

Effective Problem Solving

Methods and tools to solve
problems and continuously
improve processes

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Effective Problem Solving

OBJECTIVES:

- Why have a problem solving process?
- Learn the problem solving process
 - Assemble a problem solving team
 - Define the problem
 - Analyze and determine root causes
 - Develop and evaluate potential solutions
 - Develop a plan to implement the best solution
 - Verify effectiveness
 - Communicate and celebrate success
- Other problem solving methods

Effective Problem Solving

- What is a problem?
 - An opportunity for improvement
 - A deviation from standard performance
 - The difference between what is and what is desired
- Which problem to solve?
 - How urgent is the problem?
 - How serious is the problem
 - Is the problem getting bigger?
 - Is the problem causing other problems?

Effective Problem Solving

- Why use a formal problem solving system?
 - Demystify problem solving
 - Provide a common set of tools and language
 - Assists in finding true root cause
 - Keep people from skipping steps and jumping to conclusions

Effective Problem Solving

- Mental Attitudes that Block Improvement:
 - “Everything is fine, there is no problem.”
 - “We’ve tried this before and it didn’t work.”
 - “This is how we’ve always done it and it works for us.”
 - “It’s not my responsibility to make improvements.”
 - “Improvements cost money. Give me ten thousand dollars, then I can fix it.”
 - “I’m too busy to do anything.”

- Kiyoshi Suzuki The New Shop Floor Management

Effective Problem Solving

- Mental Attitudes that Support Improvement
 - “There is no end for improvement.”
 - “Don’t think of excuses for why it will not work. Think positively.”
 - “Always consider the current situation as imperfect.”
 - “Do away with a fixed mindset.”
 - “Let’s think from a broader perspective.”
 - “Keep working on improvement so that fire-fighting will eventually go away.”

- Kiyoshi Suzuki [The New Shop Floor Management](#)

The Problem Solving Process

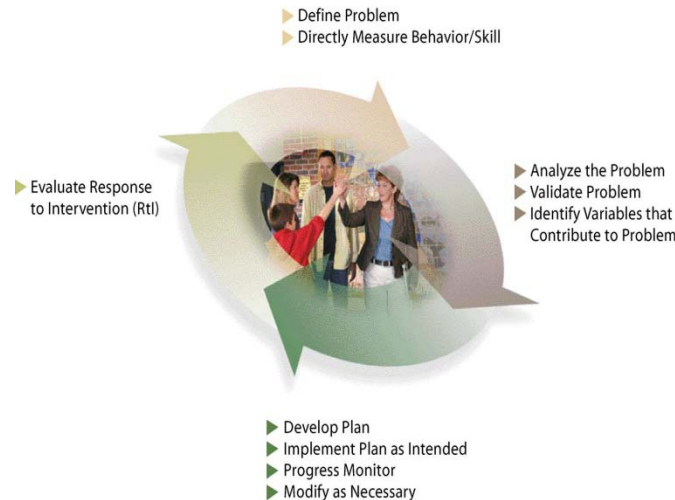
- **Assemble a problem solving team**
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Assemble the team

- Who should be on the team?
 - Assign an owner or project manager to guide the process
 - Involve people familiar with the problem
 - Technical expertise
 - Operators/users involved in the process
 - Maintenance personnel
 - Management support

Assemble the Team

- Three important conditions for problem solving teams:
 - Be patient communicators
 - Work to create synergy
 - Use a disciplined problem solving process



Assemble the Team

- Key Characteristics of an Effective Team
 - Members support each other.
 - Members work hard and have fun together.
 - Members keep learning as they move forward.
 - Members feel that they have grown as individuals as the result of being on the team.
 - Team has a good track record of progress.

The Problem Solving Process

- Assemble a problem solving team
- **Define the problem**
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Define the Problem

- Is a Containment action needed?
 - Containment actions are immediate first aid
 - Do not normally address the root cause
 - Temporary, short term actions until a permanent solution is developed
 - Protect the customer/user/environment



Define the Problem

- Tools to help define the problem
 - 5W2H2I
 - Is/Is Not Analysis
 - Process mapping
 - FMEA
 - Data collection



Tools to Define the Problem

- Use the concept – 5W2H1I

5W	Why?	Why is this a problem? What was supposed to be happening, what requirement was not met?
	What?	What was affected? - identify specific parts or jobs; equipment, customers. What is occurring?
	Where?	Where did the problem occur? - identify the specific work station, equipment, department, plant, customer, where the problem was discovered.
	When?	When did the problem occur? - identify the specific time, day, shift, production run, season when the problem happens.
	Who? (not intended to blame)	Who identified or observed the problem, who was/is involved? - identify the operator, customer, maintenance personnel, QC, that was/is involved with the problem
2H	How Much?	How much was affected? - Define how many rejects or defects or customers are involved.
	How often?	How often has this happened? - First time? How many times? Comes and goes? What frequency? Seasonal occurrences? Patterns?
1I	Impact?	What is the impact? Customers not getting orders, customers shut down, customers/users injured, money lost, sales lost

