

Solving problems from first principles

Summary: The range of problems is extremely varied and therefore no single problem solving methodology used in the same way can be the best practice. The NASCAR pit crew on race day is going to have different needs than the nuclear reactor operator. Understanding the fundamentals of problem solving will help you best tackle each specific problem you face regardless of the differences between problems and the solutions required.



Written by Taylor Milner, June 2009

Introduction

As engineers, one of your primary roles will be as a problem solver. Therefore, much of your success will depend on how good a problem solver you are. To maximize your personal success, how do you make sure you are the best problem solver? From this author's perspective, it is by understanding problem solving from the fundamentals and approaching every problem from first principles.

There are lots of different types of problems that you will tackle as an engineer: improving an outdated process with new technology, fixing a process that did not work in the first place, or developing a completely new idea. Each problem will have its own set of characteristics. These characteristics will define how to tackle each specific problem best. What may be appropriate for one, will not be for another, and your winning problem solving strategy may not always work.

Many different problem solving methods exist to help you structure your problem solving, but no single one of them is right for every situation. To be able to tackle a specific problem best, you must understand the fundamentals behind problem solving. By taking a fundamentals based approach, you will be able to utilize the best parts of

different problem solving approaches and apply them to the specific situation.

In this article, we will look at the basic steps of problem solving. We will explore the goal of each step and how we achieve it. We will also look at the different types of methodologies that exist and their strengths and weaknesses. We will attempt to give the reader the ability to understand them from the fundamentals and avoid being caught up in the hype around one methodology over another.

The Continuum of Problem Solving Methodologies

Problem solving methodologies come in many forms and can be characterized by any number of their traits. This author likes to think of problem solving methodologies in two different ways: the formality of the method and the aptitude required to use it.

Some methods are quite formal and even bureaucratic. Because of this, they can be very useful in situations where incredible detail is necessary. Imagine a nuclear power plant where structure, process, and record keeping are paramount. The formality of these processes also makes them time consuming. They are therefore not always the best choice in fast-paced situations, such as a high-speed manufacturing line or the NASCAR team on race day.

Different Problem Solving Methodologies

- Divide and conquer
- Means-ends analysis
- Trial-and-error
- Guess and Check
- Brainstorming
- 5 Whys
- Kepner-Tregoe
- Failure mode and effects analysis (FMEA.)
- Pareto analysis
- Fault tree analysis
- Bayesian inference
- Ishikawa diagram (Fishbone diagram)
- Cause Mapping
- Barrier analysis
- Change analysis
- Causal factor tree analysis
- Event and Causal Factor Charting
- TapRoot
- ARCA; Apollo Root Cause Analysis
- RPR Problem Diagnosis
- Morphological analysis
- Method of focal objects
- Lateral thinking
- Research
- Reduction (complexity)
- Hypothesis testing
- Root Cause Analysis
- Working Backwards
- Forward-Looking Strategy
- Simplification
- Generalization
- Specialization
- Split-Half Method
- The GROW model
- TRIZ
- Eight Disciplines Problem Solving
- Southbeach Notation
- Behavior Justification
- Cause and effect analysis

Other methodologies are the opposite: incredibly simple and fluid. These are generally aimed at giving those involved in problem solving a bit more rigor with the problem solving process than Guess-and-Check or Experience provides. These are great when you want to add some basic skills to people who not necessarily receive formal problem solving training, such as an assembly line worker. Unfortunately, these tools' usefulness decreases significantly when faced with a complex problem.

Below is a chart that visually displays this author's view of where many of the different problem solving methods fit along these two different continuums. (This does not speak to the quality of the methodology.)

| Very open | | | Highly formal | |
|---------------------------|-------------------------------|-------------------------|---------------------------|---------------|
| | Variable Analysis | TapRoot | DMAIC, DMADV, Apollo | High aptitude |
| | 6M's; 8P's; 4S's | Simple Root Cause (SRC) | | |
| | Ishikawa or Fishbone Diagrams | | | |
| Brainstorming, Experience | 5 Whys | | Work site risk assessment | Basic skill |

Detailing these differences reinforces the point that a universally effective methodology does not exist. When selecting the best problem solving tool, we have to consider the type of problem, who is going to be solving it, how much time they have, and what kind of solution they require.

