

Lesson Ten: **Discovering Your Path To Mastery of Problem Solving & Decision Making**

Desired Learning Outcomes:

- For you to be able to excel at using **“questioning skills”** to become an exemplar problem solver or decision maker
- Be able to use a simple five step process of problem-solving for non-complex problems
- When problem to be solved is more complex, be able to follow a problem analysis process that will help you narrow down to the root cause(s). Plan a corrective action(s) to make followed by use of a verification method that checks that the fix worked
- Utilize a check sheet to determine whether to use a team or an individual or sub-group to work on a problem solution
- When a choice is not clear for decision making, be able to use a decision analysis process that will help you pick the best alternative with the least amount of risk
- Identify other decision making methods and when it is appropriate to use each one
- How to construct and use a cause-and-effect diagram

Key Concepts:

1. Distinctions describe what is different between your "is" and "is not facts" gathered in problem analysis. Often these will help lead you to root cause(s) of a problem.
2. What Changed to cause the current "actual" state versus the way things "should" be that is creating the problem you are experiencing (another key area in analysis to look for cause).
3. Weighting the Wants or the desired outcomes of your decision - determine which of the criteria are more important in selecting the best alternative from those being considered.
4. Screening Alternatives through your "Must Criteria to eliminate any not needing further analysis - avoid wasting time getting to final choice.
5. Evaluating Risks of each alternative to help decide which would be your best choice for the decision you are making.

Questions You Will Be Able To Answer After Completing This Lesson

1. How do you eliminate causes in problem analysis to narrow down to root cause(s)?
2. What are distinctions and why are they important to find root cause?
3. How do you weight your "want criteria" in decision analysis?
4. Why does screening your alternatives through your "must criteria" help shorten the time spent in coming up with a quality decision?
5. What are six different decision making methods, what are their disadvantages and advantages, and when is it appropriate to use each one?
6. When to use an individual or sub-group rather than a team to solve a problem you or your group is facing?

"SYSTEMATIC QUESTIONING" IS THE KEY SKILL OF SUPERIOR DECISION-MAKERS AND PROBLEM-SOLVERS!

INTRODUCTION

- Follow a process - a systematic set of steps with specific questions to ask to meet your goal of determining the best alternative to make your decision with or find the root cause in order to make the right corrective action to solve your problem.
- Success in decision analysis or problem analysis process depends on using a systematic approach and asking questions effectively in the right order.
- Effective questioners understand: the intent behind their questions (they avoid getting bogged down in decision making meetings by asking the wrong questions); the assumptions they have made; the importance of

choosing question words carefully; and where they are likely to get the answers to make their decisions or solve their problems.

- Decision Analysis is a systematic questioning process for making a choice to balance the benefits and risks of different alternatives you are considering.
- In Decision Analysis, "Must Objectives/Criteria" have to be mandatory (required - can't live without - will eliminate an alternative if it does not meet); measurable (set limit); and realistic (can be met).
- In Decision Analysis, "Risks" are the adverse consequences of alternatives you are considering - what could go wrong?
- Problem Analysis is a systematic questioning process for finding cause of a positive or negative deviation from the way things should be or you desire them to be.

(THE FOLLOWING PAGES LIST THE DECISION ANALYSIS AND PROBLEM ANALYSIS SYSTEMATIC QUESTIONING PROCESSES TO HELP GUIDE YOU INDIVIDUALLY OR AS A TEAM THROUGH MAKING DECISIONS OR SOLVING A PROBLEM)

DECISION ANALYSIS

1. CLARIFY PURPOSE (by writing decision statement)

State Decision What is the fundamental purpose of this decision?
What is the appropriate decision level?

Develop Objectives/ Criteria What short and long term results should be accomplished?
What resources can be used or conserved?
What restrictions influence this choice?
What are the objectives related to:
People Policies
Organization Government
Clients Legal / Regulations
Personal Money
Products / Services Time
Competition Material
Productivity Facilities
Research Equipment

Which objectives need to be clarified by making them more specific?

