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Judul Ciptaan	:	**Introduction To 8D Methodology (Problem Solving For Securing Customer's Need)**
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a.n. MENTERI HUKUM DAN HAK ASASI MANUSIA
DIREKTUR JENDERAL KEKAYAAN INTELEKTUAL

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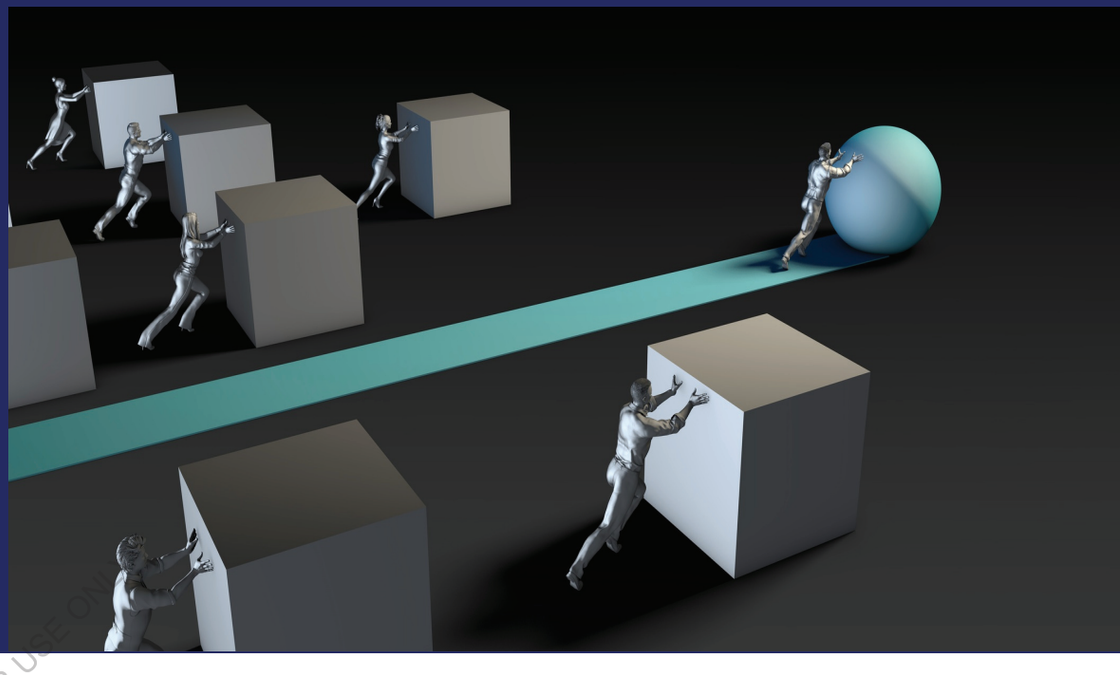
This book provides an overview of the 8D process, provides guidance on finding root causes, and shows the stages of the 8D approach to problem solving and considerations at each stage.
Guidance that enable you to understand and easily apply this method when it comes to solving complex problems. Use 8D problem solving methods to turn your operational failures into knowledge to drive your strategic and competitive advantage.
Anyone who wants to solve complex problems in structured way, quality-improving approach, regardless of industry, will get benefit from the 8D approach which has been successfully applied in many fields.
The eight discipline (8D) problem-solving methodology includes the following:
1. Form a Team
2. Describe the problem
3. Interim Containment Action
4. Root Cause Definition
5. Choose and Verify Corrective Actions
6. Implement Permanent Corrective Actions
7. Prevent Recurrence
8. Congratulate the Team



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Tri Wahjoedi

Introduction to 8D Methodology

Problem Solving for Securing Customer's Need

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8D Methodology

Of Problem Solving

For Securing Customer's Need

Tri Wahjoedi

Preface

This book is based on the author's years of experience in manufacturing and education. The purpose of this book is to introduce the 8D methodology of problem solving structured in terms of how to secure customer's needs.

8D is a rigorous process tool for solving complex problems that has a structured way of thinking about problems and fact-based prevention through data driven and commitment to solving problem sources.

Implementing the 8D is a matter of working on eight disciplines in sequence. Below is an overview of the steps and disciplines that make up the 8D framework; D0- Prepare for 8D Process, D1- Form a Team, D2- Describe the problem, D3- Interim Containment Action, D4- Root Cause Definition, D5- Choose and Verify Corrective Actions, D6- Implement Permanent Corrective Actions, D7- Prevent Recurrence, D8- Congratulate the Team.

At the end of the chapter, an example of a case study implementation of the 8D methodology is given.

I would like to express my appreciation to all parties who have provided support for the publication of this book.

Tri Wahjoedi

Contents

1

Introduction

The US government first standardized the 8D process during the Second World War (Military Standard 1520: Corrective measures and a disposition system for non-conforming substances).

The 8D was popularized by the Ford Motor Company in the 1960's and 1970's and the 8D has become the standard in the automotive industry.

In the late 1990s, Ford developed a revised version of the 8D process, officially entitled "Global 8D" (G8D) which is the current global standard for the automotive industry.

1-1 What is 8D

8D is a rigorous process tool for solving complex problems that has a structured way of thinking about problems and fact-based prevention through data driven and commitment to solving problem sources.

8D is a common problem-solving approach that forms and tools for structuring and facilitating the flow of information.

8D is a problem solving tool that is used to identify, repair and avoid recurring problems that have occurred. This 8D or Eight Disciplines will be very useful if we use it in activities to improve the quality of work and improve the quality of the product because there are permanent corrective actions based on the analysis of the problems that occur by finding the root causes of these problems.