The basic steps

Look at most problem solving methodologies and you will see the same basic steps:

- Define the problem
- Understanding the problem detail
- Analyze the problem to understand the root cause
- Develop a solution
- Implement and ensure successful elimination

For some methodologies, this may stretch or shrink in the number of defined steps, but most of them include some component of each of these five.

| | DMAIC | 5 Whys | Apollo | Brainstorming | Variable Analysis |
|--|---------|--|--|--------------------------------------|--|
| Define the problem | Define | Write down the problem | Define the problem | Set the Problem | Define the problem |
| Understanding the problem detail | Measure | | | Determine a set of leading questions | Describe the problem |
| Analyze the problem to understand the root cause | Analyze | Ask why until you have identified the root cause | Analyze cause and effect relationships | Generate ideas | Expand the analysis tree and eliminate the sub-variables |
| Develop a solution | Improve | | Identify Solutions | Evaluation of ideas | |
| Implement and ensure successful elimination | Control | Develop and implement a solution | Implement the best solutions | Implementation | Implement a solution |

It is good that we find this commonality between methods. This means that if we can understand the fundamentals of problem solving, we can tackle problems from first principles rather than be constrained by a fixed methodology. We can borrow the best parts of different methodologies while not being constrained by their weaknesses. This is not unlike in physics where understanding the fundamentals of mechanics, and the three or four laws that govern them, allows you to solve any problem. You do not need to be encumbered by lots of different formulae; instead, you can work out the physics of any given situation from first principles.

Understanding the fundamentals of each step

Defining the problem

The first step of any problem solving process is definition. This is not surprising, as we need to understand what the problem is before we actually start focusing on solving it. Different methodologies have different rules as to how you do this. Some, such as brainstorming, want the problem in the form of a question. Others, such as 5 whys treat this very simply and just ask, "What is the problem?" Conversely, some such as DMAIC are much more

complicated asking the solver to map the process and understand the customers.

So what are the critical principles to this step? First, we have to make sure we are working on the right problem. Second, we want to define that problem in such a way that we know when we have a problem and when we do not.

It may sound odd, but long running problems often have colloquial names attached to them that may not have anything to do with the problem. By following the name, you end up looking at something that may not actually be the problem you want to solve. As a problem solver, this is why making sure we are actually working on the right problem is so critical. Otherwise, we may waste our time going down the wrong path.

For example, one of my colleagues was once challenged with a problem that had always been called “froth density.” The problem occurred in the process of removing sand and water from oil while processing oil sands. Froth is the mixture of water and oil. The perception was that changes in density of the froth, the ratio of oil and water, cause different parts of the plant to fail taking them out of service and limiting the output of the process. This focused the organization on controlling the density of the froth. The team my colleague led found that froth and its density had nothing to do with the failure of equipment. Instead, there was foreign material finding its way into the process, which ended up plugging the equipment causing it to fail. All of the work that had gone into controlling froth density was interesting from an engineering perspective, and had no effect on plant throughput.

Likewise, we want to define the problem in such a way that we understand how to judge when we have a problem and when we do not. The easiest way to do this is to describe the problem in a measureable form with a value (or range of values) that indicates when we have a problem and when we do not.

Let’s take the simple example that you have a fuse that continues to trip in your kitchen. You could describe the problem as “blown fuse.” This gives you

some indication that you have a problem, but it does nothing to help you understand when you don’t have a problem and therefore the ideal state you are trying to work toward. Instead, we could define the problem as “amperage through the circuit.” With the help of an amp meter (or an electrician) we can find out that our circuit trips above 15 amps. This gives us a much clearer view of the problem we are actually trying to solve and a much better idea of how to fix it.

