufficient lubrication drawn up by the pump.”
4) “Why was there insufficient lubrication draw from the pump?”
   • “Because the pump shaft was worn and rattling.”
5) “Why was the pump shaft worn?”
   • “Because there was no strainer on the lubrication device inlet port, and small metal cutting chips entered the system causing damage.”

Note deeper causes exist!!!! However here at this level a quick, inexpensive, and effective countermeasure can be established
Statistical Based - OVAT

Simple case of inadequate coolant flow to the part due to a blocked / damaged coolant line.

One variable (coolant flow) cause the entire problem....

Before Cpk 1.15

After Cpk 2.33
Statistical Based - MVAT

Complex case of multiple independent variables
- Temperature
- Pressure
- Processing time
- Etc.

Basic OTD Case & Multiple Factors
- Inventory amount
- Order entry system
- Lead time to produce
- Material storage
- Production schedule
- Set up time
- Production execution
## Key Points in RCA

<table>
<thead>
<tr>
<th>Area of emphasis</th>
<th>Key Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>Break it down to the proper level for study. No one technique is always best.</td>
</tr>
<tr>
<td>Quantitative / Qualitative</td>
<td>Measure and organize carefully in order to understand relationships.</td>
</tr>
<tr>
<td>Detailed</td>
<td>Get the facts using 8G’s or 5W 2H to the proper level for the problem in question.</td>
</tr>
</tbody>
</table>
5 Why & RCA Review

FIRST WHY
Q: WHY has the machine stopped?
A: There was an overload and the fuse blew.

SECOND WHY
Q: WHY was there an overload?
A: The bearing was not sufficiently lubricated.

THIRD WHY
Q: WHY was it not lubricated?
A: The lubrication pump was not pumping sufficiently.

FOURTH WHY
Q: WHY was it not pumping sufficiently?
A: The shaft of the pump was worn and rattling.

FIFTH WHY
Q: WHY was the shaft worn out?
A: There was no strainer attached and metal scraps got in.

RECURRENC PREVENTION COUNTERMEASURE:
Add fine mesh strainer to inlet port to prevent cutting chips from entering the system.
Establish Countermeasures

<table>
<thead>
<tr>
<th>ADMINISTRATION</th>
<th>DETECTION</th>
<th>PREVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Examples include increasing inspection duties, adding training or altering work instructions for the operator.</td>
<td>• Examples include any instances of sensors or alarms used to signal that an abnormality has occurred in the product or process and stops the defect from moving downstream. Mistake or error proofing in the process.</td>
<td>• Examples include creative usage of techniques to prevent the defect or abnormality from occurring in the product or process. Or elimination of the underlying condition or potential.</td>
</tr>
<tr>
<td>• These controls are generally weak and mainly acceptable as temporary short term countermeasures.</td>
<td>• These controls are stronger in nature and contain defects internally better than administrative ones.</td>
<td>• These controls either alone or in conjunction with detection for the strongest type of defect control.</td>
</tr>
</tbody>
</table>

Select countermeasures which are most likely the prevent recurrence of the problem. Training and inspection are not satisfactory countermeasures.
Administration Countermeasures

Examples of Administrative C/M
Standardized Work / Work Instructions
Inspection Frequency or Method
Training and Communication
Detection Countermeasures

Jidoka concept

Examples of Detection C/M
- Error proofing
- Sensors (Mechanical, Electrical, Optical, etc.)
- In-process auto measurement
- Immediate post process auto measurement

Automatically stop the process at any detection of a defect or abnormal condition
Prevention Countermeasures
Check Results

**Primary Purpose:**
1) Check and verify if you have attained your results goal
2) Check and verify if your process metrics are sound

**Common Mistakes:**
1) Falling into the mistake of checking the completion of action items. That is not the same thing as checking whether or not you have accomplished the goal!
2) Not checking if you attained your goal!
Check Results

Key Points:
1) How long will you follow up to ensure success?
2) Are your countermeasures “sticky”?
Follow Up & Standardize
Follow Up & Standardize

STANDARDIZE & FOLLOW UP

How to sustain?