Tools to Define the Problem

● Use the Is/Is Not Analysis

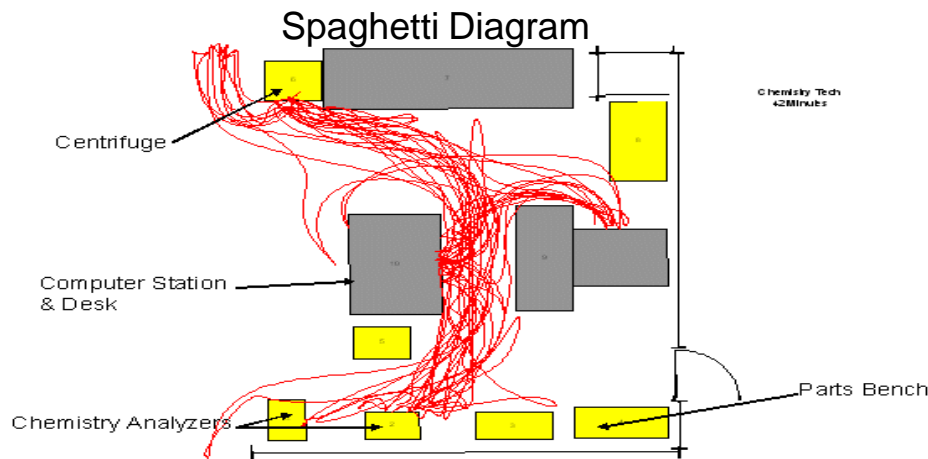
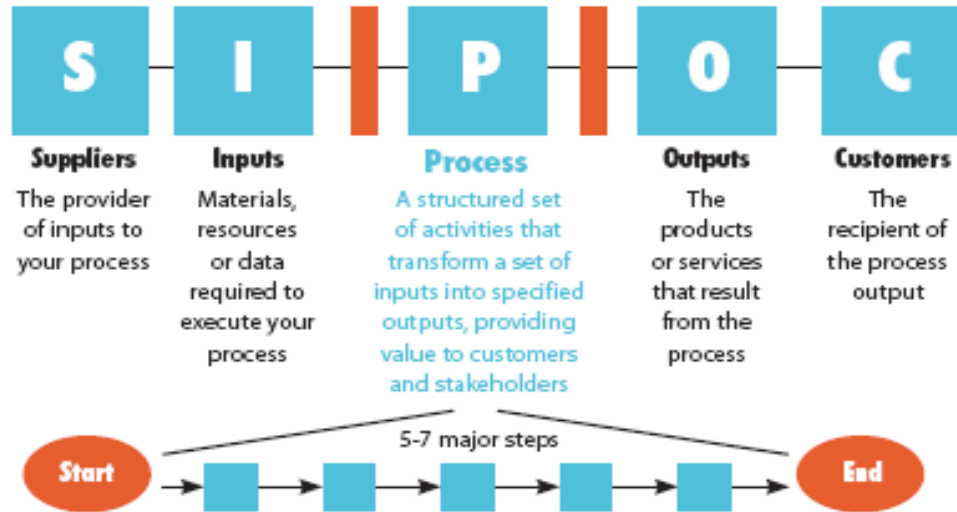
Problem:				
	Is	Is Not	Distinctions	What has Changed?
What	What is affected	What is not affected	What is distinct about the affected parts	What recent changes may have occurred?
Where	Where is the problem occurring? Where on the object is the deviation?	Where is it not occurring? Where on the object is it not happening?	What is distinct about where it occurs	Has anything changed ?
When	When is it happening? Any patterns?	When is it not happening?	What is distinct about time or patterns?	What has changed? Seasonal business or?
Who	Who is involved? To whom, by whom, near whom does this occur?	Who is not involved.	What is distinct about who is involved?	Were there any staffing changes recently?
Extent	How many objects or situations have problems? How many defects per item?	How many objects do not have the problem.	What is distinct about the objects?	Has anything changed?
	How serious is the problem?			