Additionally, if we can measure when we do and do not have a problem, we can be fairly certain we know what the problem is. Thinking back to the “froth density” problem above, there was no actual correlation between froth density and plant downtime. When my colleague first started looking at the problem, this was the first indication that it had nothing to do with “froth density.”

At the end of this first step of problem solving, you should have a clear understanding of what the problem is and when you have it. The next step is to understand the detail surrounding the problem.

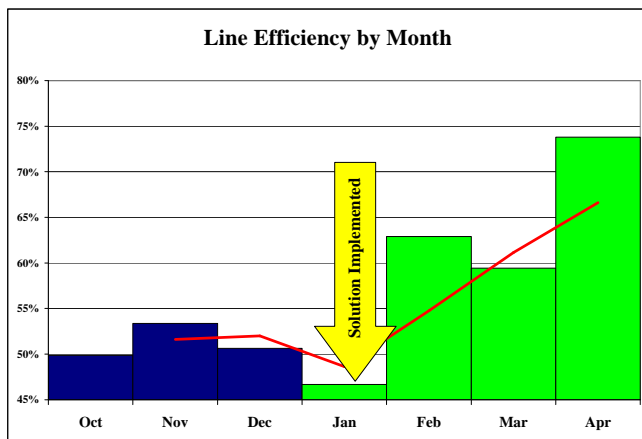
[Understanding the problem detail](#)

Of all of the steps in problem solving, I believe this one is the most useful. This is because if you do this step really well, you can likely solve 80%+ of the problems that exist. You will also make significant headway and add lots of insight into the other 20% (where the next step, analyzing the problem to root cause, becomes the critical step).

This step is about finding the patterns that the problem follows. Regardless of their complexity, all problems follow a pattern (we can only sometimes recognize it). To do this we need to ask all of the “who, what, where, when, why” questions about a problem. We need to collect and analyze failures when the problem has occurred. Above all, this step is about collecting facts and avoiding getting caught up in the opinions that surround the problem.

Here is a real example of how critical this step can be. A well-known national ready to eat cereal manufacturer had installed a new manufacturing line to consolidate the production of their signature brand.

The line made two sizes of product. Running the smaller of the two sizes was almost impossible because the bags of cereal would jam as they were put into the carton. The company had to keep two of the old lines and all of the costs involved to make up for the short fall in production. They also had to delay the installation of new capital into that space which delayed a new product launch and additional savings. Everything had been tried to solve this problem. The OEM's (Original Equipment Manufacturers) who designed the equipment had been in, as had the best engineers in the company. All of the maintenance personnel had tried to solve the problem as well. All attempts proved fruitless; it did not even get better. Almost all of the work to solve the problem had focused on the cartoner, the machine that put the bags of cereal into the carton. This is because the problem was first seen in the cartoner when a bag of cereal would jam the machine by not being fully inserted into its respective carton. The key to solving the problem came when a colleague of mine, someone who knew nothing about the problem (or making cereal for that matter), focused on understanding the pattern of failure.



The key pattern that my colleague found was that all of the jammed bags came from one of the three baggers upstream of the cartoner. The baggers filled the bags of cereal before sending them to the cartoner. This was not an easy pattern to find as it involved marking the individual bags as they came out of the different baggers and then following them downstream to the cartoner. After this pattern was found, developing and implementing a permanent solution took about 1 hour. The resulting improvement, as seen in the graph, increased the

throughput of the line by 20%. Additional problem solving drove the line performance up a total of 50% over the original baseline.

How do you get really good at collecting problem details and finding patterns? First, put finding solutions out of your mind. We so quickly want to find a solution that we forget to understand the problem. Instead, we hypothesize a solution and then look for a pattern that proves or disproves it. Ignore the solution and focus on the problem detail. Second, practice looking for patterns. As described above, the individual that solved the problem was the one who thought to look for the pattern in which bags caused the problem. As you look at problems, spend extra time thinking about and exploring the different patterns you could have.

