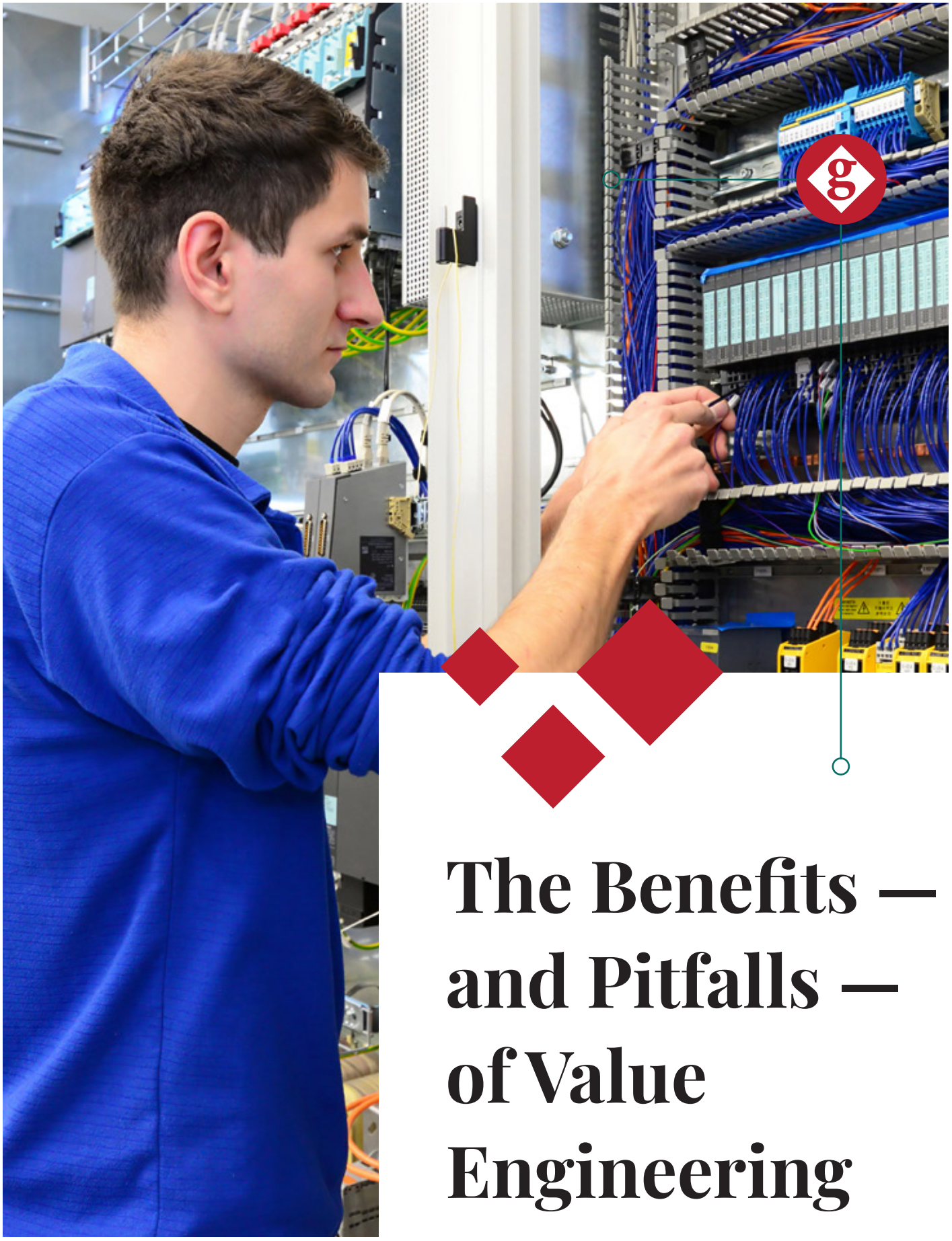


The Benefits — and Pitfalls — of Value Engineering

Value engineering was conceived at General Electric (GE) during World War II in response to shortages of skilled labor, raw materials, and component parts. As engineers at GE identified acceptable substitutes, they also noticed that the replacements often reduced costs, improved the product, or sometimes accomplished both. This serendipitous discovery was later turned into a systematic process dubbed “value analysis.”

