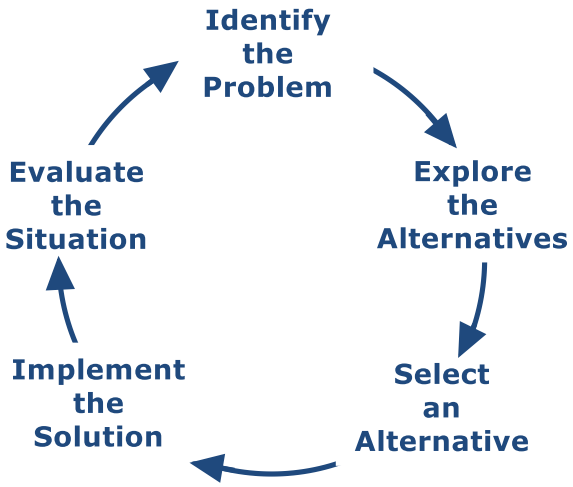
4/5/2020

THIRTEEN PROBLEM-SOLVING MODELS

FRED NICKOLS
DISTANCE CONSULTING LLC

This page intentionally left blank.

Analytical Problem-Solving Approach - FEMA



Step	Description
Step 1: Identify the Problem	Determine the situation or condition that will exist in the future and is considered undesirable by members of the organization. In order to identify the problem, you need to size up the situation to make sure that you have the full picture. Size-up involves analyzing the current situation to determine: • What is happening (and not happening). • Who is involved. • What the stakes are. This information will enable you to identify the problem more accurately.
Step 2: Explore the Alternatives	This step includes generating alternatives and evaluating them. You can generate alternatives through brainstorming, surveys, discussion groups, or other means. Alternatives should be evaluated using a consistent process. In a crisis, exploring alternatives involves: • **Identifying contingencies.** Consider the future and think about all of the things that can get in the way of solving the problem you are facing. • **Determining objectives.** Develop objectives that clearly state what you need to do to be successful. • **Identifying needed resources.** Identify the people, information (data), and things needed to resolve the problem.

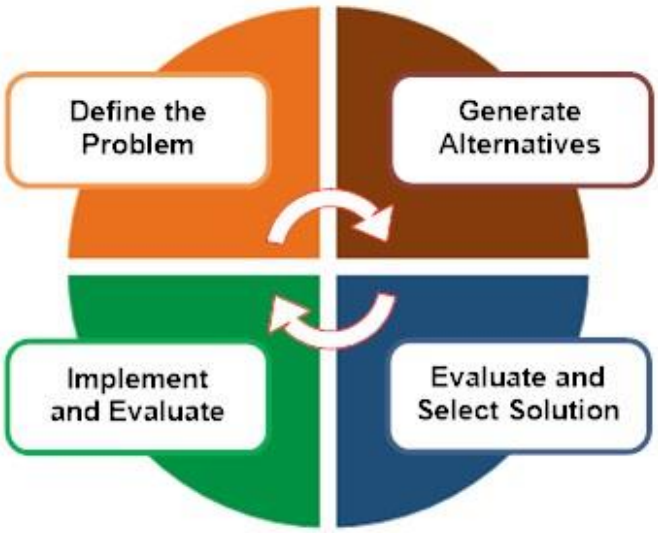
Analytical Problem-Solving Approach - FEMA

Step	Description
Step 3: Select an Alternative	After you have evaluated each alternative, select the alternative that comes closest to solving the problem with the most advantages and fewest disadvantages. There may be repercussions to any solution selected. Carefully consider how the solution will be implemented before selecting an alternative. In a crisis, selecting an alternative involves building a plan that states: • Who • Will do what (and with whom) • By when • Where • How Plans need to be communicated to all parties involved.
Step 4: Implement the Solution	Take action to implement the selected solution. Implementation involves the following: • Developing an action plan (what steps are needed). • Determining objectives or measurable targets. • Identifying needed resources. • Identifying details of the action plan (who will do what, by when, where, and how, as applicable). • Using the plan to put the solution in place.
Step 5: Evaluate the Situation	Evaluation involves monitoring progress and evaluating the decision that was made. During evaluation, identify if: the situation has changed, more or fewer resources are required, or a different alternative solution is required. Monitoring the success of a solution is an ongoing process that is critical to fine tuning a course of action.

For FEMA Training using this model see: https://training.fema.gov/emiweb/downloads/is241.pdf

ASQ Four-Step Model

The American Society for Quality (ASQ) argues that to effectively manage and run a successful organization, leadership must guide their employees and develop problem-solving techniques. ASQ further asserts that finding a suitable solution for issues can be accomplished by following the four-step problem-solving process and methodology outlined below.