Below is an overview of the steps and disciplines that make up the 8D framework; D0- Prepare for 8D Process, D1- Form a Team, D2- Describe the problem, D3- Interim Containment Action, D4- Root Cause Definition, D5- Choose and Verify

Corrective Actions, D6- Implement Permanent Corrective Actions, D7- Prevent Recurrence, D8- Congratulate the Team.

1-2 Why 8D

8D starts with identifying and eliminating complex quality problems that impact quality cost reductions and delivering visible results to customers.

With 8D will distribute the increased quality of ownership to the entire business team.

8D also highlighted systematic quality issues that could lead to a better understanding of the process by all team members. Where customer complaints, process control, design gaps are exposed.

8D is a structured problem solving which;

- Assist in facilitating complete problem solving and in a timely manner.
- Ensuring that problem solving, decision making, and planning are supported by data.
- Ensuring that the real root cause of the problem is being resolved rather than masking the effects.
- Structured to prevent problems from recurring.

8D can be developed to prevent:

- Wrongly described the problem.
- Rushed problem-solving process.
- Poor team participation.
- There is no logical process.
- Misidentifying possible causes as root causes.
- Not implementing permanent corrective actions.
- Lack of recorded information.

8D provides a framework for undertaking the initial analysis to get the right data and information, pilot testing, and final execution of a solution. Addressing issues in this way is beneficial for a number of reasons (Rever Team, 2019);

- Containment – the eight disciplines problem-solving approach allows you to first contain the issue at it's cause so that its negative effects are mitigated.
- Root cause analysis – it then enables you to identify the core of the problem so that an effective solution can be found and repetitions of the issue are avoided.
- Increases successful outcomes – using a proven framework like 8D problem-solving increases the likelihood that an issue will be solved successfully and for the long term.
- Efficiency – the 8D model identifies causes that can negatively impact efficiency and productivity so that businesses operate to their fullest potential.
- Profitability – removing problems means that operations run more smoothly and there are fewer customer refunds, both of which contribute to greater profitability.

1-3 When do we need 8D?

Here are the troubleshooting steps:

- Understand the problem by clarifying the problem.
- Choose the right problem-solving tools that can help solve the problem.
- Stick to the chosen method of work and use this tool in the right way.

8D is the right choice when the cause of the problem is not known, if problem solving is beyond one person's ability where the symptoms are complex enough to require a team effort.

1-4 8D process

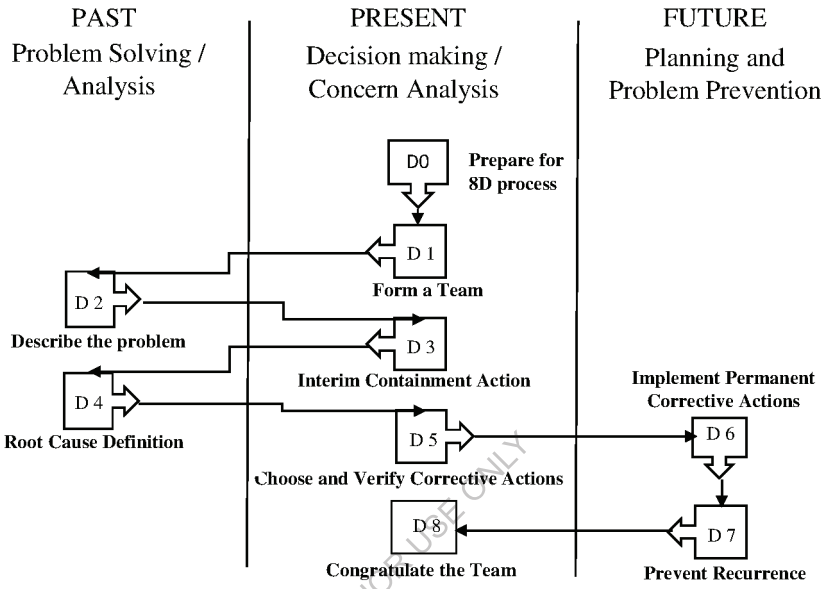

Fig. 1. 8D Process Steps

2

D0 – Prepare for 8D Process

2-1 Purpose

Before forming a team for problem solving, the very first thing is to plan the topic of the problem, who is needed to participate in the team, the time needed to solve the problem in question and plan the use of other resources.

Proper planning will always lead to a better start. So, before an 8D analysis begins, it's best to ask an expert about their impressions first. After receiving feedback, the following criteria should be applied before forming a team:

- Is the cause unknown?
- Is solving the problem beyond one person's ability?
- Are the symptoms complex enough to require a team effort?

Below are some activities to prepare the process:

- Gather information about the symptoms.
- Use the Symptom Checklist to ask the correct questions.
- Identify the need for Emergency Response Action, which protects the customer from further exposure to unwanted symptoms.

2-2 Supporting Questions

Below are some supporting questions that can provide completeness during the preparation process:

- Is emergency response necessary?
- Are service actions required as part of the emergency response?
- How are emergency response measures verified (internally)?
- How are emergency response measures validated (externally)?

- Will the new 8D duplicate the existing 8D?
- Have all changes been documented (e.g., control plan, process flow)?
- Do we have the right team composition to move on to the next step?
- Have we collected & reviewed data (facts and figures)?
- Have we determined if a service action is required?

3

D1 – Form a Team

3-1 Purpose

In stage D1 begins to form a cross-functional team to investigate and resolve problems. The formation of a cross-functional team is intended to support the resolution of this complex problem from various perspectives.

The selected team member must have the expertise and knowledge that can support problem solving, have a commitment to time in following the problem solving process at hand.