Tools to Define the Problem

- Process Mapping
 - Detailed process map
 - Swim Lanes
 - SIPOC
 - Spaghetti diagrams

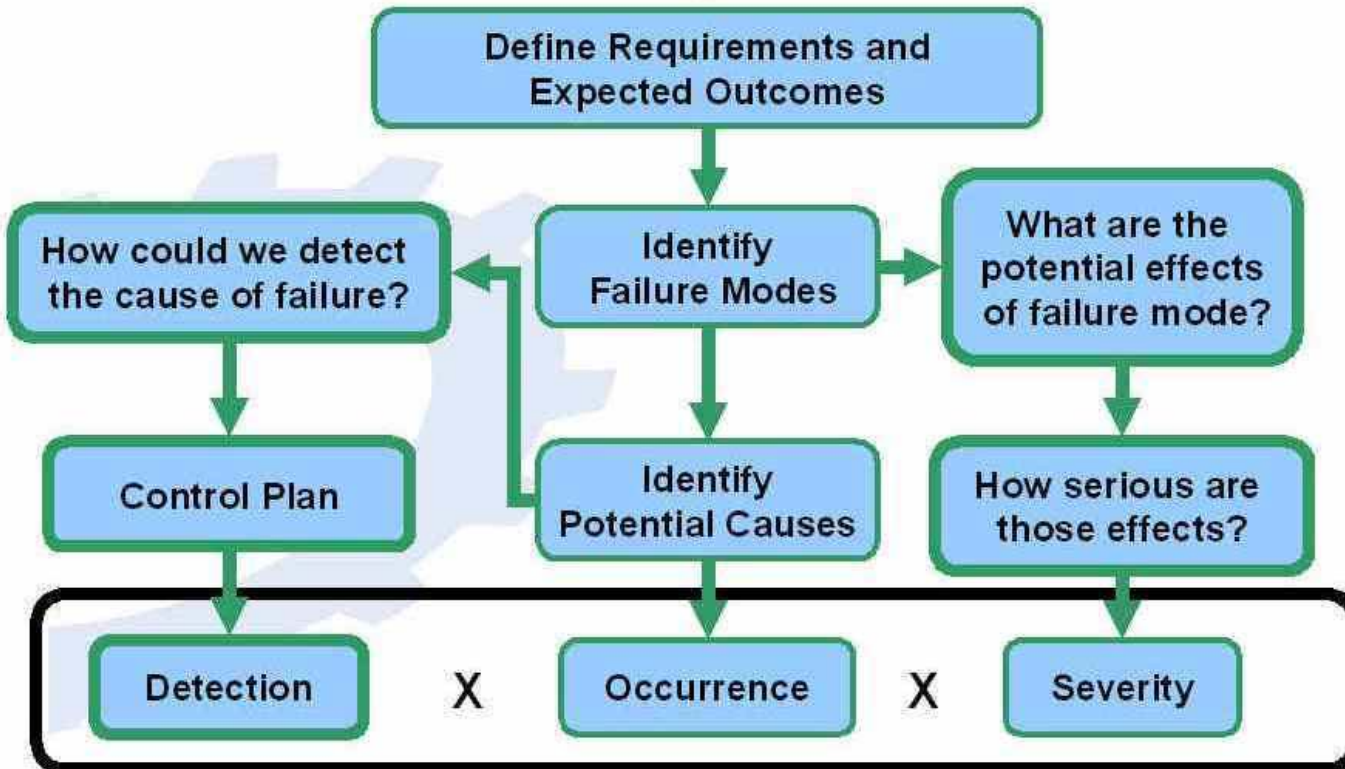
Tools to Define the Problem

Figure 1. SIPOC – understanding processes



Tools to Define the Problem

- FMEA – Failure Mode Effects Analysis



Detection X Occurrence X Severity = Risk Priority Number (RPN)

Tools to Define the Problem

- FMEA – Failure Mode Effects Analysis

Potential Failure Modes and Effects Analysis

System _____ FMEA Revision _____

Subsystem _____ FMEA Prepared By _____

Part Number _____ FMEA Date _____

Designer _____ FMEA Revision Date _____

Item/ Function	Potential Failure Modes	Failure Mode Effects	S E V	Potential Failure Causes	P F	Current Controls	D E T	R P N	Actions Req'd	Owner/ Target Date	Actions Taken	S E V 2	P F 2	D E T 2	R P N 2

Tools to Define the Problem

● Data Collection

- Gather data to help define the problem
- Determine what data needs to be collected
- Determine how to collect the data and who will do it
- Develop a clear operational definition of the data and a data collection plan
- Create the data collection sheet



Tools to Define the Problem

A Data Collection Form

MJII p. 33

Source Information (a-e)

- a** Name of project
- b** Location of data collection
- c** Name of person recording data, if it applies
- d** applies
- e** Date(s)

Content Information (f-j)