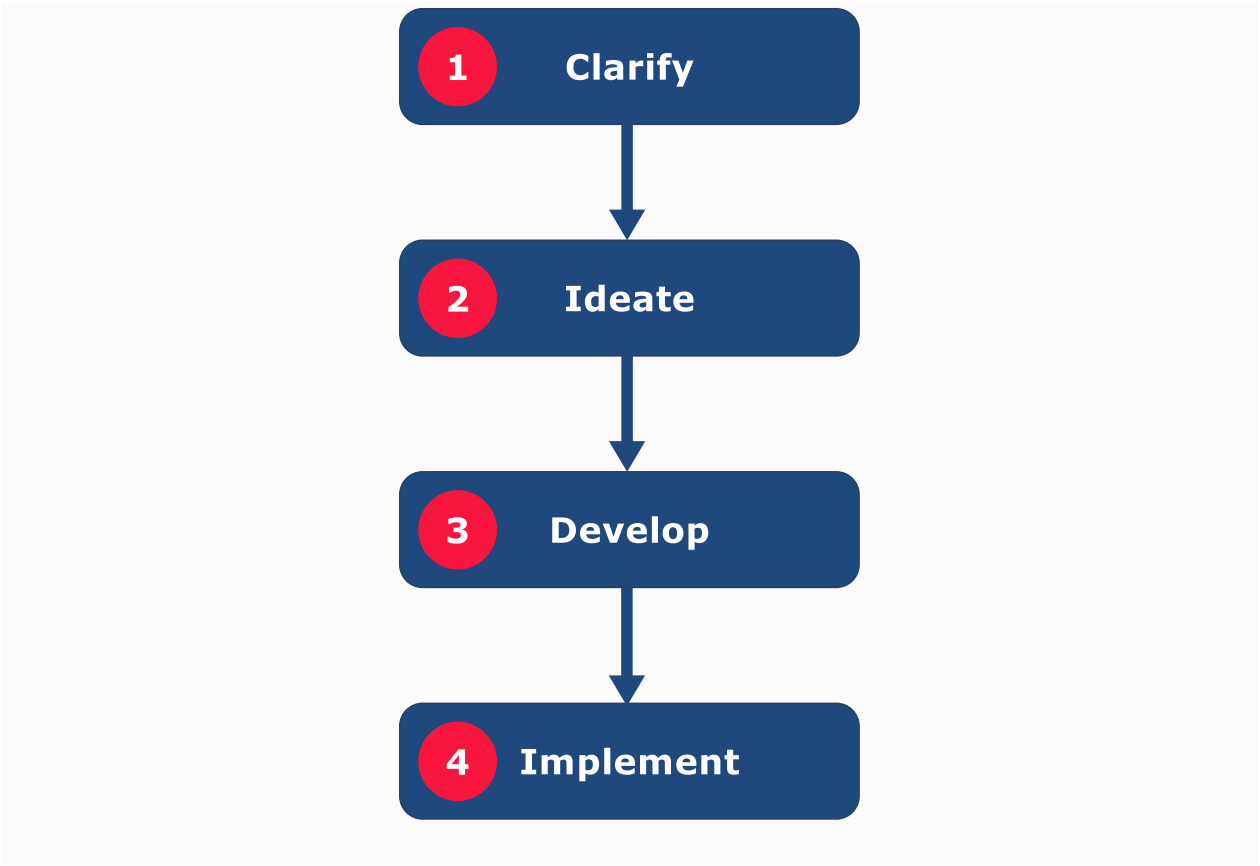
Step	Characteristics
1. Define the Problem	• Differentiate fact from opinion • Specify underlying causes • Consult each faction involved for information • State the problem specifically • Identify what standard or expectation is violated • Determine in which process the problem lies • Avoid trying to solve the problem without data

ASQ Four-Step Model

Step	Characteristics
2. Generate Alternatives	• Postpone evaluating alternatives initially • Include all involved individuals in the generating of alternatives • Specify alternatives consistent with organizational goals • Specify short- and long-term alternatives • Brainstorm on others' ideas • Seek alternatives that may solve the problem
3. Evaluate and Select Solution	• Evaluate alternatives relative to a target standard • Evaluate all alternatives without bias • Evaluate alternatives relative to established goals • Evaluate both proven and possible outcomes • State the selected alternative explicitly
4. Implement and Evaluate	• Plan and implement a pilot test of the chosen alternative • Gather feedback from all affected parties • Seek acceptance or consensus by all those affected • Establish ongoing measures and monitoring • Evaluate long-term results based on final solution

Source: https://asq.org/quality-resources/problem-solving

Creative Problem-Solving Model - Mindtools



1. Clarify

Explore the Vision

Identify your goal, desire or challenge. This is a crucial first step because it's easy to assume, incorrectly, that you know what the problem is. However, you may have missed something or have failed to understand the issue fully and defining your objective can provide clarity. Read our article, 5 Whys , for more on getting to the root of a problem quickly.

Gather Data

Once you've identified and understood the problem, you can collect information about it and develop a clear understanding of it. Make a note of details such as who and what is involved, all the relevant facts, and everyone's feelings and opinions.

Formulate Questions

When you've increased your awareness of the challenge or problem you've identified, ask questions that will generate solutions. Think about the obstacles you might face and the opportunities they could present.

Creative Problem-Solving Model - Mindtools

2. Ideate

Explore Ideas

Generate ideas that answer the challenge questions you identified in step 1. It can be tempting to consider solutions that you've tried before, as our minds tend to return to habitual thinking patterns that stop us from producing new ideas. However, this is a chance to use your **creativity** .

Brainstorming and **Mind Maps** are great ways to explore ideas during this divergent stage of CPS. And our articles, **Encouraging Team Creativity** , /community/Bite-SizedTraining/ProblemSolving.php **Problem Solving**, **Rolestorming** , **Hurson's Productive Thinking Model** , and **The Four-Step Innovation Process** , can also help boost your creativity.

3. Develop

Formulate Solutions

This is the convergent stage of CPS, where you begin to focus on evaluating all of your possible options and come up with solutions. Analyze whether potential solutions meet your needs and criteria and decide whether you can implement them successfully. Next, consider how you can strengthen them and determine which ones are the best "fit." Our articles, **Critical Thinking** and **ORAPAPA** , are useful here.

4. Implement

Formulate a Plan

Once you've chosen the best solution, it's time to develop a plan of action. Start by identifying resources and actions that will allow you to implement your chosen solution. Next, communicate your plan and make sure that everyone involved understands and accepts it.

Source: https://www.mindtools.com/pages/article/creative-problem-solving.htm

Note: The embedded links above are to articles on the MindTools site.

Fred Nickols' Four-Step Model

As the diagram below indicates, the problem-solving process consists of four major steps:

1. ASSESS: Take Stock of the Situation
2. ANALYZE: Figure Out What to Do About It
3. ORGANIZE: Get Ready for Action
4. EXECUTE: Make It Happen

Four Steps in Solving A Problem

Each of the four steps is described in more detail in the table on the following page.