3-2 Membership guidelines

Following are membership guidelines for optimizing teamwork:

- Size: 4-10 people.
- Skills: both process and content knowledge.
- Dedication: must allocate time to fully support the effort (but rarely 'full time').
- Change: membership is subject to change as more information about the issue is collected.
- All team members agree on goals, roles and procedures.

3-3 Supporting Questions

Warming up:

- What has been done to help team members build their relationships with one another?
- What has been done to help team members focus on team activities?

- Has the team been informed about TOR (Term of Reference) of meeting?

Membership:

- Are people affected by the problem represented?
- How is the 8D customer's point of view represented?
- Is the team large enough to include all the necessary input but small enough to act effectively?
- Do team members agree to membership?

Knowledge:

- What specific skills or experience do the team need to function effectively?

Operating Procedures:

- Have the team objectives and membership roles been clarified?
- Does the team have sufficient decision-making authority to achieve its objectives?
- Do all members agree and understand the team goals?

Role:

- Has the designated team champion been identified?
- Has the Team Leader been identified?
- Are the roles and responsibilities of team members clear?

4

D2 – Describe the problem

4-1 Purpose

The purpose of D2 is to describe the customer problem by:

- Identify problems.
- Breaking down the problem in measurable terms.
- Where and how it was found?
- What's the customer voices and what's the engineering definition?

4-2 Describe the problem

Problem statement:

- Simple and concise statement identifying objects and defects for which the cause is unknown.
- The problem statement is obtained by using a process question and testing it with "Repeat Why?" (5 times why).
- Additional tools for developing problem statements: process flow, flow chart, problem tree.

Problem description:

Problem description Is the output of a process used to reinforce the problem statement in terms of what, where, when, how much.

- Where is the defect seen? Is it only visible in one customer or one customer's factory or only on one device pin or only by the choice of a particular customer or product?
- When did it start? Date code and customer traceability?
- How big (ppm, number of failures, cost of impact, etc.)?

4-3 Develop action plan to collect additional information

Need to be defined:

- What information?
- Who is accountable?
- Due date.

4-4 Supporting Questions

Problem statement:

- Have specific Problem Statements been determined (objects and defects)?
- 'Why is it repeated' being used? (Why? Why? Why? ... stop when "guessing" without facts)?
- What's up with what?
- How big since when?

Problem Description:

- Has a product information analysis been conducted (what, where, when, how much)?
- When did this problem arise before?
- What patterns, if any, can be recognized for in this problem?
- Do similar components and / or parts exhibit the same problem?
- Has the current process flow been identified? Has this process been modified recently (planned or unintentional)?
- Have all the necessary data been collected and analyzed?
- Is there sufficient information to evaluate the potential underlying causes?

Review Problem Description:

- Has the Problem Description been reviewed for completeness with the customer and affected parties?
- Should this matter be reviewed with the Champion and executive management (in case of a red warning)?

General:

- Have all changes been documented (e.g., control plan, process flow)?
- Do we have the right team composition to move on to the next step?
- Do we review data (facts and figures)?

5

D3 – Interim Containment Action

5-1 Purpose

The purpose of D3 is to define, verify and implement one or more temporary Containment Measures to isolate problem effects from the customer until Permanent Corrective Action is implemented, validated and verified.

5-2 Verification and Validation

Identify potential containment measures that will secure and isolate the customer from the effects of the problem.

Install and verify containment measures while selecting the best course of action based on effect and cost.

Verification:

Gather Evidence before implementation that the action will be carried out as intended and will not cause new problems.

Validation:

Continuous evidence that the action did what it intended without creating new problems and subsequent successful verification and implementation.

Containment action:

Include special traceability tags where necessary and use containment measures as a temporary solution only.

5-3 Supporting Questions

Prior to the Implementation of Interim Containment Action:

- Is interim containment action required?

- Are service actions required as part of interim containment action?
- Based on consultation with 8D customers and Champions, have the interim containment action selection criteria been established?
- Based on the established criteria, does interim containment action provide the best balance between benefits and risks?
- How does this option meet the following conditions?
    - Interim containment action is verified.
    - Interim containment action is cost effective and easy to implement.

Planning:

- Has the appropriate department been involved in planning this decision?
- Have appropriate tools (e.g. control plans, instructions) been considered?
- Has the plan, including action steps, been identified?
- Has a validation method been determined?
- Does the customer have a problem with this interim containment action?
- Have we identified what could go wrong with our plans and considered countermeasures and contingencies?
- Are implementation resources adequate?

Post Implementation:

- Does the validation data show that the customer is adequately protected?
- Can the effectiveness of interim containment action be improved or at least maintained?

General:

- Have all changes been documented (e.g., control plan, process flow)?
- Do we review new data (facts and figures)?
- Have we determined if a service action is required?

6

D4 – Root Cause Definition

6-1 Purpose

The purpose of D4 is to isolate and verify Root Cause by testing each possible cause against problem description and test data.

Isolate and verify the place (escape point) in the process (control system) where the effects of the Root Cause should have been detected and contained.

6-2 Process to identify root causes

Some process helps to identify root causes:

- Brainstorming.
- 5 why.
- Cause and Effect Diagrams (Fishbone Diagram or Ishikawa Diagram).
- Cause and Effect Matrix.

6-3 Brainstorming

Brainstorming is a creative technique that seeks to solve a particular problem by collecting ideas spontaneously from group members.

Brainstorming approaches:

- Structured - Everyone contributes ideas in turn.
  - Make sure everyone has the opportunity to participate.
  - Can slow down flow but create more engagement.
  - Could put several people in place.
- Unstructured - Ideas flow freely.
  - Team members can contribute at their own pace.