[Graph showing improvement trend over standard and gap]

- Work Instructions
- Forms
- Checklists
- Audits
- Spare Parts
- Training
- Communication
- Manuals
Type 1 Troubleshooting is about rapid action and response to the abnormal condition...an analogy is thinking fast.

Type 2 Gap from standard problem solving is about being more deliberate and slowing down to consider what is the real problem or root cause...an analogy is thinking slow.
Exercise & Discussion

• Same as before

• Now prepare a Type 2 Problem for presentation

• Flip Chart – Basic Steps
  1. Problem Background
  2. Problem Definition
  3. Set a Goal
  4. Root Cause Analysis
  5. Countermeasures
  6. Check Results
  7. Standardize & Follow Up
4 Types of Problem Situations
Type 3 – Target State

- **Acceptable (Current State) Situation**
- **Normal Status**
- **(Future) Ideal Situation**

**Type 2 - “Gap from Standard”**

**Problem Solving**

**Kaizen Methods**

**改善方法**

**問題解決**
Type 3 – Raise the Bar
Target State Concept (Time Frame)

**KEY PERFORMANCE INDICATORS**

**Type 2 Problems & Gap From Standard**

**HOW THINGS “ARE”**

- Performance Trend

**Type 3 Problems & Target State Setting**

**HOW THINGS “SHOULD BE”**

- Safety
- Quality
- Cost
- Delivery
- Productivity
- Morale/HRD

**SELECTED HOW THINGS SHOULD BE**

- Future State
- Current Conditions

- Customer Satisfaction
  - 100% Quality
  - 100% On Time
  - 100% Productive
  - 100% On Cost

- Human Development
  - Safe
  - Engaged
  - Challenged
  - Professional

- Challenge
  - Every Day
  - Every Person
  - Every Opportunity

**PROBLEM SOLVING TO THE CONCLUSION**

- Problem Background
- Problem Definition
- Goal
- Root Cause Analysis
- Countermeasure
- Check Results
- Follow Up & Standardize

**PERFORMANCE TRENDS**

- Gap
- Standard
- Actual

**RANKED OF GAP**

- Large
- Medium
- Small
You Can Target State Anything!

- Products
- Processes
- Services
- Sports
- Metrics

But you have to think and not just copy...
Two Types of Thinking

Critical Thinking
- analytic
- convergent
- vertical
- probability
- judgment
- focused
- objective
- answer
- left brain
- verbal
- linear
- reasoning
- yes but

Creative Thinking
- generative
- divergent
- lateral
- possibility
- suspended judgment
- diffuse
- subjective
- an answer
- right brain
- visual
- associative
- richness, novelty
- yes and
Target State Improvement Steps

- **TARGET STATE**
  - **TRUE NORTH**
  - **CUSTOMER SATISFACTION**
    - 100% Quality
    - 100% On-Time
    - 100% Productive
    - 100% On-Cost
  - **HUMAN DEVELOPMENT**
    - Safe
    - Engaged
    - Challenged
    - Professional

- **CURRENT STATE**

- **BACKGROUND**
- **CURRENT STATE DEFINITION**
- **CURRENT STATE ANALYSIS**
- **GOALS**
- **TARGET STATE DEFINITION**
- **IMPLEMENTATION PLAN**
- **CHECK RESULTS**
- **FOLLOW-UP & STANDARDIZE**

- Depict the “as-is” current state
- Measure and analyze the process and key performance indicators
- Show the specific key details for improvement
Process Example SMED Example