Although the term “value analysis” is routinely interchanged with “value engineering,” there are important differences between the two processes:

- Value analysis looks at similar aspects of savings *after product release*
- Value engineering applies to the activities *during product design*

For the purposes of this paper, “value engineering” refers to a review process that can happen within either of these lifecycle stages.

Defining Value Engineering

According to the United States government, value engineering is:

> *an analysis of the functions of a program, project, system, product, item of equipment, building, facility, service, or supply of an executive agency, performed by a qualified agency or contractor personnel, directed at improving performance, quality, safety, and life-cycle costs.*

Formulaically, value engineering is a systematic method to improve the "value" of goods or products and services by using an examination of function and cost.

Value = Function/Cost

- **Function:** the specific work or actions that a product must (or can) perform
- **Cost:** the material and time cost of the product, including manufacturing and testing
- **Value:** the most cost-effective way to reliably accomplish the functionality that will meet the user's needs, desires, and expectations

This formula can vary greatly, since each variable really represents a theory.

Applying the Value Engineering Formula

There are two ways to apply value engineering:

- Decreasing cost while maintaining functionality
- Maintaining cost while increasing functionality

> *Either path is a viable option, though it is imperative that the functionality has quantifiable value to the end user. Adding functionality without validating its value can be detrimental to a product's true value, and thus could be counterproductive.*

A deeper dive into each option reveals benefits and pitfalls.

Decreasing Cost While Maintaining Functionality

This method is generally preferred by OEMs. They have a product that works well and maintains a healthy market share — but the OEM wants to increase margins by decreasing cost.

The more complex a product is to fabricate at a component level or to assemble and test, the more likely it is there are opportunities to reduce costs in these key areas:

- **Reduced purchase price of individual materials or components**

  There may be options for new suppliers, supplier consolidation, or fabrication process improvements. Specific components vary greatly across product categories, but the baseline principle remains universal. Each component of a higher-level assembly is a possible candidate for cost reduction, though common practice dictates application of the 80/20 rule. Deeper analysis performed on fewer high-cost items typically generates the fastest and most significant savings.

- **Reduction or combination of components**

  Combining multiple components into a single part or eliminating unneeded components can lead to both hard and soft cost savings. Having fewer parts translates to fewer required touches to manage quality, assembly time, waste, supplier interaction, and so forth. This particular aspect falls wholly within the Design for Manufacturability (DfM) category, since a guiding DfM principle is part reduction.

  Likewise, Albert Einstein was right when he said, "*The best design is the simplest one that works.*" Reducing SKUs by using common components can also be particularly effective. For example, using a common screw across a specific product or family of products can simplify part management and is often a viable option for mature products.

- **Sub-tier supplier consolidation**

  Increasing total volume with fewer suppliers can reduce costs of supplied parts be it through make/buy decisions, kitting at sub-tier suppliers, or consolidating purchases for complements in a specific category. As a contract manufacturer for global tier one OEMs, GMI has seen the effects of this firsthand. Strategic relationships with fewer key suppliers can be a win-win at every level of product manufacture and can reduce the overall cost of most components.

- **Assembly process improvements**

  Over time, processes often get comfortable for the manufacturing team; the philosophy of "that's how we've always done it" can carry significant costs over a product's lifecycle. It is important to always question how things are done at every step. Fixtures and jigs, assembly order, and efficient systems can all lead to solid gains. Process review by outside sources can also reveal possible improvements.

  An internal process-based Kaizen event may also prove valuable. Get new cross-discipline team members to watch the fabrication, assembly, and testing processes to objectively identify and discuss areas of question or concern. GMI has participated in these types of events with large, global OEM partners and had great success. Kaizen was further expedited by having the product managers in the room with GMI engineering to address questions and possible solutions in real-time.

- **Testing process improvements**

  For capital equipment manufacturing, testing is often time-consuming and complex. This is especially true for application-critical capital equipment where heightened consideration must be given to activities or tools that can shorten or automate long testing sequences. Similarly, quantification of the effectivity rate of each test needs to be monitored to prevent allocation of time to testing product aspects that are extremely unlikely to occur.