- Some usual patterns in manufacturing environments:**
- On what side of the equipment do we see the failure?
 - Does the failure produce damaged product?
 - Does that damage show similar failures?
 - Does the failure come from a specific mould, head, machine, etc?
 - For rotating equipment:
 - How many revolutions between failures?
 - At what point in the revolution is the failure?
 - Where else do we see similar patterns?
 - Does the problem happen at a specific time, day, shift, etc?

[Analyze the problem to understand the root cause](#)

For the most complex problems, the most difficult 20%, this is the most critical step. It is also this step that I believe sets the truly great problem solving methodologies, and therefore problem solvers, apart. Problems become complex when:

- Several variables are failing at once or in such a way that spotting the root cause through pattern recognition is impossible.
- The root cause of the problem may not be readily visible.

To cover the first bullet, imagine you are working with a chemical process where the problem is the sudden loss of volume of a gas in a reaction. From basic chemistry we know that the pressure, temperature, and mass flow rate of a gas are could all

be causing the problem to happen. In this specific case, it is impossible to tell from the pattern of failure which one of these is actually causing the problem. Somehow, you will need to use a structured method for understanding how each of these properties is supposed to act and what is changing in the process to upset it separate from the other three.

As for the second point, the more steps it takes to reach the actual root cause, the more potential causes we have to check. The more checks, the longer it takes and the more potential we have for making. Think of problem solving as driving somewhere you have never been before. The more turns you have to make, the more likely you are going to get one of them wrong or miss one along the way. Additionally, in the case of problem solving not only are we more likely to make a mistake each time we check a potential root cause, but we also eat up valuable time. To continue our driving analogy, imagine you had to stop for five minutes every time you made a turn. If this were the case, we would see our GPS devices with another option besides shortest time and most use of freeways: fewest turns.

The key principles then for this step are: have a rigorous process for determining all the root causes that need analyzing and do it in such a way that we check the fewest number possible saving time and the potential for error. When comparing the different methodologies, some of the simplest, and therefore most popular, start to struggle as problems get more complex. Their biggest failure is allowing the solver to look at too many potential causes and therefore taking too long to solve the problem.

For example, a colleague of mine was recently working on a problem of the weight variation of granola bars. Previously to his work on the problem, the approach had been to look at the recipe for the product and see how all of the many different individual ingredients were varying. This was an incredibly time consuming and tedious process, especially when you consider the many different flavors of granola bars being produced.

My colleague took a different approach to minimize the number of variables his team needed to check.

Instead, he suggested that the weight of the granola bar was determined by only two variables: its volume and its density. Through only a few experiments he found that the initial density of the bars varied only slightly. They found this by picking apart the different ingredients in a bar and finding their ratio. This meant that the weight variation was largely caused by variations in initial volume. By eliminating density of material (and all of the formulation behind it), the team was able to focus on volume variation and determine a solution to the overall weight variation problem.

The above example illustrates why complex problem solving does not reward broad thinking. We want to limit the number of variables we need to check not expand it. Brainstorming, for example, epitomizes the drive for broad thinking and is therefore not structured enough to keep the user from running off down any number of paths. Although they may eventually get to the root cause, they simply take too long because the user has to check too many potential options. The same applies to some other methodologies such as 5 Why's, 6 M's, 8P's, and 4's that encourage the user to think of as many potential root causes as possible.

Let's look at an example that will help illustrate the importance of both of the principles described above. In this example, my colleague was confronted with a bacteria issue in fresh orange juice. This was a highly complex problem that had existed for two years and consumed hundreds of hours of problem solving focus. The organization faced with this problem had come to the conclusion that the problem was unsolvable. They were planning to redesign the entire filling system, at the cost of several million dollars, to eliminate any potential contamination issues (they hoped).

When he began working with the team on the problem, there was already a good picture of the pattern of failure. The contaminated juice all came from one filler that made a certain size carton. It caused an off flavor and the containers to swell. It was caused by a specific strain of bacteria, and almost no other bacterial contamination was ever seen. It occurred most frequently in one type of product "flavor."