  - Can let some dominate while others hide.
- Choose the method that works for the team.
  - Mid-session change of approach is possible.

The key to a successful brainstorming session is a free atmosphere without criticism to explore creative ideas in order to find limitless alternative solutions. The brainstorming process can be divided into 3 phases (SSCX Authoring Team, 2020), namely:

- **Generation:** The forum is open to all participants to issue their ideas. Explain the initial rules of brainstorming and explain how this session will be conducted. Set a time limit for the brainstorming session, determine who will be the timekeeper and idea recorder. Write the topic that will be brainstormed in a sentence question and make sure all team members understand. Collect ideas from each member in two ways: alternating or spontaneous. Write down ideas directly on the board / sticky note. Make sure all teams can see clearly.
- **Clarification:** The team reviews all ideas and ensures that all participants understand what is meant.
- **Evaluation:** The team reviews the entire list. Eliminates duplicates and combines alike.

6-4 5 Why

Why-Why analysis is a root cause analysis tool for problem solving. This tool helps identify the root cause or cause of a non-conformity in a process or product (SSCX Authoring Team, 2020).

5 Why Basics:

- Ask why until there is no additional explanation?
- Investigate the problem associated with the final "Why" answer?
- Its purpose is to determine the "Root Cause!"

General steps when doing root cause analysis with why why analysis:

- Determine the problem and problem areas.
- Gather a team for brainstorming so that we can have different views, knowledge, experiences, and different approaches to problems.
- Go to 'gemba' (going down to the field) to see the actual area, the actual object, with the actual data.
- Start asking using Why Why.
- If the root cause is known, immediately identify and implement the solution.
- Continue to monitor its performance to ensure that the problem does not recur.

Example 5 Why format

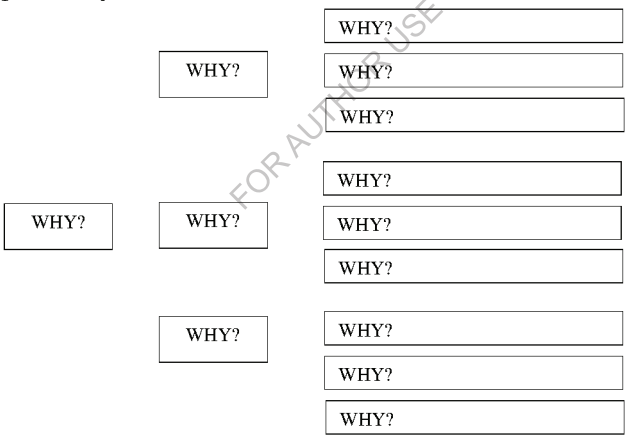

Fig. 2. Example 5 Why format

6-5 Cause and Effect Diagrams

A fishbone diagram is a method for analyzing the causes of a problem or condition. Often this diagram is called a cause-effect diagram or cause effect

diagram. The discoverer was Professor Kaoru Ishikawa, a Japanese scientist who was also an alumni of chemical engineering at the University of Tokyo, in 1943. So it is often called the Ishikawa diagram (Ali SD, 2017).

Why-Why Analysis or 5 Why's Analysis is usually used in conjunction with a Fishbone Diagram and uses an iterative technique by asking 'why' and repeated several times to find the root of the problem.

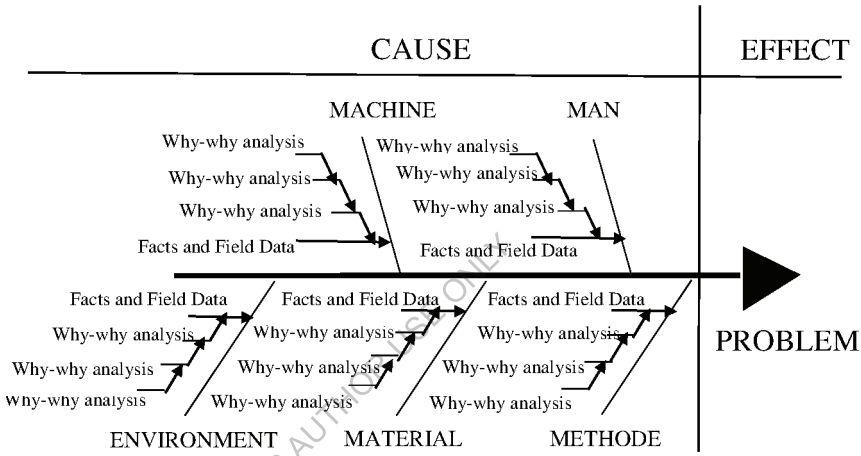

Fig.3. Cause and Effect Diagram

6-6 Cause and Effect Matrix

The cause and effect matrix is a six sigma tool used to prioritize key process input variables based on customer output priority. In other words, it establishes the correlation between process input variables and customer outputs during the root cause analysis (Ramana PV).

Benefits of a Cause and Effect Matrix:

- This helps to include customer input for decision making.
- Visualize the correlation between the main input variables and the customer output.

- The priority ranking method helps make decisions based on scores rather than individual opinions.
- Data collection costs can be reduced by ignoring non-key process inputs
- Helps list all the required input variables for the process.