  While it is clearly not healthy to remove testing that avoids risk, there are often improvements that can be made to save time — and thus money — on each unit that is tested. Recurring savings, even small ones, really add up when the total quantity is considered.

Why Should I Use a Single-Source Supplier?

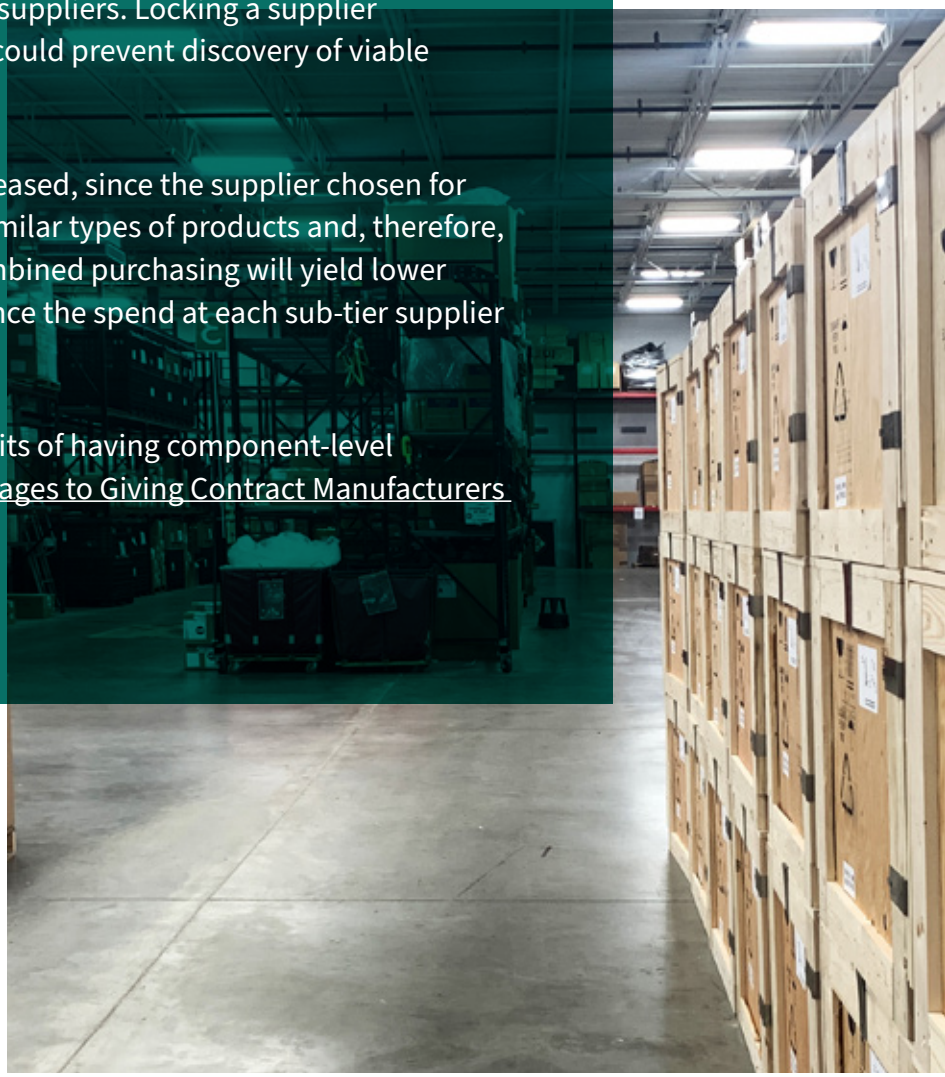
To realize the most value, an OEM should gravitate toward a single source for the product or assembly at a higher level.

Supplier consolidation — getting the higher level assembly from a single source — offers one of the best options for ongoing value engineering. The more a supplier understands a product at an assembly level, the more holistically the components and assembly process can be assessed and improved.

Freedom to explore changes is critical, and suppliers should be allowed to pursue improvements with sub-suppliers. Locking a supplier into extremely rigid requirements could prevent discovery of viable opportunities for improvements.

Purchasing power can also be increased, since the supplier chosen for consolidation likely builds other similar types of products and, therefore, buys similar components. This combined purchasing will yield lower costs on individual components since the spend at each sub-tier supplier is increased.