Fred Nickols' Four-Step Model

Investigation		Intervention	
ASSESS	**ANALYZE**	**ORGANIZE**	**EXECUTE**
Take Stock of the Situation	**Figure Out What to Do About It**	**Get Ready for Action**	**Make It Happen**
Clarify the Situation - establish its boundaries - determine its nature - understand & explain it - describe it **Specify the Outcomes** - achieve - preserve - avoid - eliminate **Classify the Structure** - physical - financial - operational - behavioral **Tend to the Politics** - consensus - support - opposition - communication	**Choose an Approach** - repair - improve - engineer **Diagram the Structure** - elements - connections - relationships **Identify Change Targets, Changes, and Means** - what is to be changed - in what ways - through what means **Specify the General Form of the Solution** - what are you going to do - over what time frame - using what methods - at what costs - why	**Reconcile Result, Resource & Time Conflicts** - reconcile restraints - reconcile constraints - obtain funding - obtain other resources **Prepare an Action Plan** - tasks & assignments - milestones & events - contingencies **Settle on A Change Management Strategy** - persuasion - education - coercion - adaptation **Tend to the Politics** - consensus - support - opposition - communication	**Carry Out the Solution** - act - assess - adjust **Appraise the Situation** - better or worse - closer or farther - enough or more - same or different **Evaluate the Solution and Its Implementation** - effectiveness - efficiency - costs and benefits **Critique the Effort** - mistakes made - lessons learned - tips for next time

The IDEAL Problem-Solving Model

The IDEAL model, shown below, presents five steps or phases involved in solving a problem. It was originally developed by John Bransford and published in 1984 a book titled *The IDEAL Problem Solver*. Bransford and Barry Stein published a second edition in 1993. The process, as they describe it, is cyclical or iterative and does not call for a rigid, linear approach. Each of the five steps or phases is briefly discussed below.

Identify Problems and Opportunities

The aim is to identify potential problems and treat them as opportunities.

People often fail to do this because they take unpleasant circumstances as givens and do not stop to think about the possibilities of improving upon the situation.

Another issue in this stage relates to the failure to realize that current actions underway or policies being put into effect might lead to problems later on. It is important, then, to give thought to current actions and policies with an eye toward predicting future problems.

The IDEAL Problem-Solving Model

Define Goals

The objective here is to carefully define your goals with respect to the problem situation. In this regard, it also becomes important to examine alternative goals with respect to the problem situation. Doing so leads to the exploration of different strategies.

Solutions can take the form of physical objects (e.g., a screen to place atop a frying pan to prevent grease spatters) but they can also take the form of concepts and ideas (e.g., if your goal is to transport executives from one place to another while restricting fuel consumption, do you evaluate solutions in terms of the miles-per-gallon efficiency of a given vehicle or passenger-miles-per-gallon?).

Explore Possible Strategies

Here, systematic analysis plays an important role.

Also important here is the use of external representations of the problem (e.g., diagrams and drawings as well as verbal and mathematical representations).

Other general strategies include working backward and using a simpler, specific situation using scale models or experiments).

Another important factor here is specialized knowledge that enables the problem solver to know when, how and why to apply a particular strategy.

People who want to become effective problem solvers must become effective at learning about relevant conceptual tools.

Anticipate Outcomes and Act

This often requires testing strategies and using prototypes. This helps greatly in avoiding unanticipated and unwanted effects of a solution.

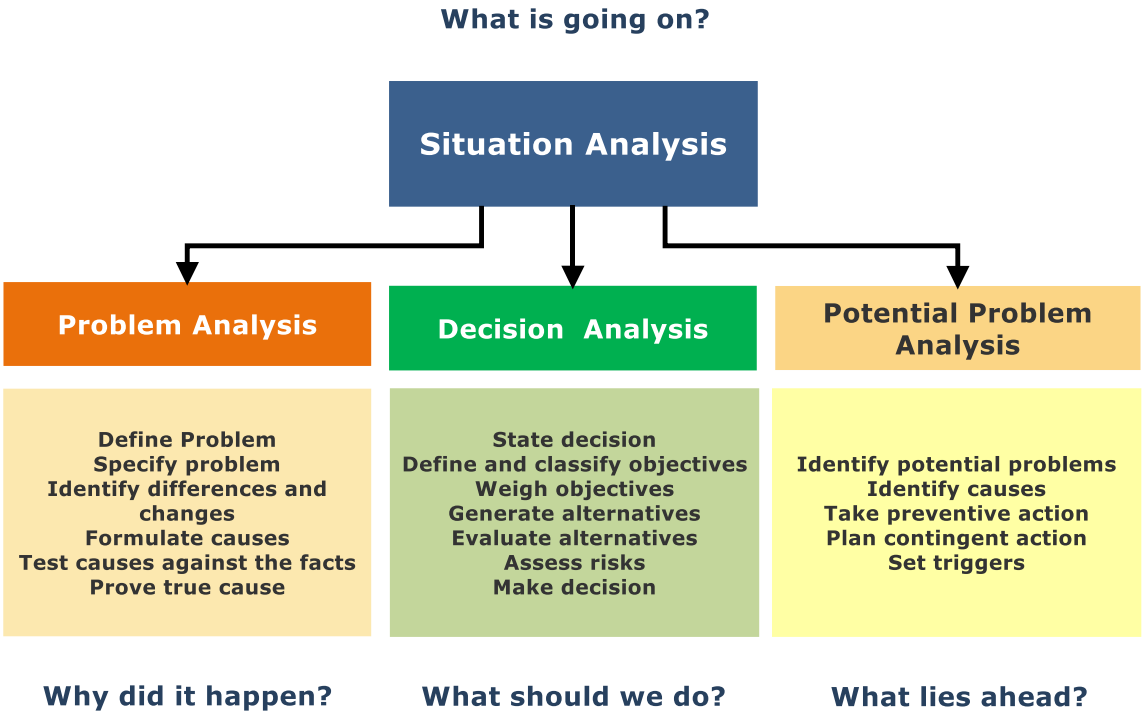
Look Back and Learn

The basic point here is to look at the actual effects of the strategy and to learn from that experience.