Classify Objectives Into MUSTS & WANTS Which objectives/criteria are mandatory - "musts"?
What is the measurable limit for each?
Which objectives are desirable, but not mandatory - "wants"?
Which must objectives should be reflected in the "wants" (e.g. Least money to be spent)

**Weigh
The
Wants
(1 to 10
Scale)**

What is the relative importance of each WANT (pick the most important one and give it a 10 & compare rest to it in benefit to you and give each a number somewhere between 1-10)?

EVALUATE ALTERNATIVES

**Generate
Alternatives**

What are the different choices available?

**Screen
Alternatives
Through the
Musts**

Does the alternative meet each MUST limit?

**Compare
Alternatives
Against the
WANTS**

How do the alternatives compare against each WANT objective/criteria? (Score the one that has the most benefits a "10" and assign a score of 1-10 to the rest based on benefits compared to this one). Multiply you previous want rating times this number to weight your wants.

ASSESS RISKS

Develop Adverse Consequences	What are the implications of being close to a MUST limit? Where might information about this alternative be invalid? What are the implications? What could go wrong, short and long term, if this alternative was chosen?
Assess Threat	What is the probability (High/Medium/Low) that each adverse consequence will occur? What will be the seriousness if it does occur (High/Medium/Low)?

MAKE DECISION

Make Best Balanced Choice	Which alternative provides the greatest gain (highest scoring “wants”) with acceptable risk?
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Where is the defect on the object?

Where else could the defect be on the object, but is not?

WHEN

When was the defective object first observed (in clock/calendar time)?

When since that time has the defective object been observed? Any pattern? (sporadic, continuous or intermittently)?

When, in the object's life cycle or history, was the defect first observed?

When else could the defective object have been first observed, but was not?

When other times could the defective object have been observed, but was not?

When else could the defect have been first observed in the object's life cycle, but was not?

EXTENT

How many objects have the defect?

How many objects could have the defect, but do not?

What is the size of a single defect?

What other size could the defect be, but is not?

How many defects are on each object?

How many defects could there be on each object, but are not?

What has been the trend (increasing, decreasing, or stable?)

What other trends could have been expected, but were not observed?

IDENTIFY POSSIBLE CAUSES

Use knowledge & experience to develop possible cause statements

From experience, what could have caused this deviation?

Use distinctions & changes to develop possible cause statements

What is different or unique about an “IS” as compared to its “IS NOT”?

What has changed in, on, or about each distinction?

When did the change occur (**time is key data to collect**)?

How could each change have caused this deviation?

How could a change plus a distinction have caused this deviation?

How could a change plus a change have caused this deviation?

EVALUATE POSSIBLE CAUSES

Test possible causes against the “IS” & “IS NOT” facts to determine most probable cause(s).

If “X” is the true cause, how does it explain both the IS & IS NOT information?

What assumptions have to be made to explain the specification (IS & IS NOT facts)?

Of the causes tested against the specification, which best explains the IS & IS NOT data?

CONFIRM TRUE CAUSE

Verify assumptions made in testing; conduct observation; try fix & check result.

What can be done to verify any assumptions made in testing this cause?

How can this cause be observed where the problem is occurring?

When corrective action is taken, how will results be checked?

THE FIVE STEP PATTERN FOR **PROBLEM SOLVING** (Used For Non-Complex Problems)

The steps are easy to remember.

1. Select a problem to work on.
2. Get the facts about the situation.
3. Question all the facts in detail.
4. Develop the preferred solution.
5. Install or sell the idea.

The pattern itself is intended to be nothing more than a guide to thinking. It is the simple summary of many patterns used for scientific analysis and problem solving. Here's how it works.

The First Step -- **Select a Problem**

This is the Brainstorming step where team members list issues or concerns facing the team. They then assess which is the most important by looking at the seriousness, urgency and potential growth of the problem if not resolved soon (high/medium or low).