For more information on the benefits of having component-level flexibility, see our ebook "4 Advantages to Giving Contract Manufacturers Supply Chain Flexibility"



Increasing Functionality While Maintaining Cost

Often when products are reviewed, the addition of new "bells and whistles" seems like a natural approach to achieving value engineering goals. This is sometimes ideal, and it is possible that the product needs to have new features to keep up with customer demands or compete with functions available on competitive products.

However, improvement for improvement's sake can lead to a number of potentially expensive pitfalls:

- **Adding new functionality with little or no additional cost**

  Sometimes, additional value via functionality can be added with little or no investment. If a simple and easily implemented change — perhaps a software update or tweak — can make your product better, it should be considered. However, the consolidation comes with a caution. There are other possible costs attached to the change — revision controls, product update issues, unknown effects, and other less tangible and unintended outcomes.

- **Adding functionality with a cost but with a higher return in value**

  It is an option to add value and cost to a product, provided the value to the customer is greater than the cost increase. This can also be harder to sell internally — chances are the value engineering process was entered into based on potential savings. Management may not want to hear about ideas that increase cost. Be ready to establish the value to the customer with empirical data.

- **Adding functionality to compete**

  Sometimes it becomes necessary to add functionality to maintain market share or keep up with competitors. Though these changes might feel forced, it is still important to use a value engineering philosophy. Sometimes, additional functionality adds value in less empirical ways — keeping your product relevant in the market may be the return on investment — even if margin levels are reduced.

  These situations may, in fact, require additional features. However, vigilance is required to avoid:

- **Adding functionality with no value**

  Development teams can fall into the "shiny object syndrome" and add new functions without verifying with customers that the added functions actually add value. It's nearly certain that new functions will add complexity, so the resulting value has to be significantly higher than that new complexity to truly be value engineering.

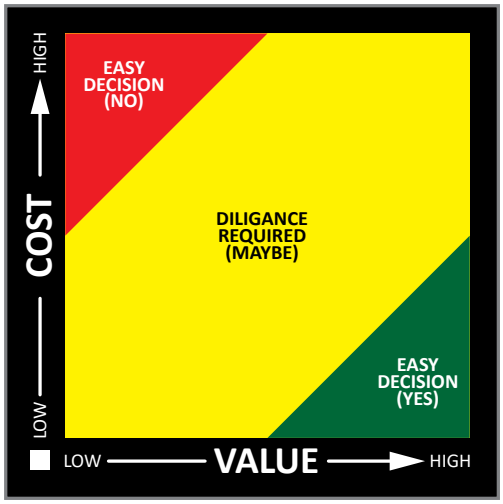
- **Adding functionality that ends up increasing cost**

  Obviously, adding functions drives potentially expensive changes and possibly new/revised hardware. When a team is assessing the costs of change, there needs to be complete understanding and support of the costs across the organization. Changing a product results in changes to items like existing customer support, product documentation, assembly and test processes, and many other aspects of product support internally and externally. Change is never free and due diligence is necessary to avoid surprises elsewhere.

- **Causing unnecessary delays**

  The more complex a product is, the more time it will take to make even minor changes. This is particularly true when it comes to application-critical capital equipment; the validation process can cause serious delays. Sometimes it is best to create a queue of potential changes and aggregate them into fewer, consolidated changes to reduce the quantity of changes while still leveraging the individual improvements.

This chart exhibits a path to help get to the right features to consider more efficiently. If a suggestion falls quickly into the red or the green areas, a quick decision can be made.



Clearly, ideas with high value and low cost should be implemented and in the opposite case rejected. Chances are most of the focus would be on the less obvious ideas; things that fall into the middle areas. They can still be great ideas — just less obvious.

Some ideas will be challenging to categorize; more due diligence may need to be done to truly understand the cost or value. Remember the value axis is best defined by customers. The team's perception is important, but the voice of the customer is king.

Ultimately it may be valuable to plot your ideas into the correct areas of a printed version of the chart.

If the product needs to get new functionality to keep market share and compete against similar products, it is important to recognize that and react accordingly. Regardless, teams should be very careful to avoid the pitfalls of this approach and not go overboard.