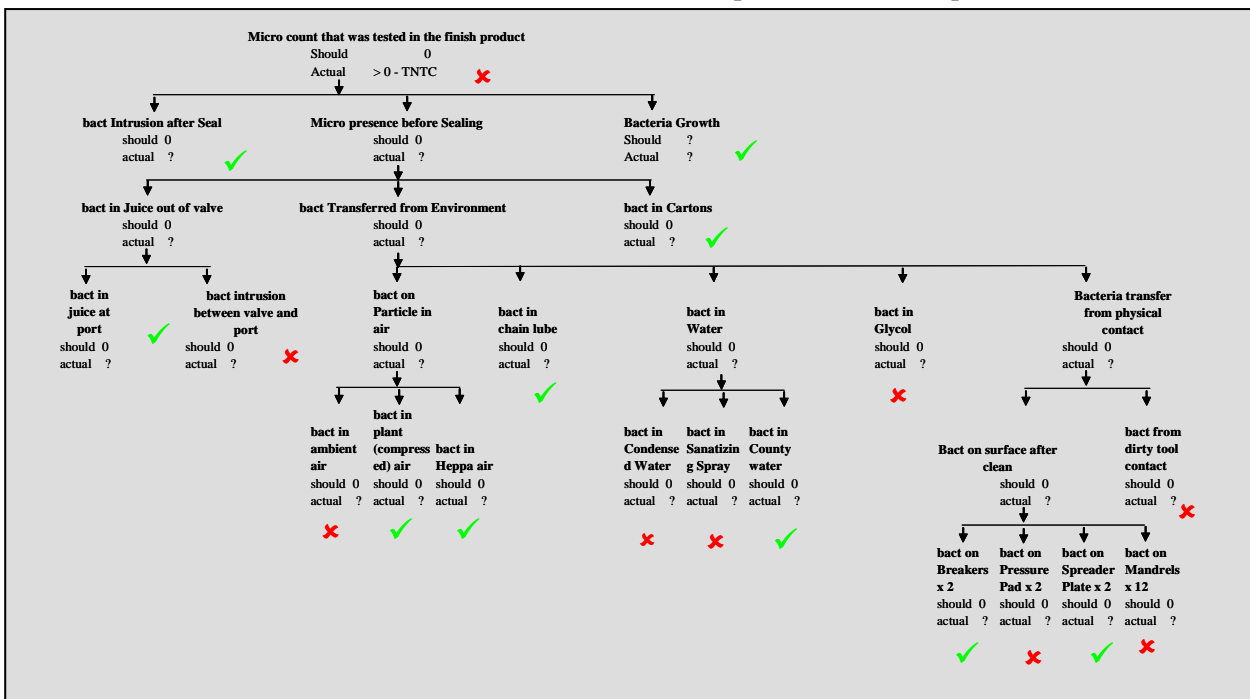
My colleagues, armed with the Variable Analysis method, but no knowledge of the juice industry or microbiology, began to tackle the problem with a team of experts in the filling process and microbiology. These were many of the same people that had worked on the problem previously and deemed it unsolvable. They used Variable Analysis to understand the different variables and sub-variables that controlled the growth of bacteria in the process. They were then able to check these different variables to understand their performance, especially during a failure. As the team moved down the tree, and the sub-variables got more specific, they were able to focus in on the root cause of the problem. You can better understand the complexity of the problem by looking at first few levels of the variable tree below. (The sub variables marked with a ☑ is in control; one marked with an ☒ is out of control)

problem solving that went into finding it. This is often the case with good problem solving as anyone can come up with a complex solution, but it takes really good problem solving ability to come up with a simple one.

For the most complex problems, this is the critical part of the problem solving process as it determines whether you get to the root cause or not. It is also the part of the process where you will spend the most time. Of all of the methodologies that exist, I have not found one better than the Variable Analysis process for finding root causes in a time efficient and structured manner.