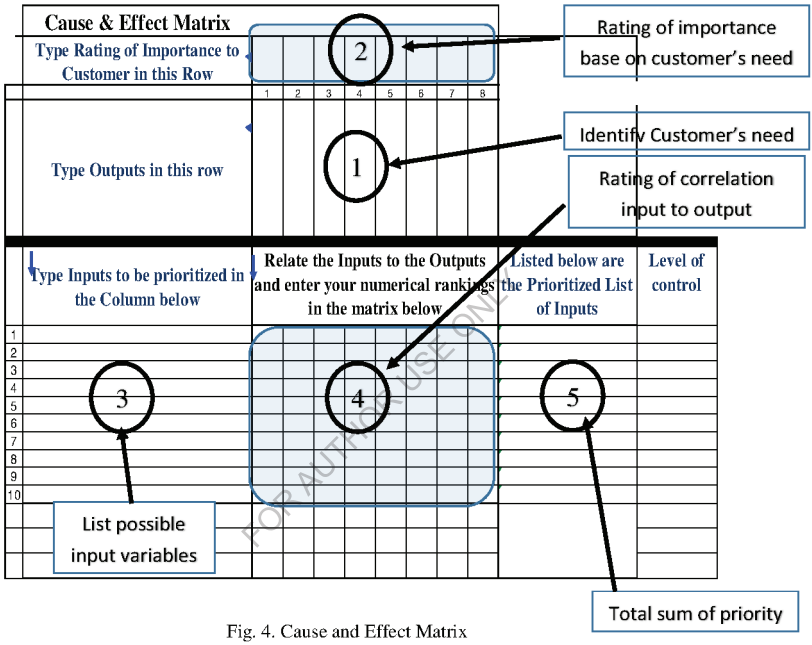

Fig. 4. Cause and Effect Matrix

Table-1: Rating of importance

Value	Note
1	Not important
2	Not important for some customer
3	Sometime important for some customer
4	Sometime important for all customer
5	Important for some customer
6	Important for all customer

7	More important for some customer
8	More important for all customer
9	Most important for some customer
10	Most important for all customer

Table-2: Rating of correlation

Value	Note
1	Week correlation
3	Strong correlation
5	More strong correlation
9	Most strong correlation

Table-3: Rating of controlled

Value	Note
1	High controlled (we are able to control this input}
3	Controlled
9	Not controlled (e.g. geographical, etc. restriction)

CE Matrix steps:

Step 1: Identify the needs of the customer or in other words understand the customer's voice. This can be gathered by conducting surveys, focus groups, and other means of gathering their priorities.

Step 2: Assign priority factors for each customer output. Using rating of importance.

Step 3: List all possible main input variables or process improvement factors in each row.

Step 4: Assess the relationship between the main input variables and the customer output and give an appropriate rating of correlation for each input variable.

Step 5: Cross multiply the customer output priority numbers by the correlation rank and add up each row.

Step 6: Finally, rank according to the highest total number and highlight some important variables. This will help to identify areas of improvement.

6-7 Supporting Questions

Root cause:

Is there a root cause? (a single verified reason that explains the problem).

What factors have changed to cause this problem?

What data is available?

How do we verify the root of this problem?

Does the root cause explain all the facts gathered in D2?

Do we understand the relationship between the root cause and the problem?

Escape Point:

Is there a control system to detect problems?

Does this control system represent a change from the original design?

Is the control point identified closest to the root cause / potential cause?

Is there a need to improve the control system?

General:

Have all changes been documented (e.g., control plans, process flow)?

Do we have the right team composition to move on to the next step?

Do we review new data (facts and figures)?

Have we determined if a service action is required?

7

D5 – Choose and Verify Corrective Actions

7-1 Purpose

The purpose of D5 is to choose and verify corrective actions (for the root cause and the point of escape).

- To choose the best permanent corrective action to eliminate the root cause.
- To choose the best permanent corrective action to address the exit point.
- To verify that both decisions will be successful when implemented.
- To avoid unwanted effects: Make sure this action fixes the root cause and doesn't cause other problems.

7-2 Attention Points

Some points to consider when choosing:

- What evidence (proof) do we have that this will solve the problem at the root cause level?
- Have we neglected the better options?
- Can our customers live with this resolution?
- What departments should be involved in planning and implementing this decision?

7-3 Supporting Questions

Prior to permanent corrective action decision:

- What criteria have been established for selecting permanent corrective action for root causes and exit points?
- Are service actions required as part of the permanent corrective action?

- What options have been considered for permanent corrective action?
- Do we have the right experience in this team to make this decision?
- What are the risks associated with this permanent corrective action and how can you manage them?
- Do Champion agree with the permanent corrective action choice?

Verification:

- What evidence (proof) do we have that this will solve the problem at the root cause level?
- Which metrics do we measure during the verification step? Does this indicator support voice verification?

After the permanent corrective action decision:

- How likely is it that this option, once implemented, will cause other problems?
- Can our customers accept this solution?
- Will our custody continue to be effective until our permanent corrective action option is implemented?
- What resources will be required for permanent corrective action implementation?
- What disciplines should be involved in planning and implementing this permanent corrective action?
- Have actions been considered that would enhance interim containment action prior to permanent corrective action implementation?

General:

- Have all changes been documented (e.g. control plans, process flow)?
- Are we reviewing new data (facts and figures)?
- Have we determined if a service action is required?

8

D6 – Implement Permanent Corrective Actions

8-1 Purpose

The purpose of D6 is to determine and implement the best corrective action. Also, validate corrective action with evidence of empirical improvement.

- Plan and implement selected Permanent Corrective Actions and define an implementation plan (responsibility assigned, time specified, required support defined).
- Remove the Interim Containment Action.
- Monitor long-term results (validation).
- Pay attention to the internal process to validate if ppm or defect is not in the measurement indicator.

8-2 Supporting Questions

Planning:

- What disciplines are needed to implement permanent corrective action?
- What customer and / or supplier involvement is required?
- Who will do the planning for the customer? For suppliers?
- Has an action plan been defined (responsibility assigned, specified support time required)?
- Do we have the resources necessary to implement this plan? What is needed?
- How do we monitor completion of plans?
- What data (facts and figures) will be used to validate permanent corrective action results (both short and long term)?

