
PROVEN STRATEGIES TO FUEL YOUR DESIGN TEAM

Overview

Continuous improvement separates great companies from mediocre ones. Innovative products, efficient manufacturing, and an energized staff are attributes of a company constantly looking at itself and asking, "How can we do this better?"



Manufacturing companies' design teams are an often underutilized asset for continuously improving products and processes. Given the right environment, design teams' work can extend beyond product design to improve other critical business areas. Design teams can help shorten time-to-market, reduce production errors and costs, and increase revenue.

If companies expect design teams to help fuel continuous improvement, they must foster an environment where the design team can continuously improve. It doesn't take big, disruptive changes in operations to create that kind of an environment. Although some business legends started with big, radical ideas, continuous improvement stems from many small changes that produce big results.

An increase of just 6 percent in the output of a manufacturing plant may not sound like much, but 6 percent increases over a dozen years will more than double a factory's production. The return on investment (ROI) is enormous. Experts estimate the odds of a radical new invention or process succeeding are between 0.1 and 10 percent.¹ The best strategy is to focus on myriad small innovations and watch them accumulate into big gains.

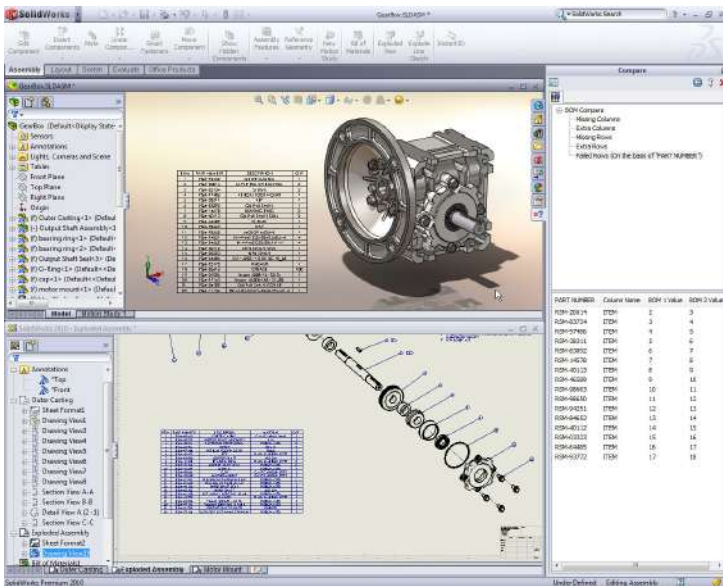
This paper focuses on strategies for applying the principle of continuous improvement to product design teams. It suggests ways to focus design teams on important and interesting work; provide them with the right tools; optimize their time through better scheduling; and enable them to contribute to manufacturing and sales processes.

Identifying and automating repetitive tasks

Designers spend hours each day performing repetitive tasks, but don't confuse repetitive with trivial. Many repetitive tasks are essential to the design process. When a design calls for several instances of features such as mounting pads, ribs, bosses, or slots with rounded ends, every one of them is important to the final design. The same holds true for inserting feature patterns such as bolt holes and vent-hole arrays. Toward the end of the design process, developing cost calculations and compiling bills of materials (BOMs) are critical parts of manufacturing resource planning, yet they are extremely repetitive.

Being repetitive makes these tasks excellent candidates for automation. If a designer must perform the same mouse clicks and keyboard strokes over and over, the task can most likely be scripted or users can create wizards to save keystrokes.