[Develop a solution](#)

Once you have found the root cause, the next step is to develop a solution to the problem. With all of the



After six weeks of work, they found that the root cause of the problem was the temperature of one part of the machine that formed the cartons to be filled with juice. The mandrel that the carton was formed around was too cool, causing condensation to build up and providing a medium for the bacteria to grow. When the temperature of the mandrel was raised, the bacteria no longer had a medium for growth, and the problem went away. In hindsight, the solution to the problem is quite simple given the complexity of the

time and effort that has gone into finding the root cause to the problem, this step often gets less focus and our solutions are therefore not as robust as they could be. To understand the key principles of this step, let's understand the components of a great solution. A great solution should:

- Eliminate the problem completely and permanently

- Require as little future interaction to maintain as possible
- Be quick to implement
- Be as low cost as possible

Let's look at each one in more detail to understand how to achieve these four goals. First, we need to eliminate the problem completely and permanently. The best solutions completely eliminate a problem such that in a few years, people do not even remember the problem existed. The risk of not completely eliminating a problem, only reducing it, is that it slowly creeps back to its full extent without anyone really noticing. Additionally, because the problem still exists, people will attempt to continue to solve it. In doing so, they may inadvertently make this problem (or others) worse.

If we have to solve the problem again, even by implementing the same solution, we did not solve it permanently the first time. Permanent solutions are more difficult to generate than one might think. For example, we once worked with a client who made toilet paper and other paper products. They had a regularly occurring problem that would stop the machine that wound the rolls of toilet paper, caused by a screw coming loose. By just tightening the screw, they could make the problem go away, but they had not permanently solved it. To solve it permanently, they needed to eliminate the potential for the screw to come loose in the first place. Was there a way to use Loctite, change it to a bolt and locking nut, or best yet, weld the screw in place? Those would all be far more permanent solutions than just re-tightening the screw. In the end, they chose to weld the fixture in place.

Second, our solutions should require as little future interaction to maintain as possible. It is often very easy to come up with a solution that requires people to do something such as check a setting, record some data, and then make an adjustment. Anytime we add human interaction to a solution, we decrease the odds

of its long-term success significantly. Humans need motivation, time, and a host of other reasons to do something. We should not count on this happening to make our solution a success unless we have good set up accountability behind the solution. It is far easier to weld a fitting in place than get a person to check and make sure that fitting is positioned properly. It may take a little time to find out exactly where to weld this fitting in place, but it will save countless hours in the future.

The classic example of this is the settings of rails in lines that produce bottles and cans. The conveyors that move the bottles and cans between pieces of equipment have side rails to keep the bottles and cans from falling on the floor. These side rails are often adjustable to allow multiple sizes of bottles and cans to run on a single line. All lines have a couple of critical points where an out of adjustment rail causes a bottle or can to jam or fall over.



This downed bottle will subsequently jam a piece of equipment, stopping the line. It is not unlikely to see a line where 5% to 10% of total time is lost to downed bottles stopping the line.

Finding and fixing this problem by adjusting a rail might take an hour once it is identified as a problem. Unfortunately, unless some focused action is taken to making the solution permanent, the problem will likely return again when the line is changed to run a different sized product or the rail is bumped or vibrates out of position. In the best case, this adjustment is removed and the rails are welded in one position. When this is not possible, the rails can be fitted with special change parts that only allow them to be adjusted to specific positions.

A great resource for ideas for simple, permanent solutions is in the many different cycle time reduction methods (SMED, rapid changeover, etc). These methods look for ways to accelerate cycle times by reducing and eliminating the time it takes to complete different steps in a task. The race car pit crew is the

classic example of the application of one of these methods. They have found ways to reduce what might take the average person many minutes or hours down to a few seconds. These methods are a good resource because adjustments take time and eliminating them reduces the total time of the changeover process. Processes that have had SMED applied to them will often be great places to find ideas for taking adjustments out, adding permanence to our solutions.