In the case where a product needs to be refreshed or improved to maintain its competitive edge, this should be treated as a separate activity. Consider finalizing the needed improvements to the product, then consider value engineering activities. Keeping them separate can help each activity reach its full potential.

The Value Engineering Process

There are eight critical steps that must work in tandem to accomplish the goals of a solid value engineering effort. The steps may vary by organization or by product, but it is critical to include each.

1 Gather information

The product must at least appear to be suitable for value engineering, since some products simply cannot be changed enough to make a real difference. If this is the case and your product shares a healthy market and is selling well, consider a price increase instead of value engineering. Depending on the scenario, this may be a simple way to accomplish the overarching goal.

For products that are clearly candidates for cost savings, strategically assemble a group that includes team members from the various departments that work with the product, from sourcing to support. Very valuable information can and should be gleaned from their unique perspectives.

2 Discern current functionality

This involves competitive and internal analysis. Depending on the product being assessed, it is important to understand the overall product functionality and the value customers place on those functions. While an internal team evaluates the product, they may have preconceptions on the value of specific functions since they were involved in the addition of those very functions. Reach out to customers for fresh, objective data. The results may validate the team's conclusions or hold some interesting surprises.

3 Pursue ideation

Ideation can come in a variety of forms. Some OEMs prefer an Kaizen-based approach, where multi-discipline teams look at a product and bounce ideas around. This can be very effective. For more complex products, it may make sense to divide teams into groups with specific knowledge to comprehensively assess each product aspect. A software engineer, for example, may not understand the options for making the product's cooling system more economical and the cooling system expert won't necessarily know what software simplifications are possible.

This is also where DfM and DfA tie into the process, as discussed in detail here.

To reiterate, there are two aspects to this analysis — reduction of undervalued functions and consideration of new functions.

If you can keep a higher value function using a lower costs option, this should certainly be considered. Conversely, when the time comes to add new functions, be sure there is data to support the value of the functions. Adding functions adds cost, and if the customer doesn't value it on any level, you are taking a step backwards.

4 Focus on refinement

Once ideas are short-listed for exploration, internal disciplines should get involved as needed. Divide the tasks into groups, and include mixed-discipline team members to form a well rounded team. This may include mechanical or electrical engineers, software developers, procurement teams, quality personnel, and even sales and marketing staff. Loop in the field service team too — they may have valuable customer feedback as well as insightful data, such as rates of failure for specific functions. Likewise, if there are specific people charged with customer satisfaction, be sure to include them throughout the process. If possible, you may even consider including customers in the process; they may offer objective insights on the value of a specific idea.

5 Develop the plans

Since there are many aspects of the process that vary tremendously by product category, you will need to develop a short list of elements to update or redesign. Take the best ideas that have been developed and explore options on both sides of the value engineering principles; reduce cost on existing functions or add new functions with high value to the customer with little or no cost increase.

This may mean changing materials, adopting off-the-shelf components to replace custom components, streamlining or automating testing procedures, reducing overall part count — the list goes on and on. Your product and your processes will dictate the details of the plans.

Though all ideas should be considered valuable, some ideas or possible solutions will drop off at the development stage. It may not be possible to implement some of the things that seemed to be great ideas, and that's perfectly acceptable. If all of the ideas are successful, you may not have reached far enough outside your conventional ideation. It's also important to keep the team engaged. Dismissing ideas outright can lead to people being reticent in expressing their ideas. This never makes the next effort better.

6 Present ideas for approval

Chances are there is a mixture of great ideas and "just okay" ideas that came from the ideation process. Further, some ideas were likely not possible or simply didn't make sense in the cost/function calculation.

When presenting the list of ideas, start with the general concepts and move toward the specifics of each aspect. Take the best ideas and assemble them into a clear presentation that explains the costs, timelines, internal requirements, effects on final functionality and cost.

Finally, consider creating two separate presentations — one for the executive team with summaries and one for the technical/operations team that includes the nuts and bolts of per-discipline implementation.