The Second Step -- Get the Facts

After the prioritized issue or concern is determined, the next step is to begin assembling information about the problem.

A fact can take a lot of different forms, but, it has very important ingredients. It *describes the present situation*, not what it should be, but what it is.

The description should be specific, and whenever possible, should include *numbers* indicating how serious the problem really is, *not generalities or opinions*, but documented details.

How far is it? How much time? How many pounds or gallons?

So to gather the facts, you have to ask the questions:

What?

Where?

When?

Who?

How?

Don't forget to write the facts down so they can be examined in the next step.

The Third Step -- **Question All the Facts**

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Much of the time getting the facts or gathering information about the problem can be accomplished by one team member or by a sub-group of the team. But when it comes to questioning the details of the problem, the entire team should work together.

This is the step where creative teamwork really pays off. Three of the most important ingredients of creative teamwork are careful observation, logical thinking, and constant doubt of your own opinion.

Total team participation in a positive atmosphere will raise the questions that ultimately lead to the solution to the problem. The simple question "*why?*" is applied to all the facts, and the search for better alternatives begins. How can we improve the situation through change?

At this point in the process, the team is beginning to become aware of several different opportunities for improvement. The questions provide answers that lead the team to conclusions regarding the solution. It takes substantial attention to complete Step 3 without jumping to Step 4.

The Fourth Step -- **Develop the Solution**

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This is the judicial or evaluation step. The team is now faced with the task of reviewing the alternatives in the light of practical application under existing conditions. Prime consideration must be given to the economics involved. Obviously, it would not be good business to spend more on the solution than the cost savings it could generate.

At this point, participation by those responsible for implementing the change is a *must*. You must always be aware that getting the idea adopted is the only way it will be of any value. A partial solution that is enthusiastically accepted by those affected is better than an ideal solution that is resisted and rejected out of existence.

In steps two and three, you have uncovered the costs and benefits (see cost/benefit forms to use in the next pages) that will be employed in developing the preferred solution. With that information, you are now ready for the final step.

The Fifth step --

Install the Solution or Sell the Idea

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Since careful attention has been given to the preceding steps, you have all the necessary data to develop the "sales pitch"...the management presentation.

That presentation should include documentation and numbers, where possible, to describe the seriousness of the problem as it now is (or was before you fixed it). Always use annual basis for cost comparisons.

Then describe the change and how it can be or was accomplished. Any cost involved, as well as dollar benefits that will result should be carefully spelled out.

Benefits that have no absolute dollar value should also be described -- this includes things like morale, attitude, housekeeping, safety, and community good will.

When you have accomplished these things, you will have put your presentation together well. The answer from management has to be: "Let's get started with your recommendation as soon as possible."

The next two pages have worksheets that can be used as you do your problem solving following the five step pattern. The key to selling any change is a good cost/benefit analysis which the second page does a good job of presenting.

Date: _____

PROBLEM ANALYSIS

Page _____

PROBLEM STATEMENT:

EXISTING STEPS IN OPERATION	NUMBERS			PROPOSED CHANGES (✓ = NO CHANGE)	COST? YES OR NO	THE CHANGE WILL SAVE OR IMPROVE WHAT?
	Dist.	Quan.	Time			
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						

SAVE → TIME, DISTANCE, MATERIALS, ENERGY, WORK, DOWN TIME, WASTE, WATER, ETC.

IMPROVE → PRODUCTION, QUALITY, SAFETY, HOUSEKEEPING, SERVICE, SPEED, MAINTENANCE,
METHOD

HOW COULD EACH STEP BE CHANGED TO BRING IMPROVEMENT?