Validation:

- Have the unwanted effects been completely eliminated?
- How do we continue to monitor long-term results?
- What are the metrics?
- Is this the best way to prove that the root cause has been removed?
- Are all systems, practices, procedures, documents, etc. Has it been updated? Do they accurately reflect what permanent corrective action is all about?

General:

- Have all changes been documented (e.g. control plans, process flow)?
- Are we reviewing new data (facts and figures)?
- Have we determined if a service action is required?

9

D7 – Prevent Recurrence

9-1 Purpose

The purpose of the D7 is to modify management systems, operating systems, practices, and procedures to prevent recurrences of these and similar problems.

- Actions are being taken to prevent current problems, similar problems and systemic problems from recurring.
- Change the system as necessary including policies, practices, and procedures to prevent the recurrence of this problem and similar problems.
- Make recommendations for systemic improvements, if necessary.
- It is important to understand the lessons learned from investigations. Can the changes be implemented into other processes / products.

9-2 Attention Points

Some points to consider when choosing:

- What management policies, systems or procedures allowed this problem to occur or escape?
- What needs to be done differently to prevent the root cause from recurring and its escape?
- What practices require standardization?
- Is the practice standardized?
- What progress check points have been set to assess system improvement?
- What data has been submitted to the Lessons Learned database?

9-3 Supporting Questions

History of the Problem:

- How and where does this issue enter our process?
- Why does the problem occur there? (Why isn't it detected?)
- Did lack of knowledge contributed to the creation of the root of this problem? Did it contribute to the escape?
- What policies, approaches, methods, procedures and / or systems allow this problem to occur and pass?
- Have affected parties been identified?

Preventive actions (this and similar problems):

- What needs to be done differently to prevent the root cause from occurring again? Or the escape?
- Is there a need for a process improvement approach (e.g. re-engineering).
- Who is best able to design improvements in any system, policy, method and / or procedure that produced these root causes and escapes?
- What practices require standardization?
- What plans have been put in place to coordinate preventive actions and standardize practices - who, what and when?
- Do the Champions agree to the Preventive Actions and plans identified?
- How will this new practice be communicated to stakeholders?

Recommended Systemic Precautions:

- What management policies, systems or procedures allowed this problem to occur or exit?
- Is this practice outside the scope of current Champions?
- Who is responsible for this practice?
- Do we need to change the cultural aspect? Who will look after?
- Does the current Champion agree with the team's structural prevention recommendations?

Lessons Learned:

- What data has been submitted to the Lessons Learned database?
- Has the permanent corrective action sheet been updated accordingly?

General:

- Have all changes been documented (e.g., control plans, process flow)?
- Do we review new data (facts and figures)?
- Have we determined if further service action is required?

10

D8 – Congratulate the Team

10-1 Purpose

The purpose of the D8 is to recognize team collective efforts. The team needs to be formally thanked by the organization.

Consideration for giving recognition to the team:

- Should not be limited to a standard performance review process.
- It doesn't have to involve cash or be expensive.
- Should also serve to promote / expand awareness of team activities.
- Must be significant enough to create a willingness to join the team in the future.
- To show the spirit of ownership and team up to excel in others.

10-2 8D Problem Solving Report

The activities:

- Closing 8D.
- Review and approval.
- Filing of the report.
- Document lessons learned and share with relevant people.
- Complete and archive documentation.

10-3 Supporting Questions

Recognition Planning:

- Was there a significant contribution from each team member?

- Are there opportunities to give recognition from Leader to team, Team Member to Team Member, Team to Leader, and Champion to Team?
- Are there any non-team members whose contributions to the 8D process justify inclusion in the confession session (party)?

Implementation of recognition:

- Are all current and previous team members recognized?
- Do the results achieved by the team justify some publicity (eg company newsletters)?
- 8D is meant to be positive for society?

Lessons Learned:

- About you? About problem solving? About teamwork?
- How will the organization benefit from this 8D settlement?
- Are there best practices in the 8D process that will be shared across the organization?
- Are there any changes in business practices that need to be considered based on the lessons in 8D?

11

Example of Case Study

Adapted 8D Methodology in Manufacturing Industries
for Securing Customers Need

11-1 Abstract

This case study explores the contribution that the 8D Methodology can make to safeguard customer concerns over quality issues and product delivery errors caused by production issues and ultimately maintain the organization's sustainability. Analyze specifically the application of the 8D Methodology in manufacturing industries. The research method used is through field observations, following problem analysis, preparing recommended actions and monitoring the progress of communication and its results. The empirical evidence adds to the existing literature on this issue by demonstrating a structured approach to the 8D Methodology and using a causal matrix that significantly affects organizational performance in solving failed production startups and preventing customer complaints due to late product delivery. By following the 8D Methodology, strong teamwork and employee learning behavior in problem solving, the problem of production failure can finally be resolved and the interests of the customer can be saved.

11-2 Introduction

8D problem solving is a problem-solving method developed to approach and solve problems. Focused on improving products and processes, the goal is to identify, verify and prevent problems from recurring.

It should be noted that Hsiang Ru Chen & Bor Wen Cheng (2010) in the topic 'Case study of customer complaint resolution based on the 8D method and the

Kano model' shows that based on the 8D method and the Kano model, which provides and a flexible framework for a customer-oriented management system to drive improvement business performance. With comparisons of different histograms, paired t test, and estimates of Cpk, a control model was created to identify the level of quality. After completing the corrective action and excluding variations in the sheet metal hardness factor, the damage rate decreased from 28% to 0.5%, and this increase resulted in a profit of at least 22 million New Taiwan dollars.