3 Dedicated Machines
No Flexibility
Each 30% Utilization
Make lots of inventory!

1 Machine / 3+ Tools
Change Over Flexibility
90% Utilization
Run more JIT style
**Set Up Reduction**

<table>
<thead>
<tr>
<th>METHOD</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measure total time required for changeover. Video tape is best.</td>
</tr>
<tr>
<td>2</td>
<td>Identify internal versus external elements and calculate individual times</td>
</tr>
<tr>
<td>3</td>
<td>Take the external elements and make sure they are done before the machine stops</td>
</tr>
<tr>
<td>4</td>
<td>Reduce and eliminate the internal elements (i.e., adjustments &amp; fastener items in particular)</td>
</tr>
<tr>
<td>5</td>
<td>Reduce the time required for external elements</td>
</tr>
<tr>
<td>6</td>
<td>Standardize and improve the new procedure over time</td>
</tr>
</tbody>
</table>

**METHODS: CHANGEOVER REDUCTION STEPS**

<table>
<thead>
<tr>
<th>PRE-WORK</th>
<th>DURING MACHINE SHUTDOWN</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 MIN</td>
<td>50 MIN</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td><strong>I</strong></td>
</tr>
<tr>
<td>25 MIN</td>
<td>20 MIN</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td><strong>I</strong></td>
</tr>
<tr>
<td>10 MIN</td>
<td>20 MIN</td>
</tr>
<tr>
<td><strong>E</strong></td>
<td><strong>I</strong></td>
</tr>
<tr>
<td>10 MIN</td>
<td></td>
</tr>
<tr>
<td><strong>E</strong></td>
<td><strong>I</strong></td>
</tr>
</tbody>
</table>

75 MINUTES

**E = External • I = Internal**
Software Example

3 Dedicated Servers
Each 30% utilized
No flexibility
Stranded resources

1 Virtual Server
Now 90% utilized
Flexibility
Less waste

Same basic principle as SMED in die exchange...

Key here is not the time change over aspect but the software ability to act and host multiple server types...
Type 3 – Target State Summary

Arubeki Sugata / Ideal State

Critical Concept:
What We Should Do
Not What We Can Do

Kaizen / C.I.
- 100% quality
- 100% value add
- 100% on time, in sequence, batch of one capability

AND

Respect for People
- Physical & mental safety
- Security
- Professional challenge

Critical Concept:
How We Should Do It
Not How We Can Do It

Everyone
Every minute
Every day

Current Condition

Divergent
Creative
Synthesis
Requires change
Longer time
Greater span
4 Types of Problem Situations

Type 1: Troubleshooting
- Immediate corrective action oriented with limited root causal emphasis
- Lower Complexity of problem
- Lower Time to resolve

Type 2: Gap from Standard
- Rapid occurrence oriented with strong root causal emphasis
- Higher Complexity of problem
- Lower Time to resolve

Type 3: Target Setting
- Future oriented with a new target state emphasis and creative solutions
- Higher Complexity of problem
- Higher Time to resolve

Type 4: Innovation Oriented
- Future oriented with a more open ended view for problem resolution
- Higher Complexity of problem
- Highest Time to resolve
4 Types of Problem Situations

- **Type 1: Troubleshooting**
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- **Type 4: Innovation Oriented**
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Time to resolve:
- Lower
- Higher

Complexity of problem:
- Lower
- Higher

Categories:
- Small
- Medium
- Large
The system was introduced by Managing Director Eiji Toyoda in 1951 when it became clear during the post Second World War economic recovery that Toyota’s production facilities needed improvement. Toyoda took the idea of TCISS (the creative ideas suggestion system) from a Ford Motor Company plant which he had visited in July 1950.

Although the TCISS offered incentives to employees, the real value of the system was that it provided motivation to employees by focusing on their skills and creativity. The TCISS systemized the practices that had been customary since the time of Toyota Motor Corporation founder Kiichiro Toyoda: respecting opinions from production and sales and conducting spontaneous on-site inspections while simultaneously inviting suggestions for improvements.
Washer Process Innovation

Entry View

Front View
Employee Improvement Idea

• “It occurred to me that the thought of putting the cylinder head through a large box shaped industrial washer was inherently a bad idea...blasting it from the outside with dozens of high pressure nozzles only pushed some cutting chips, dirt, and contaminants further into the holes and ports, etc.”