NOTE: Bransford and Stein's book is available on the web in pdf format and a copy will be provided to faculty.

The Kepner-Tregoe Method

Perhaps the best-known of commercially available problem-solving training is provided by Kepner-Tregoe, a firm named after its founders, Charles Kepner and Benjamin Tregoe. They published their classic book about problem solving and decision making in 1965. It was titled *The Rational Manager*. Later, in 1981, they published an updated version titled *The New Rational Manager*. Over the years, the Kepner-Tregoe model (usually referred to as "K-T") has evolved somewhat and the current version now looks something like the diagram shown below.



As the diagram shows, the process attempts to answer four basic questions:

1. What is going on?
2. Why did it happen?
3. What should we do?
4. What lies ahead?

The K-T Problem Solving & Decision-Making method is a step-by-step process for successfully solving problems, prioritizing issues, making good decisions, and analyzing potential risks and opportunities. It has four basic areas.

Situation Appraisal

Clear thinking for complex situations. Clarify the issues that matter in complex situations and determine how concerns should be prioritized and handled. A plan is developed for the effective resolution of each issue including what analysis is required, who needs to be involved,

and when specific actions should be taken. Situation Appraisal quickly clarifies complex situations, makes priorities visible, and avoids action without direction.

Problem Analysis

Clear thinking for tough problems. Find the cause by organizing and analyzing key factual information about the problem. Possible causes are identified and then tested against these facts. Learners verify the true cause of the problem and consider where both the cause and any fixes may have additional impact. Problem Analysis ensures cause is known before fixes are implemented.

Decision Analysis

Clear thinking for difficult decisions. Clarify the purpose of their decisions and form clear, measurable objectives. Evaluate an appropriate range of alternatives and assess related risks prior to making a decision. Decision Analysis ensures fully informed choices that maximize benefits and minimize risks.

Potential Problem Analysis

Clear thinking for managing risks. Anticipate threats to the success of planned actions. Consider causes for each potential problem and how to prevent them. Consider contingent actions and specific triggers if the problems occur. Potential Problem Analysis helps prepare in advance and avoid unplanned reactive actions.

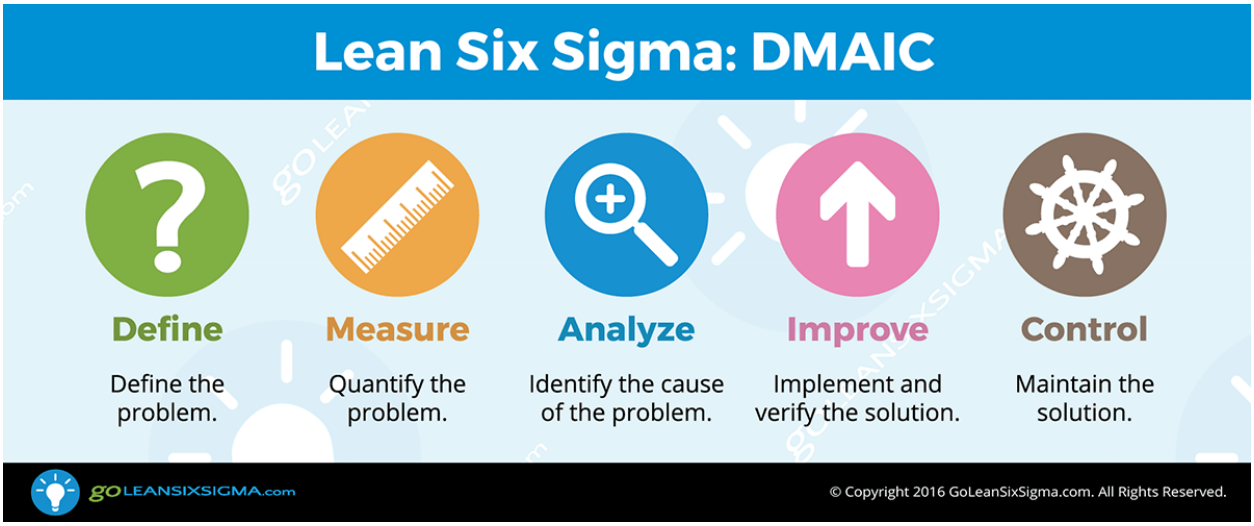
A fifth area has been added to the first four, but it does not tie to solving a problem; instead, it focuses on taking advantage of emerging opportunities.

Potential Opportunity Analysis

Clear thinking for leveraging opportunities. Anticipate and leverage extra benefits from planned actions. Consider causes for each potential opportunity and how to promote them. Consider capitalizing actions and specific triggers if the opportunities occur. Potential Opportunity Analysis helps prepare in advance to gain the advantage when things go better than expected.

Anyone wishing additional information should visit the Kepner-Tregoe web site at https://www.kepner-tregoe.com

Lean Six Sigma (DMAIC) Process



Define

What problem would you like to fix? The Define Phase is the first phase of the Lean Six Sigma improvement process. In this phase the project team creates a Project Charter, a high-level map of the process and begins to understand the needs of the customers of the process. This is a critical phase in which the team outlines the project focus for themselves and the leadership of the organization. Learn More: Define Phase

Measure

How does the process currently perform? Or in other words, what is the magnitude of the problem? Measurement is critical throughout the life of the project. As the team starts collecting data, they focus on both the process as well as measuring what customers care about. That means initially there are two focuses: reducing lead time or improving quality. In the Measure Phase, the team refines the measurement definitions and determines the current performance or the baseline of the process. Learn More: Measure Phase

Lean Six Sigma (DMAIC) Process

Identify the cause of the problem.