When a solution does require human interaction, make the use of that solution the easier path to follow than not using the solution. Humans are quite predictable; we will follow the path of least resistance unless there is a significantly strong force in another direction. As Henry Ford put it, "Progress is not made by early risers or hard workers, but by LAZY people, trying to find easier ways to do the same." If a solution involves a person, think about what the motivations are for that person to follow the solution. Adding work or making a process more complicated are almost certain recipes for failure.

For example, I once worked with a team that was driving improvement on a line that produced multi-wall bags that are filled with cement and other building products. We had solved a number of problems on the line that allowed the overall speed of the line to be increased by almost 30%. All of the team's trials showed that running at this elevated speed was safe, caused less downtime, and produced more throughput. The challenge we had was convincing the operators of the line that they could successfully run the line at this speed all the time. To lock in our solution, we programmed the line to only run at this top speed, unless it was over ridden using a special key. We made sure the key was held by one of the team members at all times. After a few weeks, the operators were completely comfortable and calls to turn the speed down went away.

Third, the best solutions are quick to implement. Because they are quick, they may not be as elegant or as pretty as we may want, but the sooner they are implemented, the sooner we see the impact. The best way to make a solution quick to implement is to reduce the number of people that need to be involved. For example, if you are solving a problem in a

manufacturing environment for a consumer products company, keep the development of the solution only to people within manufacturing if you can. As soon as you go outside to include engineering, marketing, or sales, the time to implement goes up exponentially. By making solutions quick to implement we also reduce the amount of time we have to spend on the solution. Time is expensive, and your time is limited. Even if you are not directly involved in developing or building the solution, you will spend time following up on it and checking to see if it is on track. All of this time could be spent focused on the next opportunity.

Finally, make the solution as low cost as possible. This is for two reasons. First, low cost solutions help further reduce barriers to implementation. Lower cost solutions need fewer "signatures" to put in place, and therefore get implemented more quickly. This helps us keep the number of people involved to a minimum. Low cost solutions also increase the ROI of our solution.

When thinking about the cost of your solution, don't forget to think about the potential negative cost impacts of your solution on other parts of the process. You would hate to solve a \$100,000 problem in one area, only to cause a \$1,000,000 problem somewhere else. I once worked for a client who had an issue with a casing machine jamming. The machine's job was to put eight bottles of juice into a corrugated case and seal it for shipment. The machine would jam when more than eight bottles were loaded into the case. To solve the problem, a number of changes were made to the machine to reduce the number of bottles that could enter it, reducing the pressure on the bottles being loaded and the chance that an extra one would be forced into the case. This solution almost completely eliminated the problem. Unfortunately by significantly reducing the number of bottles the machine could hold, the amount of accumulation before the caser was reduced by 75%. This caused more downtime to be seen upstream of the caser and especially at the bottleneck of the line. The actual cost of the solution was a 15% decrease in total line productivity. In the end, we helped the client solve the jamming problem and put all of the accumulation

back into the line, driving productivity up 10% from its original levels.

[Implement a solution](#)

Once we have found the root cause and developed a solution to our problem, we have to implement it. In most cases, the actual implementation is quite simple. The challenge to this final step in problem solving is leveraging the solution. This is the key principle to this step: leverage the time and effort put into solving a single problem across as many opportunities as possible.

In certain instances this may be quite straight forward. If you are working in a manufacturing environment with many identical or virtually identical lines across the organization, applying the solution will seem obvious. This will be especially easy when these other processes are experiencing a similar failure and clamoring for a solution. One of my colleagues once worked for a client that made bags of microwave popcorn. He found that they were able to speed up a single line 10% by adding a couple of pieces of well-placed Teflon tape that stopped that paper from breaking at higher speeds. After this success, he quickly applied Teflon tape to 16 identical lines spread across a number of facilities—effectively creating another one and a half popcorn lines, and eliminating the need for any new capital expenditure.