PROJECT BENEFITS

TEAM NAME _____

DATE _____

FROM PROBLEM ANALYSIS FORM			BY HOW MUCH?	HOW OFTEN?	UNIT VALUE?	ANNUAL BENEFIT	
PAGE	ITEM	SAVE OR IMPROVE WHAT?				STATEMENT	\$ SAVED PER YEAR
TOTAL PROJECT SAVINGS							

PROJECT COSTS

PAGE	ITEM	RECOMMENDED CHANGES FROM PROBLEM ANALYSIS FORM	COST
TOTAL PROJECT COST			
NET SAVINGS FIRST YEAR			

OTHER DECISION MAKING METHODS

1. Lack of Response

2. Authority Rule

3. Minority

4. Majority

5. Consensus

6. Unanimity

Method of Decision Making	Disadvantages	Advantages
Lack of Response	- Usually implies agreement	- Not that important - Really don't care - Decision will be made by itself or someone

Method of Decision Making	Disadvantages	Advantages
Authority Rule	<ul style="list-style-type: none"> - One person is not a good resource for every decision - No commitment to implementing the decision that is developed among other group members - Resentment and disagreement may result - Resources of other members are not used 	<ul style="list-style-type: none"> - Useful for simple, routine decisions - Should be used when very little time is available to make the decision - When other group members lack the skills and information to make the decision
Minority	<ul style="list-style-type: none"> - Does not utilize the resources of many group members - Does not establish widespread commitment to implement the decision - Unresolved conflict and controversy may damage future group effectiveness 	<ul style="list-style-type: none"> - When the group is under such time pressure that it must delegate responsibility to a committee - When only a few members have any relevant resources - When broad member commitment is not needed to implement the decision
Majority	<ul style="list-style-type: none"> - Usually leaves an alienated minority, which damages future group effectiveness - Relevant resources of many group members may be lost 	<ul style="list-style-type: none"> - When sufficient time is lacking for decision by consensus - When the decision is not so important that consensus needs to be used

Method of Decision Making	Disadvantages	Advantages
	<ul style="list-style-type: none"> - Full commitment to implement the decision is absent 	<ul style="list-style-type: none"> - When complete member commitment is not necessary for implementing the decision
Consensus	<ul style="list-style-type: none"> - Takes a great deal of time and psychological energy and a high level of member skill - Time pressure must be minimal, and there must be no emergency in progress 	<ul style="list-style-type: none"> - Produces an innovative, creative, and high-quality decision - Elicits commitment by all members to implement the decision - Uses the resources of all members - Future decision-making ability of the group is enhanced - Useful in making serious, important, and complex decisions to which all members are to be committed
Unanimity	<ul style="list-style-type: none"> - Beware of “Group Think” (all agreeing to get it over with even though they might not agree) - Saying you agree when you really don’t, but don’t want to risk being different 	<ul style="list-style-type: none"> - We all really do agree - Of one mind

CONSENSUS DECISION MAKING

Consensus is a method effective groups learn to use in working together. All group members can participate and contribute. Each member of any group may have a different perspective on a given subject or problem. Consensus teaches a group to explore and pool the knowledge and experience of all its members. People learn to modify their viewpoint based on logic, reasoning, and new information. The group reaches a conclusion which has blended the best ideas into a decision that everyone in the group can support.

Consensus takes time and energy, but the quality of decisions tend to be quite high because more facts, feelings, information and opinions are considered than with majority vote or compromise. Other decision techniques are often quicker but can be less effective in the long run if those who are to implement the decision are not committed to supporting it.

GUIDELINES FOR CONSENSUS SEEKING DISCUSSIONS:

- **LISTEN** to each of the other members as they explain their point of view (What do they know that you don't know? What information do they need to be able to see things your way?)
- Be willing to **CHANGE** your mind based on logic and understanding new information.
- **WAIT** your turn to explain your opinion.
- If you sense consensus has been reached, ask for a consensus check with the group by going around the table and ask each member to indicate with their thumbs where they are at:
 - Thumb Up = I agree with everyone about the decision choice and will support it.

- Thumb Down = I am not yet in consensus regarding what we have been discussing and will not support it unless convinced with more information.
- Thumb Horizontal = I could go either way but will support the group's decision.