Analyze

What is causing the problem? The Analyze Phase is often not given enough attention and, without analysis, teams jump to solutions before knowing the true root causes of the issues. The result is teams who implement solutions but don't resolve the problem! These efforts waste time, consume resources, create more variation and, often, cause new problems. The ideal is for teams to brainstorm potential root causes (not solutions), develop hypotheses as to why problems exist and then work to prove or disprove their hypotheses. Verification includes both process analysis and data analysis and has to be completed before implementing solutions. This is the crux of the Analyze Phase! Learn More: Analyze Phase

Implement and verify the solution.

Improve

How will the team mitigate the root causes of the problem? Once the project teams have determined the root causes it's time to develop solutions. The Improve Phase is where the team brainstorms solutions, pilots process changes, implements solutions and lastly, collects data to confirm there is measurable improvement. A structured improvement effort can lead to innovative and elegant solutions that improve the baseline measure and, ultimately, the customer experience. Learn More: Improve Phase

Maintain the solution.

Control

How do you sustain the improvement? Now that the process problem is fixed and improvements are in place, the team must ensure that the process maintains the gains. In the Control Phase the team is focused on creating a Monitoring Plan to continue measuring the success of the updated process and developing a Response Plan in case there is a dip in performance. Once in place, the team hands these plans off to the Process Owner for ongoing maintenance. Learn More: Control Phase

Source: https://goleansixsigma.com/dmaic-five-basic-phases-of-lean-six-sigma/

Managing the Problem-Solving Process – AT&T

In 1979, the HR Department of AT&T contracted with me to develop a one-and-a-half-day workshop that would equip second-level managers to solve problems. A high-level view of the problem-solving process created for that workshop is shown below.

Essentially, the process is a matter of Monitoring the situation to keep tabs on the alignment between *what is* and *what should be*, evaluating the information obtained to identify any existing or emerging problems, searching for solutions to any problems that exist and, once found, implementing them. Monitoring the situation is an ongoing process and it informs all concerned about the progress and success of any solutions being implemented.

An algorithm related to the process was also developed (see the next page). Below are the key questions the algorithm addresses:

Got A Problem?

- What do I want?
- What do I have?
- Is there a difference that must be addressed?

Is It Worth Solving?

- Prediction. If I don't do anything, will it go away? Will it stay the same? Will it get worse?
- Penalty. What does the problem cost me? The organization? What happens to me if I don't solve it?
- Payoff. What happens to me if I do solve it? What are the benefits to the organization?
- Priority. How badly does it hurt? Is this more or less important than other things I have to do?
- Possibility. How likely is it that I will be able to do something about it? Is it the kind of thing I should tackle?

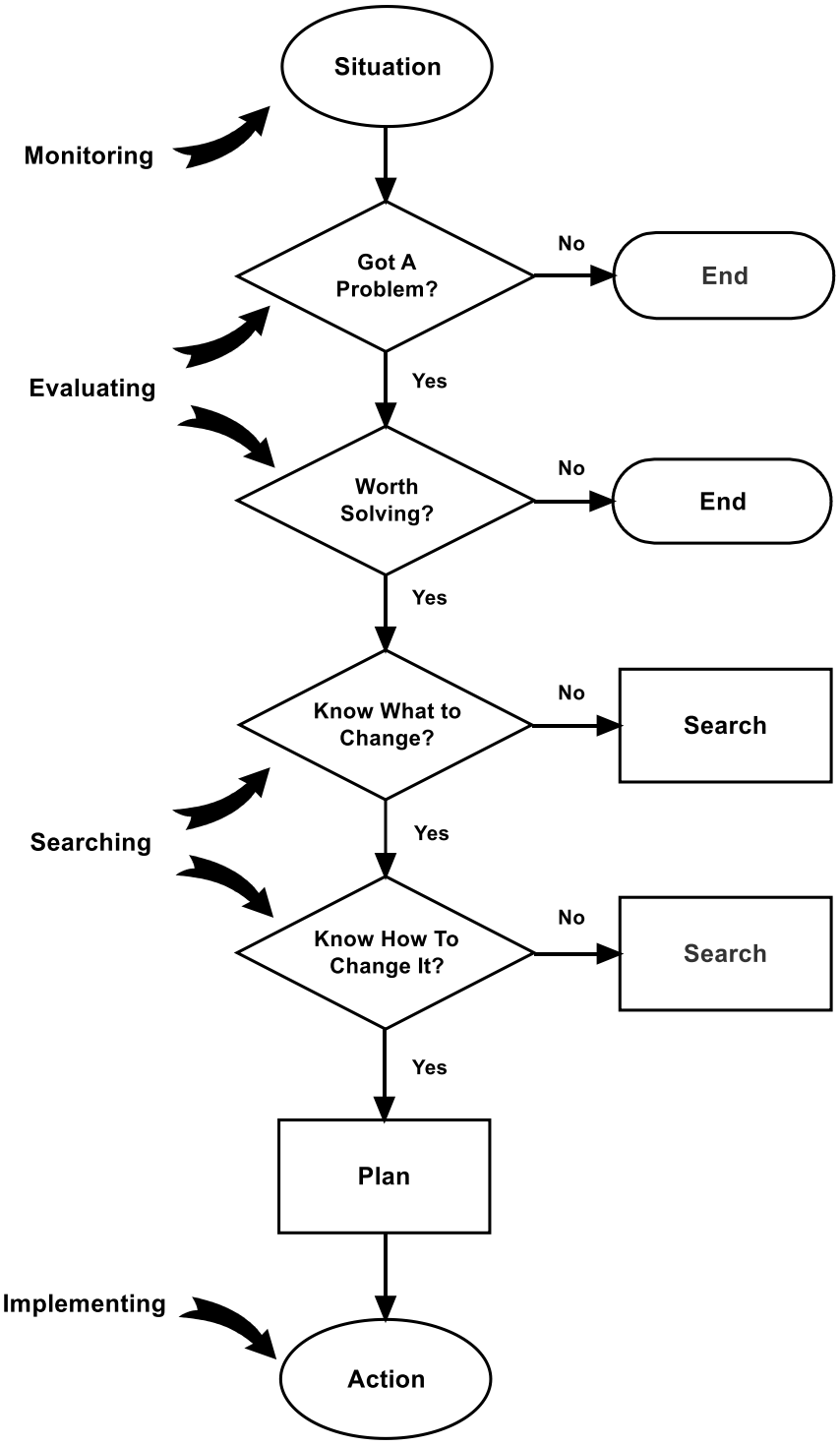
Do I Know What Has to Change to Solve the Problem?