Wan Ahmad Najmuddin Wan Saidin, Azalan Mohamed Ibrahim, Mohd Zaidi Azir, Harlina Ngah, Noraishah Mohamad Noor and MH Norhidayah (2014) on the topic '8D Methodology: An Effective Approach for Problem Solving in Automotive Assembly Line' expressed this in the application of 8D to a defective product called a left (left) side mirror slit on the trim assembly line at an automotive company. Throughout the paper, problems are defined, causes of failure are analyzed, and countermeasures are established and remedies determined until performance levels are reached. In addition, this workable approach can be extended to other key processes on the assembly line to address major issues and make substantial improvements to product and process quality.

PS Atigre, AP Shah, VR Patil (2017) with the topic 'Application of the 8D Methodology to Minimize Defects in the Manufacturing Process: Case Studies' shows that to apply the 8D methodology and analyze its effectiveness a case study is carried out. in the small-scale manufacturing industry (ISO 9001: 2000 certified). The results of the case studies show that the 8D methodology is effective. After applying the 8D methodology, the total rejections for the clutch disc portion were reduced to 6.57% from 37.95%.

All research on the above principles shows that the 8D methodology provides benefits in solving complex problems that occur in products or processes that can prevent adverse impacts on customers.

In this case study, we present a comprehensive case of 8D implementation in the manufacturing industry, through illustrating overall 8D implementation and successful problem solving, to provide insight into the potential impact of 8D in the manufacturing industry on solving production problems to avoid customer complaints in the future.

11-3 Implementation

The implementation as follow:

D0 – Prepare for 8D Process

- Is the cause unknown?

  A production failure in one type of product that appears suddenly and the cause is unknown has a negative impact, including disrupting production schedules and product delivery to customers.

  Disrupted production schedules due to one type of product which failed in production proses will have a domino effect on other product types and have the potential to cause disruption to other customers also.

- Is solving the problem beyond one person's ability?

  The problems that arise are so complex due to process failures, production failures, the majority of products are defective, production schedules are disrupted and disrupt deliveries to customers, etc. which are beyond the ability of one person but require a group to solve them.

- Are the symptoms complex enough to require a team effort?

  The symptoms that appear are very complex where instability in the production line appears in the production process, interruption of the process flow from the glass tube melting furnace to the drawing machine, the production crew in all production shifts has serious problems with their production activities, etc.

Due to the complexity of the problems that arise and will interfere with customer needs because the product is not delivered, an emergency response is needed so that customers can be served properly.

Further communication is needed regarding priorities. Is the time to determine together with the customer the priority needs of the customer.

A cross-functional team is needed to handle these complex problems.

D1 – Form a team

Team is consisting of: Process Engineer, Production Engineer, Quality Engineer, Mechanical Engineer, Electrical Engineer, Production Planner, Furnace Specialist, Production Supervisor, Unit Leader, and Operator.

The leader of this team is a quality engineer where he is also a communicator with the customer. Memberships have been selected where they represent affected areas, they are cross-functional and they have what specific skills or experience the team needs to function effectively.

D2 – Describe the problem

After replacing the ceramic tube (sleeve) production equipment, the 1.1 production line was used for different types of TLE - 1.0 mm thick, T8 - 0.6 mm thick, T12 - 0.7 mm thick and so far there have been no significant problems. However, when producing tube glass products with a thickness of T8 - 0.5 mm, serious problems occurred with the tube glass breaking in the duct before it entered the machine. Because production fails, the production line has to switch to another type of product. Customers were threatened not to get the product supply because of the problem. And this is a very serious problem.

D3 – Interim Containment Action

- Inform customers about the problem to reconfirm their production planning (Resp. Prod. Planner, W19-21)

- Re-do production planning (Resp. Prod. Planner, W19-21)

D4 – Root cause definition

Create Cause & Effect Matrix diagram to have value which can be used for choosing significant problem and execute the actions.

Cause & Effect Matrix

	Type Rating of Importance to Customer in this Row →	9	7	7	9	8	8	4	4	6	3		
		1	2	3	4	5	6	7	8	9	10		
	Type Outputs in this row →	Glass easy to pull	Glass on line catcher	Glass on track	Glass on olivotto	Less diameter variation	Less wallthickness variation	Low crack	No mirroring	No knot	No airline		
	Type Inputs to be prioritized in the Column below ↓	Relate the Inputs to the Outputs and enter your numerical rankings in the matrix below ↓										Listed below are the Prioritized List of Inputs	Level of control
1	Bottom Temperature	1	1	1	1	1	1	1	1	9	3	119	1
2	Crown temperature	1	1	1	1	1	1	1	1	9	1	113	1
3	Distributor temperature	1	1	1	1	1	1	1	1	1	1	65	1
4	Feeder S1 temp	9	9	9	9	5	3	1	1	1	3	375	1
5	Feeder S2 temp	9	9	9	9	5	3	1	1	1	3	375	1
6	Feeder S3 temp	5	5	5	5	3	3	1	1	1	3	231	1
7	Entrance tem	9	9	9	9	5	5	1	3	1	3	399	1
8	Spout temp	9	9	9	9	5	3	1	3	1	3	383	1
9	Jet temp	9	5	5	5	5	3	3	3	1	3	299	1
10	Middle temp	9	5	5	5	5	3	3	9	1	3	323	1
11	Nose temp	9	5	5	5	5	3	3	9	1	3	323	1
12	Sleeve rotation	9	9	9	9	9	3	3	5	1	3	431	1
13	Sleeve diameter	5	5	5	5	5	3	1	3	1	3	255	5
14	Sleeve angle	5	5	5	3	5	3	3	9	1	3	269	3
15	Sleeve position	9	9	9	9	5	5	1	3	1	1	393	1
16	Glass output	9	9	9	9	9	9	3	9	9	3	543	1
17	Line ctacher belt condition	1	9	5	3	1	1	3	1	1	1	175	3
18	Alignment track	3	1	5	5	3	1	1	1	1	1	163	5
19	Ollivoto	5	1	9	9	1	9	1	1	1	1	293	1
	Lower Spec												
	Target												
	Upper Spec												