(IS IT ALWAYS APPROPRIATE TO USE THE WHOLE TEAM TO WORK ISSUES? The following page will help you decide what is most appropriate – an individual or sub-group with expertise or the whole team.)

**DECIDING WHEN TO USE AN INDIVIDUAL, SUB-GROUP OR THE WHOLE TEAM
TO SOLVE PROBLEMS AND MAKE DECISIONS
("A CHECKLIST")**

It is neither prudent nor realistic to assume that any team can solve any problem, task, or issue through participatory teamwork. Your team will benefit by assessing itself and each problem, task, or issue with which it is confronted before you begin your problem-solving work. As a result of thorough assessment, your team can make an informed decision as to whether the problem, task or issue can be handled -- under the prevailing circumstances -- by either (a) a selected individual or sub-group or (b) your team.

Specify the problem, task, or issue to be subjected to problem-solving:

Instructions: Below are 21 questions in four sections. In considering the problem, task, or issue (described above), answer each question "YES" or "NO". Use a different checklist for each task or issue that the team is considering.

SECTION A: The Nature Of The Task To Be Subjected To Problem-Solving:

	<u>INDIVIDUAL</u>	<u>TEAM</u>
1. Does the task require an innovative solution or a new alternative or option that has not previously been considered?	YES	NO
2. Is there a qualified technical specialist or sub-group available which has a track record of creating innovative solutions?	YES	NO

	<u>INDIVIDUAL</u>	<u>TEAM</u>
3. Does the task require that information from different parts of the organization be brought together to produce a comprehensive, integrated solution?	NO	YES
4. Will different organizational groups have to coordinate with each other to come up with a solution (either because the work flows through each of them or because each has some information or specialized skills required to solve the problem)?	NO	YES
5. Will the problem-solving work be independent of other required routine work that is being done? Will the work of solving the problem either impact or be affected by the routine work being done by others?	YES	NO
6. Will the solution direct or guide the behavior of employees whose performance may be evaluated against the results or effects of the solution?	NO	YES

SECTION B: Importance Of Acceptance Of And Commitment To The Solution:

7. Must the solution have widespread acceptance (“Buy-In” or “Ownership by a large number of individuals or groups in the organization) in order for it to be carried out completely and efficiently?	NO	YES
8. Do we need the highest quality solution possible?	YES	NO

	<u>INDIVIDUAL</u>	<u>TEAM</u>
9. Is there a qualified technical expert or specialized sub-group available?	YES	NO
10. Is this a situation where a necessary but unpopular decision must be made – even if it may not be desired by those who must implement it or those who will be impacted by it?	YES	NO
11. Are we more willing to invest additional scarce resources (time, people, monitoring systems, etc.) to ensure proper implementation of the solution than we are to invest scarce resources in the process of solving the problem?	YES	NO
12. Are we willing to allow the quality of the solution (or its result and consequences) to be a variable?	NO	YES
TOTAL NUMBER OF CIRCLED RESPONSES (A + B):	_____	_____

If the total number of circled responses for Question 1 through 12 under **TEAM** column is larger than the number under the **INDIVIDUAL** column, the result suggests that your team believes that a participatory team approach should be used to solve this problem. However, if the reverse is true, then, for this particular problem, task, or issue at least, the result suggests that your team believes that the problem-solving should be conducted by a highly qualified individual (probably a technical specialist of some sort) or sub-group which is both intimately familiar with issues of this type and has a demonstrated track record of effective work in this area.

INSTRUCTIONS: Answer Section C and D only if the total number circled responses for Questions 1 through 12 under the **TEAM** column is larger than the number under the **INDIVIDUAL** column.