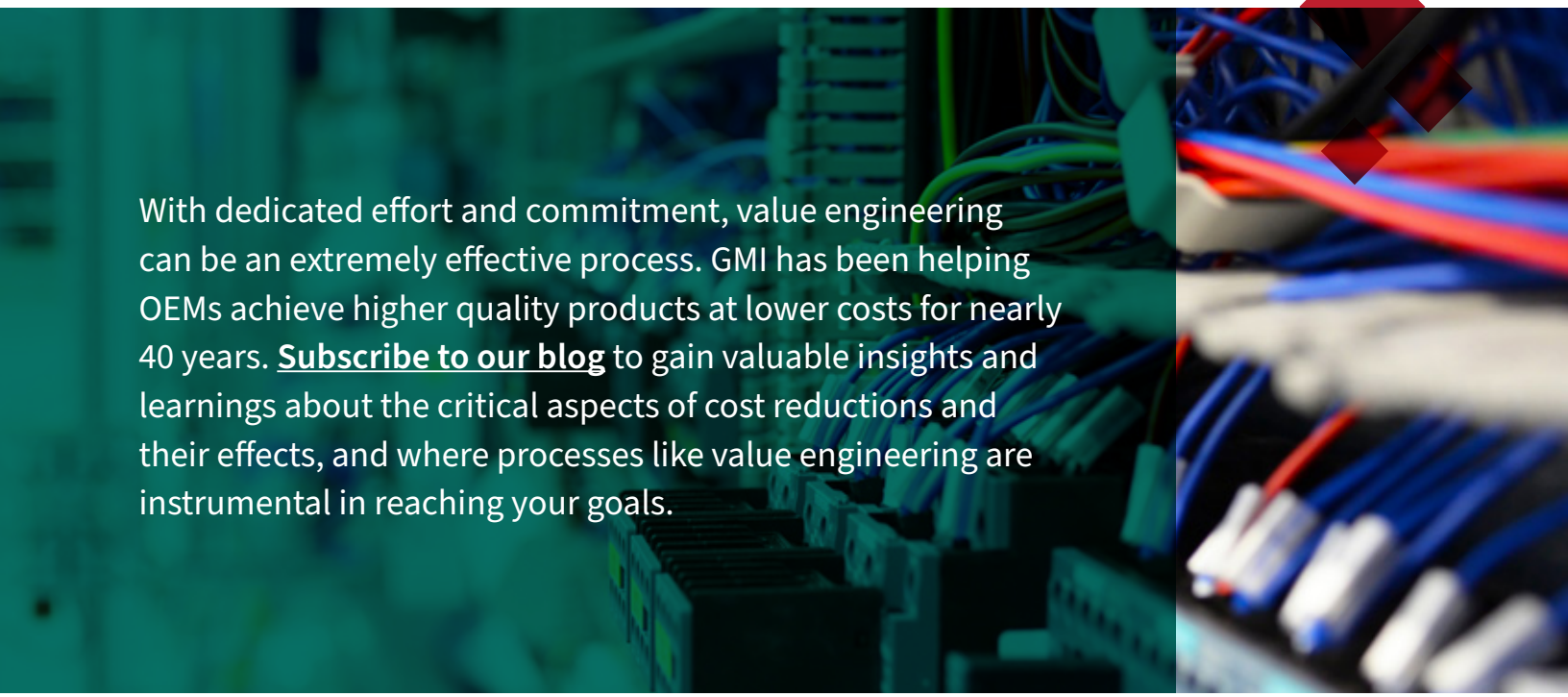
Review "The 5 Elements of Managing Change Successfully" to help make things easier and more palatable for the people approving the changes as well as those executing them.

7 Implement the process

For critical applications such as medical devices, there is a controlled process that needs to be strictly administered. Revisions need to be rolled, samples need to be tested, temporary deviations may be required, and ECOs need to be generated.

8 Validate the process

This is the final stage, and it is important to understand successes (and failures) of your team's efforts. If things went well, you should be able to roll these efforts up into provable savings using empirical data.



With dedicated effort and commitment, value engineering can be an extremely effective process. GMI has been helping OEMs achieve higher quality products at lower costs for nearly 40 years. **Subscribe to our blog** to gain valuable insights and learnings about the critical aspects of cost reductions and their effects, and where processes like value engineering are instrumental in reaching your goals.

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