- f** Column with defect/event name
- g** Columns with collection days/dates
- h** Totals for each column
- i** Totals for each row
- j** Grand total for both columns and rows

a Project: Admission Delays	c Name: (if applicable)						e Shift: All	
b Location: Emergency Room	d Dates: 3/10 to 3/16							
f Reason:	g Date							i Total
	3/10	3/11	3/12	3/13	3/14	3/15	3/16	
Lab delays	9	4	6	6	3	12	12	52
No beds available	2	7	2	4	5	8	3	31
Incomplete patient information	7	3	1	2	2	4	5	24
h Total	33	28	36	30	25	47	38	j 237

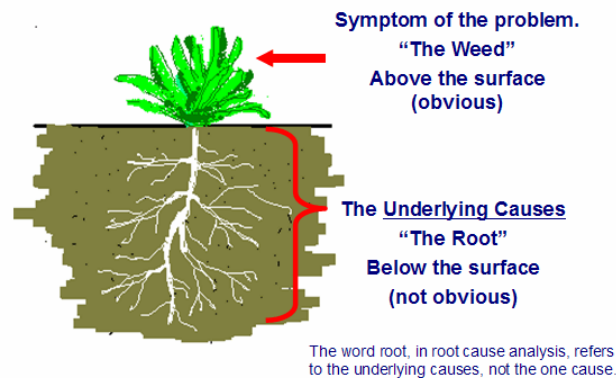
The Problem Solving Process

- Assemble a problem solving team
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- **Analyze and determine root causes**
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Analyze and Determine Root Causes

- Root Cause is:
 - The event or combination of events that initiate a failure.
 - The most basic reason, which if eliminated, would prevent recurrence of the problem.

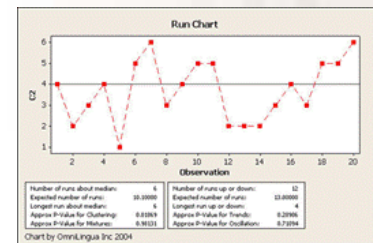
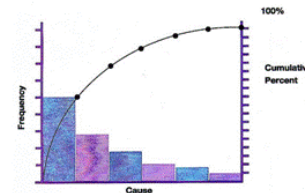
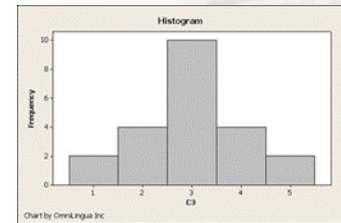
Root Cause Analysis Basics



Analyze and Determine Root Causes

- Several techniques can be used to identify potential root causes.

- Brainstorming
- Affinity diagram
- Histograms
- Pareto diagrams
- Run charts
- Check lists
- Interviews
- 5 whys
- Cause and effect diagrams



Analyze and Determine Root Causes

- 5 whys
 - Helps determine causes and relationships between causes
 - How to use it
 - Define the problem
 - Ask why the problem occurred
 - Continue asking why until you've identified a probable root cause

Analyze and Determine Root Causes

- 5 whys example

Problem Statement: Our largest customer for bicycles is unhappy.

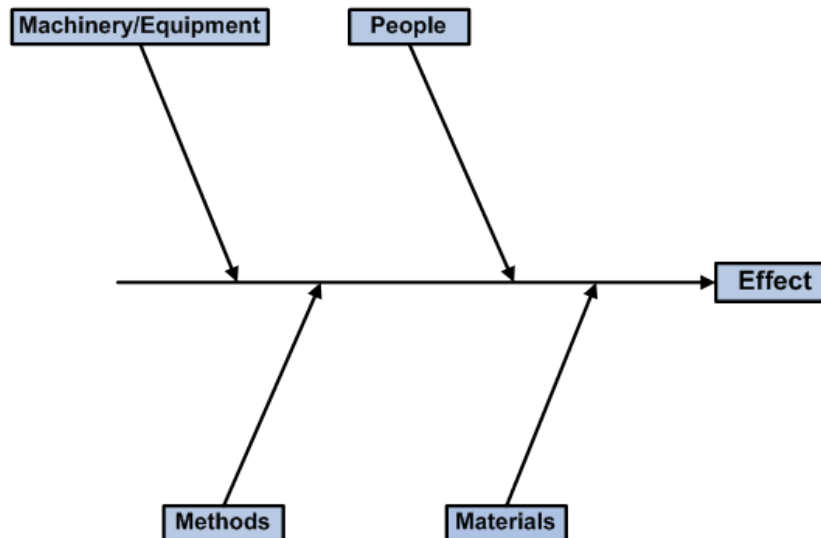
1. **Why?** *Because our deliveries of bicycles have been late for the last month.*
2. **Why?** *Because production has been behind schedule.*
3. **Why?** *Because there is a shortage of wheels.*
4. **Why?** *Because incoming inspection has rejected a large number of wheels for not being round.*
5. **Why?** *Because purchasing switched to a cheaper wheel supplier that has inconsistent quality.*

(You can verify the root cause by asking if the absence of the last answer would eliminate the problem.)