- Can I describe the specific variables that must be changed?
- Can I trace or explain the connections between variables I can change and the results I'm after?

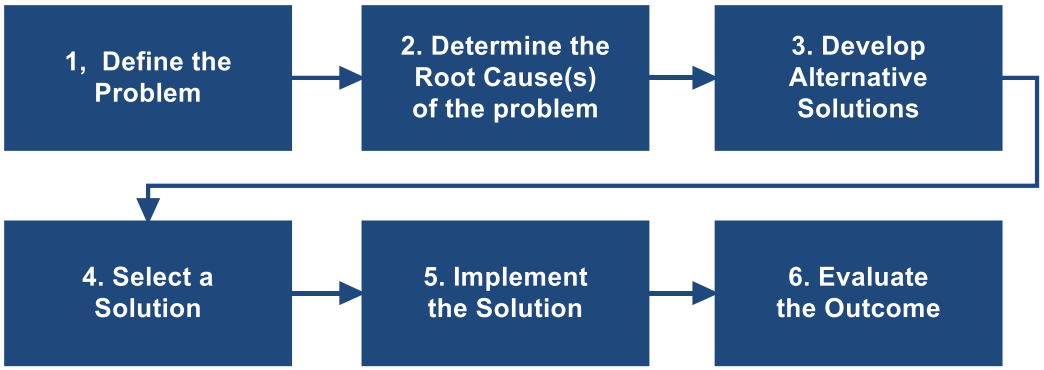
Do I Know How to Change It?

- Can I describe the kinds of actions required?
- Can I explain how these actions will affect the variables that must be changed?
- Can I describe how these actions are actually carried out?

Managing the Problem-Solving Process – AT&T



The Six-Step Model



Advantages of Six-Step Problem Solving

The Six-Step method provides a focused procedure for the problem solving (PS) group.

- It ensures consistency, as everyone understands the approach to be used.
- By using data, it helps eliminate bias and preconceptions, leading to greater objectivity.
- It helps to remove divisions and encourages collaborative working.
- It stops PS groups diverging into different problems.
- It also helps PS groups reach consensus
- It eliminates the confusion caused when people use different problem-solving techniques on the same issue.
- It makes the decision-making process easier.
- It provides a justifiable solution.
  All six steps are followed in order – as a cycle, beginning with "1. Identify the Problem." Each step must be completed before moving on to the next step.

The steps are repeatable. At any point the group can return to an earlier step and proceed from there. For example, once the real problem is identified – using "2. Determine the Root Cause(s) of the Problem", the group may return to the first step to redefine the problem.

Activities and techniques associated with each of the six steps are listed below.

The Six-Step Model

Step 1: Define the Problem

- Brainstorming
- Interviewing
- Questionnaires

Step 2: Determine the Root Cause(s) of the Problem

- Fishbone Diagrams
- Pareto Analysis
- Affinity Diagrams

Step 3: Develop Alternative Solutions

- Generate
- Assess
- Select

Step 4: Select a Solution

- Feasibility
- Acceptability

Step 5: Implement the Solution

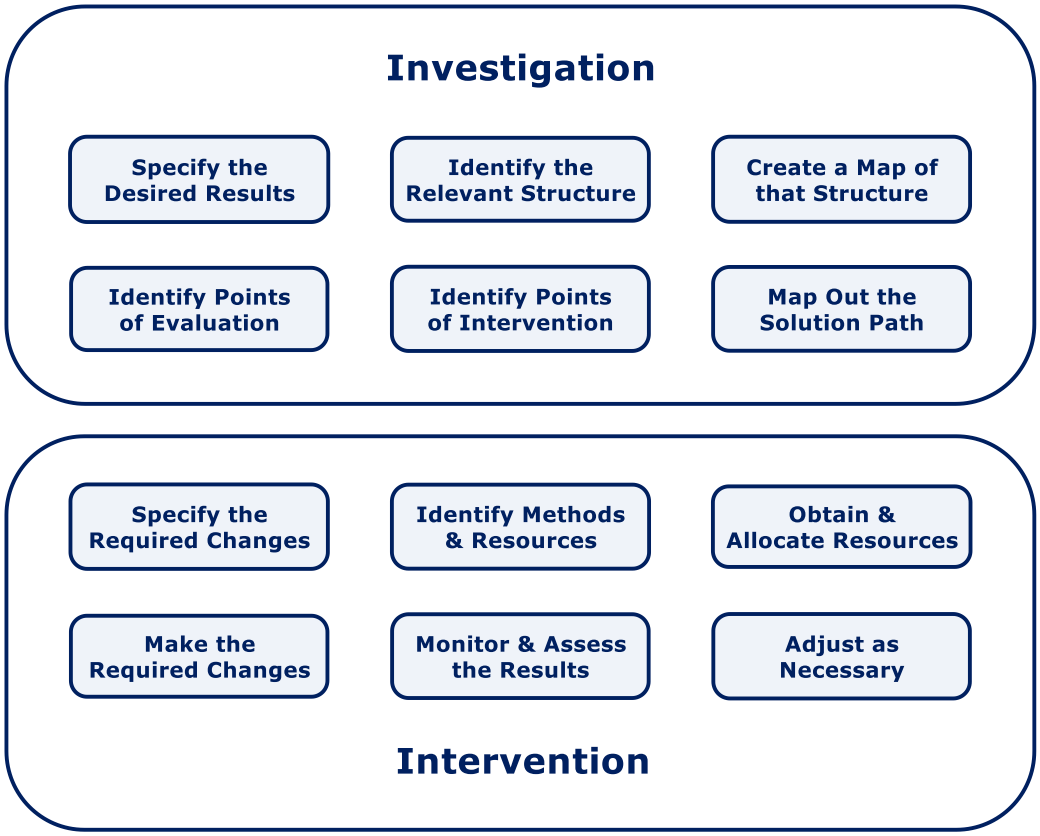
- Designate Project Manager
- Identify Necessary Others
- Set Start Date
- Set Milestones
- Identify Pre-Implementation Actions
- Identify Implementation Actions

