Problem Solving Today and Tomorrow

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Problem - Meaning

“Problem is the distance between where you are now and where you could be – no matter how good you are now.”

“Having no problem is biggest problem of all”

“No one has more trouble than the person who claims to have no trouble”

Taiichi Ohono
Common mistakes in problem solving – Today

What should be done? – Tomorrow

Not each mistake is done by every organization.
Jumping to action

- Company started getting crack as warranty complaint
- Every month 10 to 15 cases reported for last 6 months
- What will you do?

- Fact: Warranty for crack was zero for 8 years

- Action taken by company - Basic material changed as per competitor material

Key learning
- Look at long term data. Look for what is changed?
- Sr.Management should ask how they found basic material as cause? And why it was not creating problem for 8 years?
Jumping to action

- Injection moulding process: Silver mark rejection is 14% since development
- It is varying from 10% to 18% for any given day.

Whenever it is less than 12%, team continues to run the process. When rejection goes beyond 12%, they stop machine. Process experts start playing with parameters.

- Increase the barrel temperature.
- Decrease the injection speed.
- Increase the Hot runner temperature
- Increase time of material preheating

Chronic Problem: Finally team conducted full factorial DOE and set the optimum specification and achieved 0% rejection

Learning: DOE should have been done during development
Chronic Vs Sporadic problems

Need Structured problem solving

Need better day to day control

– Confusing common cause with special can only make things worst

– Dr. Deming
Look what is changed?

Variation Increased

Mean Shifted

Day wise defectives

Look for change events
Gemba
4M Changes
Process Audit
IS – IS NOT
Cause Analysis Table
Why-Why Analysis
Learning for Tomorrow

• Undelaying cause
  
  • Management is looking for quick action, not willing to see how the cause was determined.
  
  • Quick action is appreciated, not the one who is analyzing in structured way.

• Learning for tomorrow
  
  • Focus on following problem solving process, not just action.
  
  • Management must look, Is it chronic or sporadic?
  
  • How the cause is determined? How the cause is validated?
What to do when you have a Problem?

1. **Occurrence of a problem**
   - **Sporadic**
   - **Chronic**

2. **Nature of problem**
   - **Sporadic**
   - **Chronic**

3. **Standards adequate?**
   - Yes
   - No
     - **Update Standards**

4. **Standards followed?**
   - Yes
   - No-Why?
     - **Revise Standards**

5. **Standards followed?**
   - Yes
   - No
     - **4M Changes, Why-Why, Cause Analysis Table**

6. **Implement Standard**
   - Train to follow revised standards
   - Check adherence

7. **Update Standards**
   - SOP known, Not suitable, Difficult / Lack of skill, Lack of will
   - Go to Gemba, Observe, Gather facts

8. **QC Story - Structured Approach**
   - 4M Changes, Why-Why, Cause Analysis Table
Systemic Counter Measures

Why-Why Analysis – Atmospheric / After action

5 Why

Problem

Why

Why

Why

Why

Level of Problem

There is puddle of oil on the floor

Oil leak from Machine

Gasket has deteriorated early

We bought gaskets made of inferior material

We got it lower price

Purchasing agents gets evaluated on short-term cost saving

Level of Counter measure

Clean up the oil

Fix the machine

Replace the gasket

Change the gasket specification

Change the purchase policy

Change the evaluation policy for purchase agents
• Level of counter measure depends on how much deeper you want to drill down the cause

• Many organizations miss to take action on the system
  
  • Escape Cause – Why not detected?
  
  • Occur Cause – Why problem is generated
  
  • Systemic Cause – Why it is not done right first time?

  What is the underlying cause in management system?

  Taking such action should improve overall system
Motives in Today’s Problem Solving

Trying to solve all types of problems through *commonsense and technical knowledge* alone

- *Significant causes cannot be established just by “thinking”*

Starting with confusion

Decision without collecting data / Facts / Insufficient data

Error in the Inference - *decision just by looking at numbers, not by plotting and data analysis*
Problem solving looks at the problem based on his knowledge & experience which sets the limits for solution.