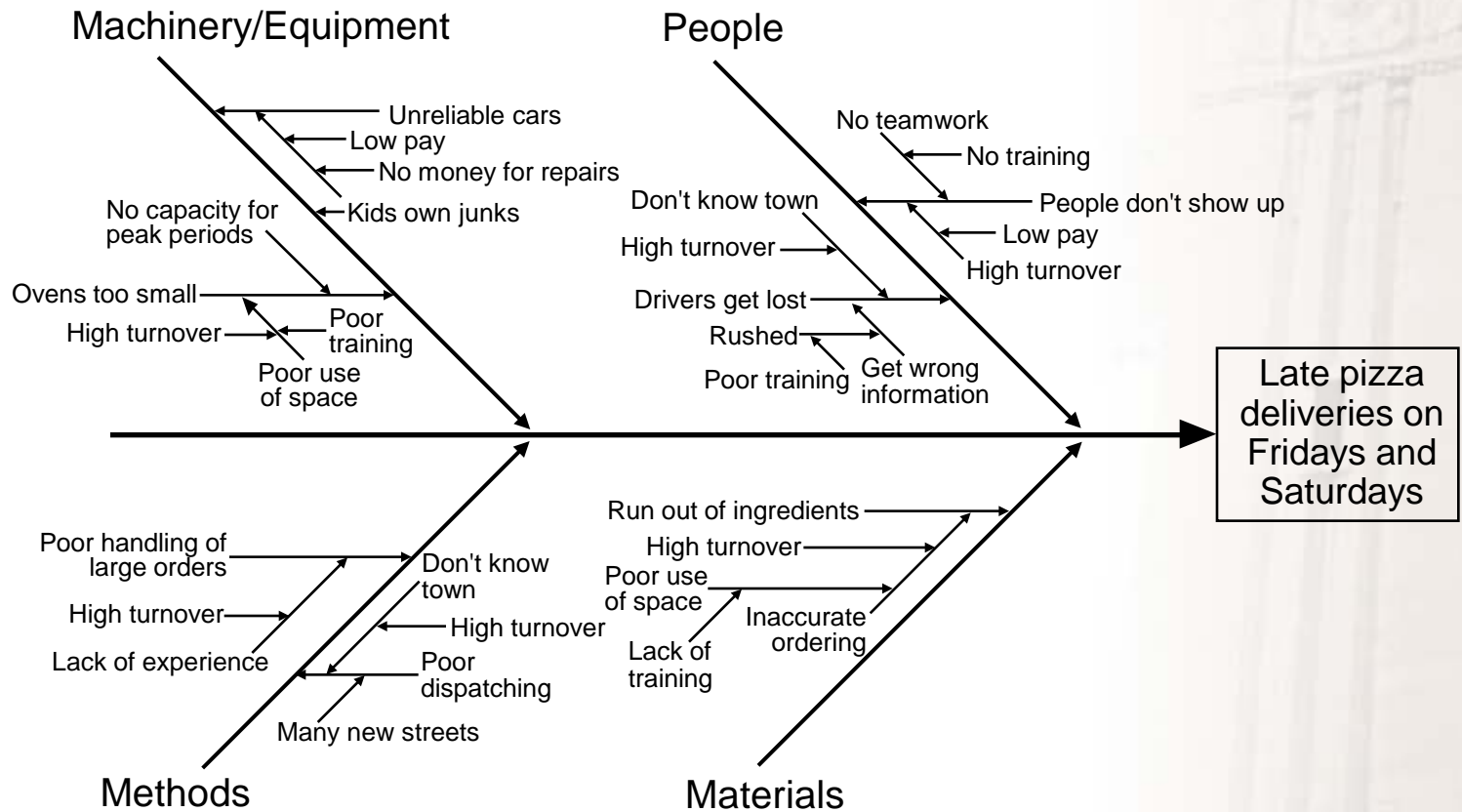
Verification Checking the purchasing records showed that the alternate wheels were purchased over a month ago and prior to that there were no issues with wheel availability.