In other situations, leveraging the solution may not be as obvious. For example, if you have solved a problem while designing a one of a kind prototype, the opportunity to spread this solution may not be instantly visible. The key then is to find ways to explore potential avenues for leverage. The best problem solving methodologies at this step are incredibly rigorous at asking numerous questions to stimulate this thinking. These questions include:

- What similar processes do we have where this solution might apply?
- What similar pieces of equipment do we have in other processes?
- Where are we making a similar product?
- How did the solution impact the process? How can we create this impact in unrelated processes?

As one would expect, if you are working in an environment with lots of repeatability of process or product, this will be a key step. Industries such as consumer goods, food, and automobile manufacturing, utilities, and technology come to mind as highly repeatable where single solutions can be leveraged across numerous opportunities.

In any case, do not underestimate the amount of communication and follow up it may take to spread a solution to all potential opportunities. I once worked for a client in the printing business. They had 10 identical printing presses spread across eight different sites in the United States. We solved a problem on one of the presses to allow it to go faster and print more sheets per minute. This required the addition of a high-pressure air line and 12 nozzles to control the paper better as it moved through the machine at higher speeds. We tried to spread the solution to the other nine presses by sending an email with all of the requisite information to the other seven facilities. Because many of the other facilities did not understand the reasoning for the solution, it was not implemented on the other presses initially. It took significant follow up, including multiple visits to all of the other facilities, before the solution was fully implemented across the entire organization.

[The devotees and purists – a note of caution](#)

All great problem solvers will likely gravitate to a preferred methodology that they use as a framework. Some will recognize that it is just that, a framework, and will, as I have suggested, work from first principles using this framework as a guide. I put myself in this camp. I work within the framework of the Variable Analysis methodology because I believe that it is the best methodology for the problems I most often find myself facing. That being said, I also try to pull in the strong points of other methodologies as needed.

Another set of individuals is 100% attached to their specific method of choice. They believe that their method of choice is perfect for every problem in every situation. For them, this may be true, as they have learned to stretch and form their method of choice to meet these situations, without recognizing that they doing so. These individuals are easy to identify

because their method is the only method, and they are quick to brush all other methodologies aside. They will disagree with almost everything I have said above because they believe their method is perfect in every situation.

[The pieces that are not important](#)

Just as recognizing the key principles to your success as a problem solver is important, so too is the recognition of the pieces that are not important. Some of these include:

- The name
- The templates used to facilitate the different steps depending on the method
- The size of paper you use to do the problem solving on
- The colors used to highlight different steps

As you read the above I hope you laughed at the ridiculousness of some of these items, even though I have been told at one point or another how important each one of these is to success at problem solving. Like all things, a bit of structure is good in making a process more efficient. Taking this to extremes where the exactness of the process followed is more important than the permanent solution at the end is not a winning strategy.

Summary

We hope that at this point you have a clear understanding of the key principles to the different steps of problem solving. By understanding and following these principles, you will be a better problem solver than if you focused on a single method alone.

The range of problems is extremely varied and therefore no single problem solving methodology used the same way can be the best practice. The NASCAR pit crew on race day is going to have different needs than the nuclear reactor operator. Understanding the differences between problems and the solutions required will define how they can best be tackled. In every case, understanding the fundamentals behind problem solving will help you best tackle each specific problem.

Thought provoking questions:

1. Why do you think all problem solving methodologies follow the same basic steps?
2. What are the different situational factors (time, location, people involved) that might affect how a problem is solved? Which do you think will be the most important to consider most often?
3. What are some of the key components to think about when developing a solution to a problem?
4. What situations can you think of where one methodology might work very well and another might fail?
5. What are two examples where you followed a problem solving methodology (knowingly or not) and what was

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Taylor is a Principal in Stroud Consulting's North American Office based in Marblehead, Massachusetts office. He has been with the company since its founding in 2001. In his time at Stroud, Taylor has managed and led various client engagements in a diverse set of industries from food and beverage to paper and packaging to healthcare. His engagements have included work driving improvement in manufacturing operations, customer service, sales, and transportation and logistics.