SECTION C: Characteristics Of Individual Team Members

	<u>INDIVIDUAL</u>	<u>TEAM</u>
13. Does each team member have unique (a) expertise and/or (b) information that is relevant to the specific team task?	NO	YES
14. Does each individual team member represent a different organizational (stakeholder) group that has a vested interest in the team's recommendation solution?	NO	YES
15. Consider the people or groups that will be responsible for the implementation of the team's solution: are they represented in the problem-solving team?	NO	YES
16. Consider the people or groups whose work lives are likely to be impacted by the implementation of the team's solution: are they represented in the problem-solving team?	NO	YES
17. Consider the members of the problem-solving team: are they more than just "planners" and/or "problem-solvers"? Are they also "organizational leaders" and/or "implementers"?	NO	YES

	<u>INDIVIDUAL</u>	<u>TEAM</u>
18. Can the problem-solving team depend on each of its members to support the implementation of its solutions?	NO	YES

SECTION D: Operating Effectiveness Of The Team

19. Do the individual team members have difficulty collaborating and working together effectively as a team?	YES	NO
20. Is the leader of the team skilled in using participatory problem-solving methods and processes?	NO	YES
21. Is a qualified and respected organizational development consultant available and willing to facilitate the team's problem-solving meetings?	NO	YES

TOTAL THE NUMBER OF CIRCLED RESPONSES (C + D): _____

If the number of circled items for questions 13 through 21 under the **INDIVIDUAL** column is larger than the number under the **TEAM** column, your team has a dilemma: your responses to Sections A and B suggest that your team believes it should handle the problem, task, or issue, but your assessment of your team suggests that you do not believe that your team is sufficiently capable of dealing with the issue properly and effectively.

In such a situation, the problem would probably best be solved by the most highly qualified individual specialist or sub-group that is available -- UNLESS the answer to Question 21 is "YES". In this case, your team may wish to develop an agreement with the organizational development consultant to help the team members acquire sufficient

competence in participatory management skills to enable the team to function effectively and autonomously.
(NOTE: If any answers to questions 14-17 are “NO”, you may want to reconsider the composition of your team.)

**(THE FOLLOWING PAGES HAVE BLANK PROBLEM SOLVING PROCESS
FORMS THAT YOU CAN USE TO WORK ON “PEOPLE PROBLEMS” OR
“WORK PLACE PROBLEMS”)**

INTEREST-BASED PROBLEM SOLVING PROCESS

DATE OF OCCURRENCE: _____

IBPS #: _____

DATE OF MEETING: _____ **DEPARTMENT:** _____

PERSONS IN ATTENDANCE:

DEFINE THE ISSUES:

IDENTIFY BOUNDARIES/CRITERIA:

IDENTIFY INTERESTS: **IDENTIFY OPTIONS TO MEET INTERESTS:**

AGREED ON OPTION TO RESOLVE CONFLICT:

DATE PARTIES WILL CHECK SOLUTION(S): _____

CONFLICT RESOLVED? YES / NO

**PROBLEM SOLVING
ANALYZE AND IMPLEMENT WORKSHEET**

PROBLEM DESCRIPTION (Ask good questions of those who know)

Date Completed: _____

What is the problem? _____

Where does the problem happen? _____

When does the problem happen? _____

INTERIM ACTION (What can we do to protect the customer while we solve the problem?)

Date Completed: _____

Interim Action(s):

LIST ALL POSSIBLE CAUSES
(Evaluate: Man, Materials, Methods, Machinery)

Date: _____

Likely cause based on problem description

1.	Yes	No	?
2.	Yes	No	?
3.	Yes	No	?
4.	Yes	No	?
5.	Yes	No	?
6.	Yes	No	?
7.	Yes	No	?
8.	Yes	No	?
9.	Yes	No	?

If you have no likely causes, ask what's changed about what, when, where, or when that may have caused the problem. If you still have no likely causes, ask for help from your department Problem Solving Resource.

LIKELY CAUSES: If more than one, develop solutions for each cause; select the best solution and develop a plan to implement.

List possible solutions for each likely cause.

LIKELY CAUSE

- 1.
- 2.
- 3.