Analyze and Determine Root Causes

- Cause and effect diagram (or fishbone diagram)
 - Allows a team to identify, explore, and graphically display, in increasing detail, important possible causes related to a problem or condition to discover its root cause.
 - Organizes large amounts of data about a problem



Analyze and Determine Root Causes



Analyze and Determine Root Causes

- Red Sweat Example
 - Practice completing a cause and effect diagram

The Problem Solving Process

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Develop and evaluate solutions

- Methods of Developing Creative Solutions to problems:
 - Brain Storming
 - Reverse Brain Storming
 - SCAMPER (substitute, combine, adapt, modify, eliminate, reverse)
 - Lateral thinking

Develop and evaluate solutions

- Brain Storming solutions
 - Structured/Unstructured
 - Mind Mapping
 - Brain Writing
- Reverse Brain Storming: a method which combines both brainstorming and reversal techniques to develop creative ideas
 - Change the wording of the problem from how to solve it, to how to cause it. (e.g. for a customer satisfaction problem, ask 'How can we cause customer dissatisfaction?')
 - Brainstorm as many ways as possible to cause customer dissatisfaction
 - Find ways to prevent the problem being caused

Develop and evaluate solutions

● SCAMPER

Substitute	Think about substituting part of the product or process for something else.
	Typical questions: What else instead? Who else instead? What other materials, ingredients, processes, power, sounds, approaches, or forces might I substitute? Which other place?
Combine	Think about combining two or more parts of the product or process to make something new or to enhance synergy.
	Typical questions: What mix, assortment, alloy, or ensemble might I blend? What ideas, purposes, units, parts, processes or appeals might I combine?
Adapt	Think about which parts of the product or process could be adapted or how you might change the nature of the product or process.
	Typical questions: Does the past offer a parallel? What else is like this? What other idea does this suggest? What might I adapt for use as a solution? What might I copy? Who might I emulate?
Modify, Magnify	Think about changing part or all of the product or process, or distorting it in an unusual way.
	Typical questions: What other meaning, color, motion, sound, smell, form, or shape might I adopt? What might I add?
Put to Other Uses	Think of how you might put the product or process to another use or how you might reuse something from somewhere else.
	Typical questions: What new ways are there to use this? Might this be used in other places? Which other people might I reach? To what other uses might this be put if it is modified?
Eliminate	Think of what might happen if you eliminated parts of the product or process and consider what you might do in that situation.
	Typical questions: What might I understate? What might I eliminate? What might I streamline? What might I make smaller, lower, shorter, or lighter?
Rearrange, Reverse	Think of what you might do if parts of the product or process worked in reverse or were sequenced differently.
	Typical questions: What might be rearranged? What other pattern, layout, or sequence might I adopt? Can components be interchanged? Should I change pace or schedule? Can positives and negatives be swapped? Could roles be reversed?

Developed by Bob Eberle

<http://litemind.com/scamper/>

Develop and evaluate solutions

- Lateral thinking - A way of thinking that seeks a solution to an intractable problem through unorthodox methods or elements that would normally be ignored by logical thinking.
- Lateral Thinking Techniques
 - Alternatives: How to use concepts as a breeding ground for new ideas. Sometimes we do not look beyond the obvious alternatives.
 - Focus: When and how to change the focus of your thinking. You will learn the discipline of defining your focus and sticking to it.
 - Challenge: Breaking free from the limits of traditional thinking. With challenges, we act as though the present way of doing things is not necessarily the best.

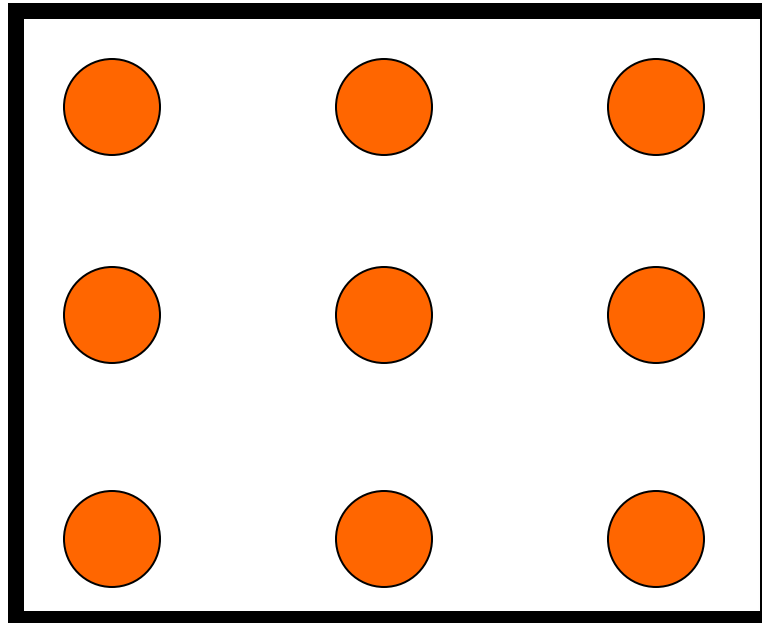
Develop and evaluate solutions

- Lateral Thinking Techniques (contd)
 - Random Entry: Using unconnected input to open up new lines of thinking.
 - Provocation and Movement: Generating provocative statements and using them to build new ideas.
 - Harvesting: Capturing your creative output. At the end of a creative-thinking session, we normally only take note of the specific ideas that seem practical and have obvious value.
 - Treatment of Ideas: How to develop ideas and shape them to fit an organization or situation.