• “It also occurred to me that just dunking the cylinder head into a series of 55 gallon sized dunk tanks via a robotic arm would work better. Plunging action into the tank with an agitator style of motion would drop the chips and contaminants out with less time, energy, cost, maintenance, and higher end quality...”
Prius, Lexus, & Mirai

FUELED BY HYDROGEN, OXYGEN, AND SKEPTICISM
## Type 4 – Vision / Innovation

**How you?**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>OFFERING</th>
<th>EXPERIENCE</th>
<th>Customer Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit Model</td>
<td>Make money</td>
<td></td>
<td>Foster interaction</td>
</tr>
<tr>
<td>Network</td>
<td>Connect with others to create value</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>Align your talent and assets</td>
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<tr>
<td>Process</td>
<td>Use Superior methods to do your work</td>
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<tr>
<td>Product Performance</td>
<td>Employ distinguish features and</td>
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<td>functionality</td>
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<tr>
<td>Product System</td>
<td>Create complementary products and</td>
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<td>services</td>
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<td>Service</td>
<td>Support and enhance the value of your</td>
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<td>Channel</td>
<td>deliver your offering to your</td>
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<tr>
<td>Brand</td>
<td>Represent your offering and business</td>
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- Gillette, Hilti
- UPS, GSK, Toshiba
- Mc Do, Fabindia
- Zara, Ikea
- Dyson, Mars, Inuit
- Microsoft, Scion
- Zappos, Car Glass, Sysco
- Nespresso, Amazon
- Intel, Virgin
- Apple, Foursquare

Doblin: 10 Types of Innovation: The Discipline of Building Breakthroughs
5 Why Example Revisited

Situation: A machine tool has stopped working halting production.

1) “Why did the machine stop working?”
   • “Because the machine overloaded blowing the fuse in the control panel.”

2) “Why did the overload condition result?”
   • “Because there was insufficient lubrication to the spindle bearing.”

3) “Why was there insufficient spindle bearing lubrication?”
   • “Because there was insufficient lubrication drawn up by the pump.”

4) “Why was there insufficient lubrication draw by the pump?”
   • “Because the pump shaft was worn and rattling.”

5) “Why was the pump shaft worn?”
   • “Because there was no strainer on the lubrication device inlet port, and small metal cutting chips entered the system causing damage.”
5 Why Revisited

- **Type 1** - Troubleshoot cutting chips by daily cleaning and maintenance of the machine for immediate relief.

- **Type 2** – Put the strainer on the inlet port in the previous example for recurrence prevention.

- **Type 3** – Evacuate the cutting chip better by breaking the cutting chips smaller, with better coolant systems, chip breakers, and better tooling conditions. Also improve machine guards and tank covers for a more creative solution.

- **Type 4** – Tooling innovation, chip formation optimization, cutting condition innovation, washer process redesign, and upstream die casting optimization for process innovation. Material and product innovation are also possible angles.
4 Types of Problem Situations

- **Type 1: Troubleshooting**
  - Immediate corrective action oriented with limited root causal emphasis

- **Type 2: Gap from Standard**
  - Rapid occurrence oriented with strong root causal emphasis

- **Type 3: Target Setting**
  - Future oriented with a new target state emphasis and creative solutions

- **Type 4: Innovation Oriented**
  - Future oriented with a more open ended view for problem resolution

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The term “7 QC tools” is named after the seven tools of Musashibo Benkei the famous warrior monk. Benkei owned seven weapons which he used to win all his battles. Similarly from my own experience you will find that you will be able to solve 95% of the problems you face if you properly use the 7 QC tools.

Professor Emeritus
University of Tokyo

A fool remembers only one thing
A fool knows only one way of doing things
Session Summary

• Benkei versus Baka analogy and be careful of experts who only know one way
• Each type has a different cadence and focal point
• Learning by doing is key for all four types
• Reflection after doing is key as well. However you can’t just “think” your way to improvement
• Problem solving, innovation and improvement require perspiration and willingness to fail more than once
Appendix