Step 6: Evaluate the Outcome

- Milestones Met
- Costs Contained
- Work Completed According to Plan and Schedule

Source: http://www.free-management-ebooks.com/news/six-step-problem-solving-model/

Solution Engineering



To "engineer" a solution means to bring it about through skillful, artful endeavor, as in "He was able to engineer a turnaround in the sales force's performance" or "She engineered a radically new approach to product development."

This is accomplished through an approach called "Solution Engineering." It has been successfully applied to operational problems, financial problems and problems of human performance.

A few of the more distinctive features of Solution Engineering include the following:

- It is results or solution-centered instead of problem or cause-centered.
- It is a non-linear, intelligence gathering or "cover-the-bases" activity, not a linear step-by-step procedure.
- It ties intervention to investigation, and it marries art with science.
- Change management is an integral part of Solution Engineering; it is built-in, not bolted on.

Solution Engineering

Perhaps its most distinguishing feature – and the source of its greatest value – is that the Solution Engineering approach requires you to make clear the connections between your immediate actions and the ultimate outcomes you seek.

This is accomplished by analyzing and mapping the structure of the situation in which the problem is embedded and in which you must intervene or change things with an outcome in mind.

The twelve "bases" that are covered during the effort to engineer a solution to a problem comprise the Solution Engineering process diagram above. They are shown below.

For more detail visit the Solution Engineering section of the Distance Consulting LLC web site at https://www.nickols.us/solutionengineering.html

Synectics

Synectics was developed as a result of observing many problem-solving sessions. This was done by two Arthur D Little consultants, George Prince, Bill Gordon and their team in the 1950s.

The process has nine steps:

1. Task Headline

Define the problem in the form 'How to…'

2. Task Analysis

Set out why the problem exists, and its background, the opportunity before you and what you have already tried or thought of. If you have one, set out your 'dream solution', so that later, you can see if there are ways to break down the barriers to achieving it.

3. Springboards

Invite provocative statements and random ideas to set off creative thinking, like:

Synectics

- *'Why can't we…'*
- *'I want to…'*
- *'If only we could…'*
- *'One idea might be to…'*
- *'With unlimited resources, we could…'*

4. Selection

Select the most appealing ideas to emerge from the Springboard, to work on further. These may be practical, visionary or intriguing.

5. Ways and Means

Look for practical steps to develop selected ideas, and ways you may be able to implement them.

6. Emerging Idea

Allow one idea to emerge as the strongest potential solution.

7. Itemized Response

Evaluate the Emerging Idea, looking for ideas for how to make it work until you identify the best way forward, if the idea were finally chosen. Test out your level of satisfaction with the idea/implementation package: is this your possible solution? If it is not, return to Step 6 and work with a new Emerging Idea.

8. Possible Solution

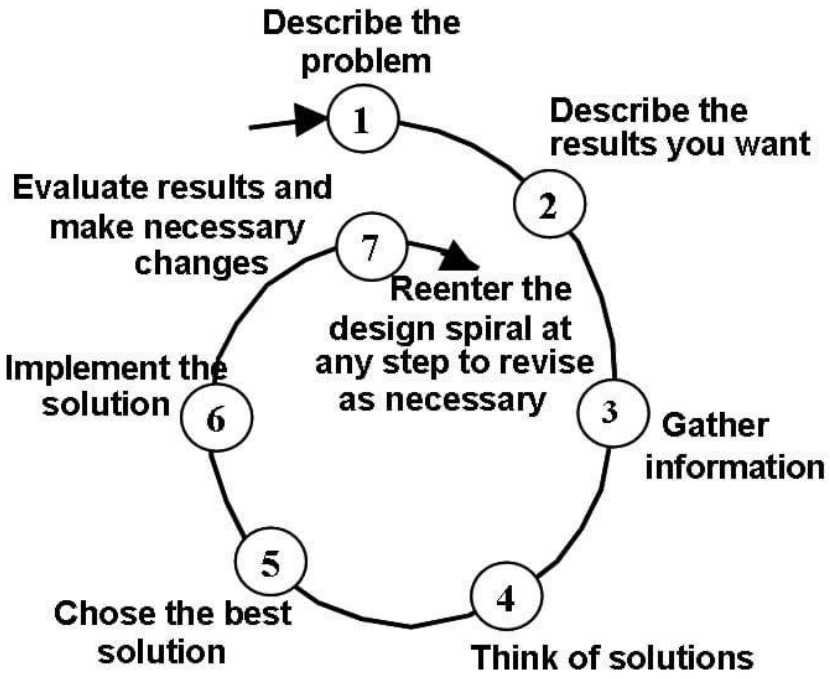
State and document the Possible Solution and the associated implementation approaches.

9. Next Step

Document the actions to be taken, by whom and to what deadlines.