“"To a man who has only a hammer in the tool kit, every problem looks like a nail”

......Abraham Maslow

All problem cannot be solved only with technical knowledge
100s of Tools

1. Problem Bank: How to prepare, how to edit, how to maintain status etc
2. Impact Vs Benefit Matrix: Project Level
3. Pareto Diagram: Company level, Various stratified pareto diagrams
4. COPQ: Estimated project benefit calculation
5. Determination of problem solving scope: Single product / Single CTQ. Single process with many CTQs, Single Cell
6. Problem solving project risk analysis
7. 4W 1 H - Problem Definition
8. "IS-IS NOT" Problem Definition
9. 9 Window approach for problem definition: Innovative way
10. Team charter: Business case, opportunity statement, Metric, Scope, Team details, project plan
11. Gantt Chart
12. Warranty Information Analysis
13. Sporadic / Chronic: Differentiating sporadic and chronic problem
14. Problem History Capturing
15. Operational Definition
16. Line Chart: Simple, Multiple, Stacked, Area chart
17. Radar Chart
18. Pivot Chart and Pivot Table
19. Time to time variation for warranty: Line chart, Stratification, season wise, wise, Manufacturing month wise
20. Vertical Analysis for Warranty Problems: 3MIS, 6MIS, 12 MIS
21. analysing in single graph
22. Distinguishing reliability Problems: Separating early
23. Time to time analysis for internal defects: Hourly, Shifting from data to data
24. Stream to stream variation Analysis: Model wise, Various factors, Cross check on product wise, LH / RH - Bore to Bore, Operator to operator, Model to model, Time to time etc
25. Warranty data collection Check Sheet
26. Various types of check sheet: Defect cause check sheet, corrective item check sheet, Defect distribution check sheet
27. Concentration Diagram
28. Histogram: Simple, Stratified Histogram, Interpreting Shape, Spread location
29. Symptoms: Analysis of symptoms of problem and using with cause and effect diagrams
30. SIPOC
31. Top down Chart
32. Functional Deployment Chart
33. Process Flow diagram
34. 3G: Gemba, Gembustu, Genjitsu
35. Process Audit
36. 10 Analysis
37. Quick Win: Identification, Evaluation, Measuring effectiveness, Sustenance
38. Measures of Quality: DPV, DPMO, DPMU, PPM, Sigma Level, RTY, Cp, Cpk, Pp, Ppk
39. Additional company specific Measures: OEE, OLE, FTR etc
40. MSA tools: Variable and Attribute Data
41. SPC tools: Variable and Attribute data
42. Confidence intervals: Calculating and interpreting confidence interval for Mean, Sigma
43. Alpha and Beta Risk
44. P value: Practical Meaning, Basic Calculation for simple data and interpretations
45. Descriptive statistics: Calculating descriptive statistics in Excel or Minitab or any other software
46. Time series plot
47. Trend Analysis
48. Auto correlation
49. ARIMA
50. Brainstorming
51. Cause and Effect Diagram
52. Cause Analysis Table
53. Why-Why Analysis
54. Multi-Var Analysis - Numerical methods using excel
55. Multi-vari charts
56. Component Search
57. Modified Component Search
58. Paired comparison
59. Product Process
60. Variable
61. Barchart
62. Pie Chart
63. Scatterplot
64. Correlation
65. Linear Regression
66. Simple Regresson (Quadratic and Cubic Equations)
67. Multivariable Experimental and experimental hypothesis
68. Designing Single factor experiments: Planning, tool ider
69. Graphical Summary
70. Power and Sample Size
71. Ho (Null) and Ha (Alternate) Hypothesis
72. Z Test
73. 1 Variance Test
74. 2 Variance Test (F test, Leven's test)
75. Equal Variance Test (Bartlett Test, Leven's Test)
76. T Test
77. 2 Test
78. Paired T test
79. 1 Way ANOVA
80. 2 Way ANOVA
81. Fully Nested Anova
82. 1P Test
83. 2P test
84. Chi-Square Test
85. Chi Square Goodness of Fit Test
86. Goodness of fit test for position
87. Chi Square test for association
88. 1 Sample Poisson rate test
89. 2 Sample Poisson rate test
90. Ruchart, Scatter, Clusture, Trend, Oscillation
91. Non Normal Tests: Sign Tests, Kruskal Wallis etc
92. DOE & Optimization: Central Composite and Box Behnken
93. DOE with multiple responses
94. Basics of Tri: 40 Innovative Principles, Contradictions
95. Concepts of Latent Thinking
96. Six Thinking Hat
97. Benchmarking
98. Reliability Studies: B-10 life estimation
99. Analysis of uncensored and censored data for reliability
100. Warranty prediction
101. Pugh Matrix
102. Capturing technical lessons and systemic lessons
103. Bias Study (When to apply, How to collect data, calculations, Inte
104. Linearity Study (When to apply, How to collect data, calculations, Inte
105. Repeatability and Reproducibility (When to apply, How to collect interpretations
106. MSA plan: How to group measurement systems, how to prioritize
107. GRR study - X bar R Method (Steps to be followed - parts selectic
108. Range chart of GRR - Method to construct, Interpret
109. Average Chart of GRR: (much different than SPC) - Method to co
110. % R&R with Study Variation, Historical Variation, Tolerance - Wh
111. ncd: Interpretations
112. GRR - ANOVA method: When to apply? How to interpret
113. GRR - Nested: Application and analysis
114. GRR- Expanded: Application and analysis
115. Range Method: When to apply? How to collect data, How to calc
116. Methods to be followed for GRR for automated gauges (no oper
Stages of learning