(Select best solution for each likely cause)

LIKELY CAUSE

- 1.
- 2.
- 3.

(Select best solution for each likely cause)

VERIFY LIKELY CAUSE(S) BY ONE OF THE FOLLOWING: FACTS – CHECK ASSUMPTIONS; SIMULATION & SOLUTION IMPLEMENTATION)

SOLUTION IMPLEMENTED:

Evaluation – Describe Results:

PREVENTION ACTIONS (Steps taken to assure problem will not re-occur):

Should a task training document be written? (If yes, notify supervisor) YES NO

Should operators be re-trained? (If yes, notify supervisor) YES NO

Should training manuals be updated? (If yes, notify supervisor) YES NO

Have all necessary persons been notified of problem solution and implementation? YES NO

Where else might the same problem occur?

Were other issues discovered during problem-solving, that if resolved, will make the process better? If yes, describe:

(THE NEXT PAGE WILL PROVIDE YOU WITH ONE OF THE MOST IMPORTANT CAUSE FINDING TOOLS THAT YOUR TEAM CAN UTILIZE TO HELP IN COMING TO ROOTCAUSE)

CAUSE – AND – EFFECT DIAGRAMS

INTRODUCTORY INFORMATION

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The Cause-and-Effect Diagram is one of the most important skill tools an efficient team can learn. When its use is appropriate, it will keep the discussion organized and “triggers” creative thinking and group participation.

For almost every problem that your team will work on, there will be many contributing causes for that problem. The trick is to identify as many causes as possible, so the team can go about eliminating them. To do this you would construct a cause-and-effect diagram.

A chalk board or pad is used. The chart pad is best because it can be saved for repeated use or hung in the work place for others to see and add possible causes. One team member acts as the writer, and with the help of the team, chooses the problem or effect to discuss. It could be product waste, safety, productivity, etc.

The diagram used is called a “fishbone” diagram because it looks much like that. A box at the extreme right indicates the effect (problem). A horizontal line is drawn leading to the box with four diagonal lines leading off from it; two above and two below.

The four diagonal lines most often are labeled with the four most common primary causes for problems in industry. The four “M’s” are:

➤ MATERIALS

➤ MANPOWER

➤ **METHODS**

➤ **MACHINERY**

Using these broad primary causes, the team will list and classify all the interrelated causes they can think of for each of the categories. The rules for this process are:

1. **Everyone participates.**
2. **No criticism allowed.**
3. **Write it down.**
4. **Don't overload or clutter your diagram.**
5. **Make sure all can see the diagram.**
6. **Group the causes identified (by category).**

The steps in constructing the Cause-and-Effect Diagram are as follows:

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1. Choose a quality characteristic or a problem to be the “Effect”. Place this “Effect” in a box at the right-hand side of the chart pad and draw an arrow to the box from the left.
 2. Draw in the four “primary cause” arrows and title them (Methods, Manpower, Materials, and Machinery).
 3. Brainstorm all possible causes of the “Effect” and write the causes with the appropriate primary cause.
 4. As a team, using valid related information, determine which are the most important causes and circle these on the diagram with a colored marker. Draw lines through the causes which the team feels are not valid.

In almost every team meeting there might be an opportunity to apply this useful technique. Don't hesitate to recommend the cause-and-effect diagram when you see a chance for the team to benefit from it.

(THE NEXT PAGE IS AN EXAMPLE OF A CAUSE-AND-EFFECT DIAGRAM – SEE IF YOU CAN ADD ANYTHING TO IT FROM YOUR EXPERIENCE)

MACHINERY

Metal type vs. glass

Too old of coffee pot

Dirty/Not cleaned often enough

METHOD

Cooked too long

Too much grounds

Cooked to short

No filter used

Too little grounds

MANPOWER

Untrained

Dirty hands

MATERIALS

Bad water

Old coffee uncovered

Poor brand of coffee

**“BAD
TASTING
COFFEE”**