Develop and evaluate solutions

Lateral Thinking Activity

CONNECT ALL NINE DOTS BY DRAWING
FOUR ***STRAIGHT*** CONTINUOUS LINES
(WITHOUT LIFTING YOUR PENS/PENCILS
OR RETRACING A LINE)



Develop and evaluate solutions

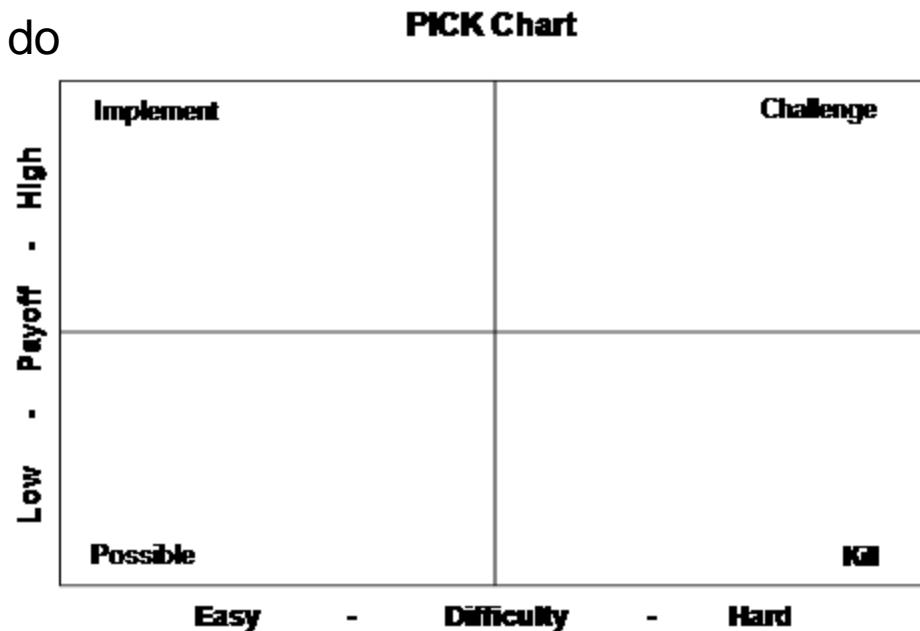
- Methods of evaluating solutions to problems
 - PICK Chart
 - Decision Matrix



Develop and evaluate solutions

● PICK Chart

- **Possible** - Low Payoff, Easy to do
- **Implement** - High Payoff, Easy to do
- **Challenge** - High Payoff, Hard to do, challenge it to see if there is an easier way e.g. break down the solution into smaller components
- **Kill** - Low Payoff, Hard to do