Source: https://www.pocketbook.co.uk/blog/2013/10/22/the-synectics-problem-solving-process/

Technological Method of Problem Solving



The Seven Steps of Problem Solving

1. Identify the problem

- Clearly state the problem. (Short, sweet and to the point. This is the "big picture" problem, not the specific project you have been assigned.)

2. Establish what you want to achieve

- Completion of a specific project that will help to solve the overall problem.
- In one sentence answer the following question: How will I know I've completed this project?
- List criteria and constraints: Criteria are things you want the solution to have. Constraints are limitations, sometimes called specifications, or restrictions that should be part of the solution. They could be the type of materials, the size or weight the

Technological Method of Problem Solving

solution must meet, the specific tools or machines you have available, time you have to complete the task and cost of construction or materials.

3. Gather information and research

- Research is sometimes needed both to better understand the problem itself as well as possible solutions.
- Don't reinvent the wheel – looking at other solutions can lead to better solutions.
- Use past experiences.

4. Brainstorm possible solutions

- List and/or sketch (as appropriate) as many solutions as you can think of.

5. Choose the best solution

- Evaluate solution by 1) Comparing possible solution against constraints and criteria and 2) Making trade-offs to identify "best."

6. Implement the solution

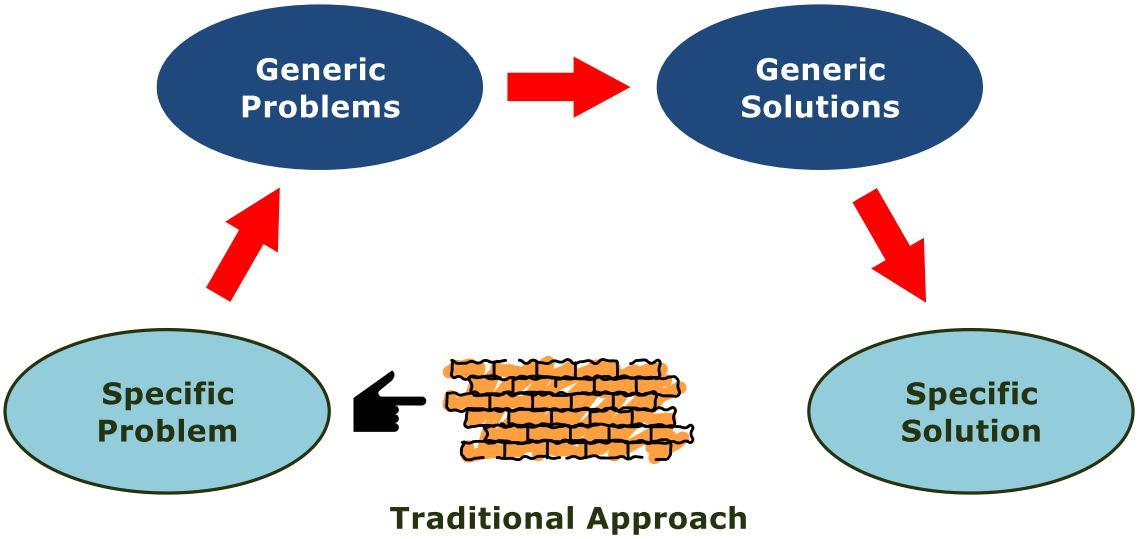
- Develop plans that include (as required): drawings with measurements, details of construction, construction procedure.
- Define tasks and resources necessary for implementation.
- Implement actual plan as appropriate for your particular project.

7. Test and evaluate the solution

- Compare the solution against the criteria and constraints.
- Define how you might modify the solution for different or better results.

Source: https://www.teachengineering.org/lessons/view/cla_lesson2_problem_solving

TRIZ



The Key TRIZ Tools

Two of the central concepts behind TRIZ are: (1) generalizing problems and solutions and (2) eliminating contradictions.

1. Generalizing Problems and Solutions

The primary findings of TRIZ research are as follows:

- Problems and solutions are repeated across industries and sciences. By representing a problem as a "contradiction" (we explore this later in this article), you can predict creative solutions to that problem.
- Patterns of technical evolution tend to repeat themselves across industries and sciences.
- Creative innovations often use scientific effects outside the field where they were developed.

Using TRIZ consists of learning these repeating patterns of problem and solution, understanding the contradictions present in a situation, and developing new methods of using scientific effects.

You then apply the general TRIZ patterns to the specific situation that confronts you and discover a generalized version of the problem.

TRIZ

2. Eliminating Contradictions

Another fundamental TRIZ concept is that there are fundamental contradictions at the root of most problems. In many cases, a reliable way to solve a problem is to eliminate these contradictions.

TRIZ recognizes two categories of contradictions:

1. Technical contradictions. These are classical engineering "trade-offs," where you can't reach the desired state because something else in the system prevents it. In other words, when something gets better, something else automatically gets worse. For example:

   - The product gets stronger (good), but the weight increases (bad).
   - Service is customized to each customer (good), but the service delivery system gets complicated (bad).
   - Training is comprehensive (good), but it keeps employees away from their assignments (bad).

   The key technical contradictions are summarized in the **TRIZ Contradiction Matrix**. As with all TRIZ resources, it takes time and study to become familiar with the Contradiction Matrix.

2. Physical (or "inherent") contradictions. These are situations in which an object or system suffers contradictory, opposite requirements. Everyday examples include:

   - Software should be complex (to have many features), but simple (to be easy to learn).
   - Coffee should be hot (to be enjoyed), but cool (to avoid burning the drinker).
   - An umbrella should be large (to keep the rain off), but small (to be maneuverable in a crowd).

   You can solve physical contradictions with the **TRIZ Separation Principles**. These separate your requirements according to basic categories of Space, Time and Scale.

Source: https://www.mindtools.com/pages/article/newCT_92.htm

TRIZ is the Russian acronym for “Theory of Inventive Problem Solving.” TRIZ was developed by a Russian inventor and science fiction writer named Genrich Altshuller.