Input	Sensitifity	Control of Priority	Rank
Glass output	**543**	**60**	**1**
Sleeve rotation	431	48	2
Entrance tem	399	44	3
Sleeve position	393	44	4
Spout temp	383	43	5
Feeder S1 temp	375	42	6
Feeder S2 temp	375	42	7
Middle temp	323	36	8
Nose temp	323	36	9
Jet temp	299	33	10
Ollivoto	293	33	11
Sleeve angle	269	90	12
Feeder S3 temp	231	26	13
Line ctacher belt condition	175	58	14
Alignment track	163	91	15
Bottom Temperature	119	13	16
Crown temperature	113	13	17
Distributor temperature	65	7	18
Sleeve diameter	255	142	19

To select priority ranking for the cause and effect matrix, start with high sensitivity. It is a combination of input-output correlation.

5 Why Analysis: Glass output

Why1	Why2	Why3	Why4	Why5
Glass output fluctuation	The pull of the glass tube by the drawing machine (olivoto) is unstable	Movement of the glass tube clamp wheel is unstable	Movement of the olivoto wheel drive piston is unstable	*The olivoto membrane piston is leaking*
	Instability glass thickness on ceramic sleeve	Instability glass out from feeder orifice	Feeder temperature setting is not appropriate	*There is no reference feeder temperature setting*
	Instability glass thickness on ceramic sleeve	The glass ribbon descending from the orifice feeder to the ceramic sleeve is unstable	Speed glass ribbon descending is not match with ceramic sleeve rotation	*There is no reference ceramic sleeve rotation*
	Instability glass thickness on	The glass ribbon descending	The distance between orifice feeder	*There is no reference the distance of*

	ceramic sleeve	from the orifice feeder to the ceramic sleeve is unstable	(flow bowl) with ceramic sleeve is not appropriate	*flow bowl with ceramic sleeve*

D5 – Choose and Verify Corrective Actions

- Check, clean and replace the piston membrane olivoto to stabilize the pull of the glass tube (Resp. Mech. Eng., W19-21)
- Resetting the feeder temperature according to production line 1.3 and optimizing the setting (Resp. Process Eng., W19-21)
- Resetting the sleeve rotation speed referring to production line 1.3 and optimizing the setting (Resp. Process Eng., W19-21)
- Resetting sleeve distance to flow bowl referring to production line 1.3 and optimizing settings (Resp. Process Eng., W19-21)
- Perform production planning (Resp. Prod. Planner, W19-21)

D6 – Implement Permanent Corrective Actions

- Fix the temperature setting for both feeder & sleeve at production line 1.1 (verification: already 2 weeks' production and the performance same as other type).
- Conduct 8D conformance cycle audit by plant auditor

D7 – Prevent Recurrence

- Standardize feeder temperature setting in production line 1.1 especially for T8 -0.5 mm thickness and documented in Standard Operating Practice and make awareness to operators about this new setting (Resp. Process Eng., W28)

- Standardize sleeve parameter setting in production line 1.1 especially for T8 -0.5 mm thickness and documented in Standard Operating Practice and make awareness to operators about this new setting (Resp. Process Eng., W28)
- Review Potential Problem Analysis for the next sleeve changing (Resp. Prod. Eng., W27)

D8 – Congratulate the team

Result is success in producing product type T8 – 0.5 mm thickness at prod.line. After solving the problem Factory Manager and Prod. Manager acknowledges for good work done by the team for solving the problem.

11-4 Benefit 8D Implementation

Benefit from 8D implementation:

- Customers are more trusting because production is more reliable.
- Improve understanding of structured problem solving technique.
- The lowest level in the organization have better ownership for driving adjustments.
- Increased sustainable results through behavior changes in processes, management systems, and people.
- Prevent recurrence problem.

11-5 Discussion

The key factors of successful problem solving with 8D method mainly are:

8D Methodology.

8D methodology is one of the key elements to solve complex problem. Its purpose is to identify, correct and eliminate recurring problems, and it is useful in product and process improvement. Cause of a problem is unknown; the resolution of the

problem is beyond the capabilities of one person, the symptoms are sufficiently complex to warrant a team effort.

Team Work.

The role of the team members is to provide the technical input in the form of information, knowledge and ideas. The team members may vary throughout the life of the investigation. The team's goals and membership roles been clarified. Individual has special skills or experience which will the team require in order to function effectively.

Well-established action problem solving-learning.

The uniqueness of 8D methodology implementation is based on structure approach on problem solving. In the review meeting the commitment to the recommendations for corrective actions is the result of problem solving approach and very good for learning process of the team.

11-6 Conclusion

The Eight Disciplines Problem Solving (8D) is a methodology used to approach and to resolve problems. Its purpose is to identify, correct and eliminate recurring problems, and it is useful in product and process improvement. Although it originally comprised eight stages, or 'disciplines', it was later augmented by an initial planning stage. In this paper shows the 8D methodology in solving the problem of production failure on the production line, by following the eight stages and strong team work, the problem of production failure can finally be resolved and the customer's interests can be saved.

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