**Unconsciously incompetent**
- We don’t know what we don’t know
- We can’t do what we don’t know

**Consciously incompetent**
- We know what we don’t know
- We can’t do as we don’t know how to do

**Consciously competent**
- We know how to do
- We can do with conscious effort

**Subconsciously competent**
- We have practiced
- We can do subconsciously

Learning is not compulsory …. neither is survival – Dr. Deming
Common Mistakes

Cause validation only by comparing bad part with spec

• Assuming that design is always right

• More than 80% warranty problems at OEMs are solved by correcting design

• Comparison of bad should be done with good

Let part decide the specification
Mistakes in writing causes

- **SOP not adequate:** Cause not addressed in SOP example: Oil application method not addressed in SOP
  - SOP is part of control, not a cause

- **SOP not followed:** What is not followed? Be specific

- **Operator Untrained:** Training is solution, not a cause. Is it lack of knowledge, Skill, Will or pure human error (like forgetting)

- **Operator Mistake:** Be specific what is the mistake

- **Improper Method:** Write specific

- **No Fixture / No Stopper / PM not done:** Don’t write reverse of solution as cause. Distinguish cause and solution
How to Learn from Past and apply for Tomorrow?

LEARN FROM YESTERDAY, LIVE FOR TODAY, HOPE FOR TOMORROW.

- ALBERT EINSTEIN
Past Trouble Data Base

Failure is success if you can learn from it

Learning
- Problem
- Cause
- Action

Horizontal deployment
- Other products / processes / plants

Learning for NPD

Microsoft Excel Worksheet
Leadership Role in Problem Solving
Leadership role in problem solving

- Creating organization structure for problem solving
- Having high impact project selection criteria
- Developing competence of people
- Creating mechanism for review
- Data based review structure
- Linking with MOPs
- Reward & Recognition
Structured Problem Solving

Steering Committee

Mentor A

Project Leader

Member A
Member B
Member C
Member D

Facilitator

Mentor B

Project Leader

Member A
Member B
Member C

Sr.Leader, Key stake holders of projects

Faculty / External Expert

Team 1

Team 2
**Types of Reviews**

**Management Review**
- To look at the progress of problem solving effort
- To look at resource requirements
- To break barriers of inter departmental issues
- To motivate people who have done good job
- To ensure that team is putting focussed effort on problem solving

**Technical Review**
- To coach people on following problem solving steps
- To make sure that right tools are identified at right step
- To make sure that data collection is adequate
- To confirm analysis done in depth
- To check all possible side effects of planned actions
Problem Solving - Tomorrow
In-depth cause identification happens during problem solving.

During FMEA several of those causes were missed.

Missed causes leading to lack of controls, resulting into problems.

After problems, people are busy in finding causes and controls.
Do right first time, Do right every time
## Inspection - QC - QA

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<td><strong>Purpose</strong></td>
<td>Protect customer</td>
<td>Minimize Defects</td>
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Do Right First Time and Do Right Every Time

The trouble with doing right first time is, nobody appreciates how difficult it was. Firefighting is appreciated by most of the people. It makes whole life so easier.

Things that can go wrong will go wrong if we don’t prevent them from occurring.

Failure leads success if we learn from it.

The Mistake Bank
Effective Process FMEA

If process FMEAs are effective,

- New or unknown defect would not occur.
- All known defects would be well within the target.
- No defect would pass to the customer

The Quality of FMEA can be known from

- Depth of identification of causes
- Extent of new controls identified through FMEA
Apply QA with intent and Rigour

- MSA : What is the real intent?
- FMEA : What is the real intent?
- PPAP – What is the real intent? If problems are still there
What stops us to apply Proactive Tools?

If you don’t have time to do it again and again, do right fist time
Most of the time,

We don’t fail because we don’t know,

We fail because we don’t do what we know