Develop and evaluate solutions

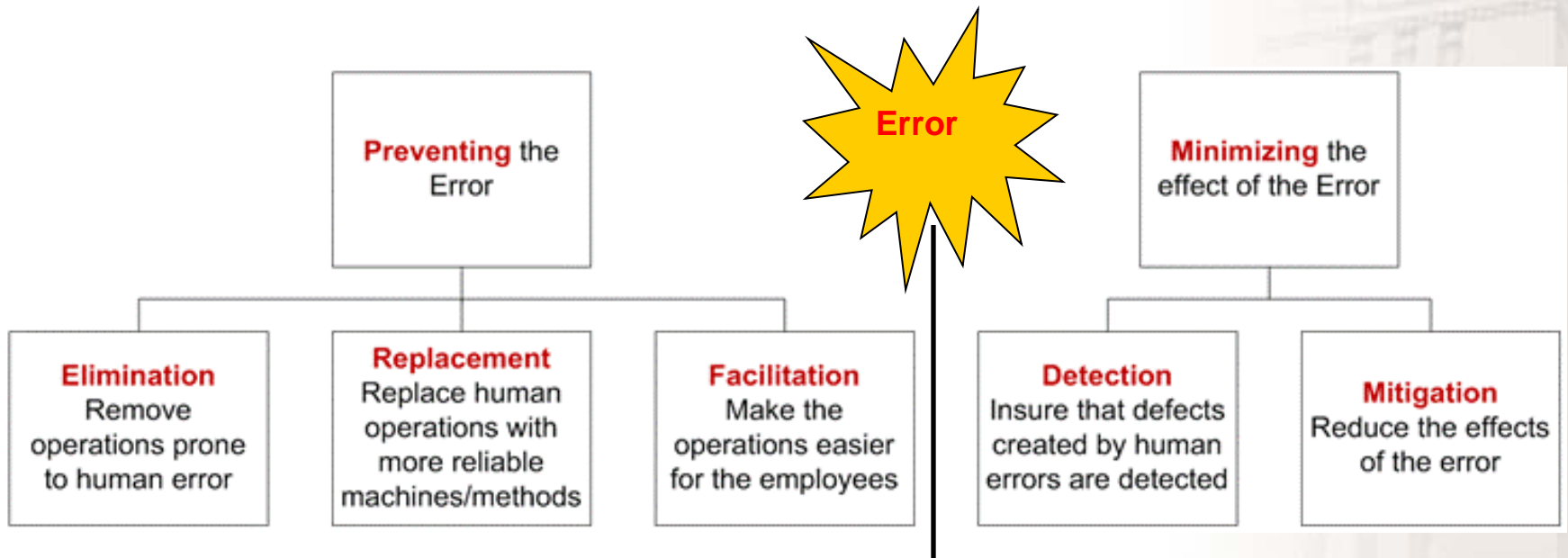
● Decision Matrix

- Establish the criteria (ease of implementation, cost, effectiveness, safety, ease of maintenance, etc.)
- Establish rating scale (low to high, 1 to 3, 1 to 5)
- Establish a weight factor for each criteria based on importance (e.g. is cost more important than safety)
- Rate each solution alternative against the criteria and calculate a total score

		ALTERNATIVES					
		Option A		Option B		Option C	
CRITERIA	Weight	Rating	Score ⁽¹⁾	Rating	Score ⁽¹⁾	Rating	Score ⁽¹⁾
Criterion C1	1	3	3	3	3	3	3
Criterion C2	2	2	4	1	2	2	4
Criterion C3	3	1	3	3	9	2	6
Total	6	4	10	7	14	7	13

Develop and evaluate solutions

- Consider error proofing solutions



The Problem Solving Process

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Plan and Implement the Solution

- Practice Good Project Management Skills
 - Define what is to be accomplished – purpose and objectives
 - Define the scope – what is included and what is not included
 - Define the deliverables – tangible outcomes that will be created
 - Determine the stakeholders and seek support
 - Break down all the tasks that need to be performed

Plan and Implement the Solution

- Practice Good Project Management Skills
 - Assign resources to the tasks
 - Develop a budget and a schedule for the project
 - Implement the plan, complete the deliverables
 - Track progress and adjust the plan as needed
 - Gain acceptance on deliverables

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Verify the effectiveness of the solution

- **Monitor** – Once the plan has been implemented and controls are in place, monitor the results to ensure the solution was effective:
 - Monitor the new process to ensure it is working properly
 - Monitor if new/revised procedures are being followed
 - Monitor accuracy of new/revised documentation
 - Monitor effectiveness through performance results
 - Monitor deviations and other problems
- **Verify Actions Taken**
 - Use the monitoring results to verify that the root cause has been eliminated



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- **Communicate and celebrate success**

Communicate and Celebrate Success

- Recognize the collective efforts of the team
 - Rewards (gift cards, hats, mugs)
 - Recognition
- Highlight any significant impacts
 - Cost savings
 - Reduced waste
 - Increased equipment uptime
 - Cycle time improvements
 - Improved customer satisfaction data
- Publicize the team's success (bulletin boards, weekly meetings, staff meetings etc)



Other Problem Solving Methods

- **8Disciplines (8D)—A team oriented problem solving process**
 - 0. Prepare for problem solving
 - 1. Assemble the team
 - 2. Describe the problem
 - 3. Implement and verify interim containment actions as needed
 - 4. Identify potential causes, determine and verify Root Cause
 - 5. Chose and verify permanent corrective (or preventive) actions
 - 6. Implement corrective (or preventive) actions
 - 7. Prevent recurrence of the root cause
 - 8. Congratulate the team and celebrate success

Other Problem Solving Methods

● Six Sigma– DMAIC

- Define—identify the problem
- Measure—gather data that identifies key characteristics and process parameters to help understand the problem
- Analyze—Analyze the data to determine the root cause and what corrective (preventive) actions should be taken
- Improve—Identify solutions; develop and deploy the plan
- Control—Establish monitoring processes to keep the issue under control and ensure no recurrences

Other Problem Solving Methods

- **“Improve” Method**
 - Identify—and define the problem
 - Measure—the impact on customers
 - Prioritize—possible causes
 - Research—and analyze root causes
 - Outline—alternative solutions
 - Validate—that solutions work
 - Execute—the solution and standardize

Effective Problem Solving

- Problem Solving is a skill that is learned.
- It takes constant practice and creativity to become more proficient.
- Don't expect to be perfect the first time.
- Problem Solving has individual styles or approaches.

Questions