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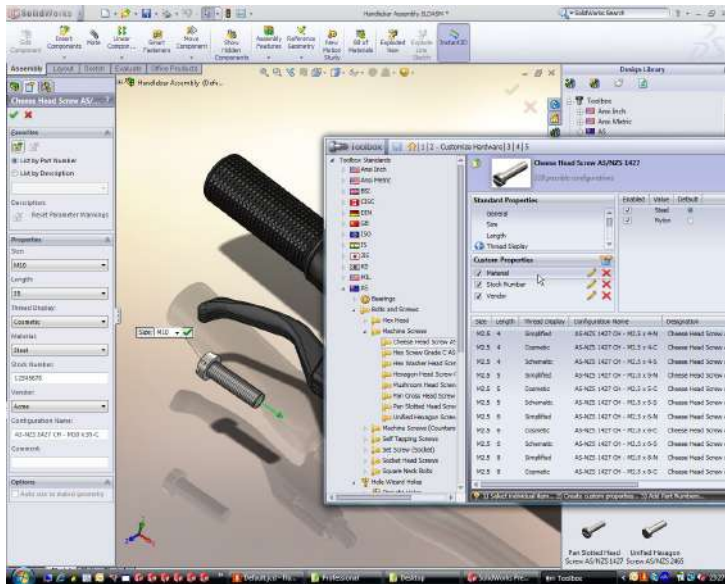
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Automation tools can save the average engineer hours each day by eliminating repetitive tasks.

All of the above tasks and many others can be automated using tools found in 3D CAD systems. Examples of automation tools include:

1. Library functions such as the SolidWorks® Toolbox, library parts, and features
2. Automated fastener placement and hole creation such as the SolidWorks Hole Wizard, Hole Series, and Smart Fasteners Technology
3. Part configurations and design tables
4. Patterns of parts and features
5. Design automation aids such as DriveWorks®
6. Visual Basic® macros
7. Interfaces that format and copy data to other systems

By automating routine tasks, designers can improve products faster, helping to drive down costs and increase competitiveness.



Maintaining a digital library of standard and often used parts is an easy way to improve productivity and streamline the design process.

Identifying past mistakes to prevent similar errors in the future

Even the best engineering organizations make mistakes, and new design concepts rarely work perfectly the first time. The difference between great design teams and poor ones is that great designers learn from their mistakes. Great design teams catch mistakes sooner, so they aren't compounded down the line. They look at what went wrong and use their experience to make future products better. Reducing failures in service can slash warranty costs, avoid product-liability lawsuits, and increase customer satisfaction. Savings from avoiding mistakes go straight to the bottom line.

Commonly occurring mistakes fall into two categories: structural and operational. The structural category encompasses all the problems that arise from poor or uninformed design. Interferences that affect fit or function are structural problems, for example.

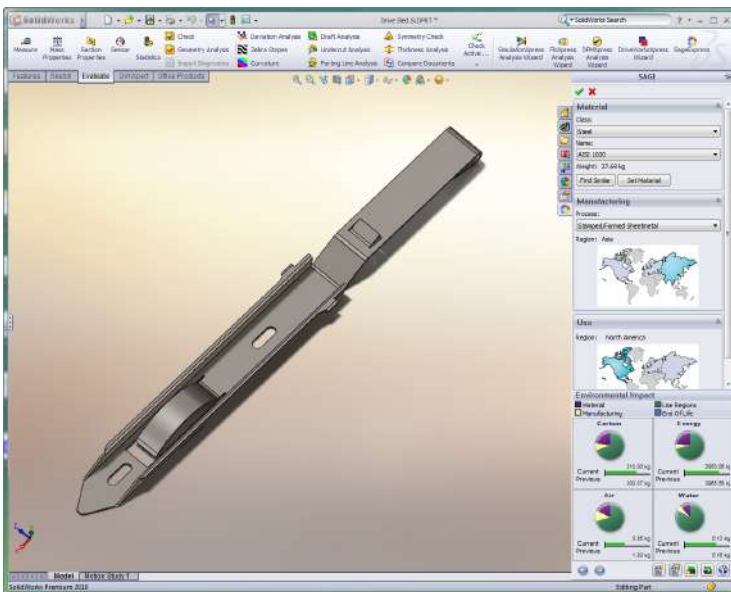
Operational issues are when a product functions as designed, but does not perform optimally. For example, a product that fails because of environmental factors, such as corroding or crazing, or that breaks under a reasonable load has operational problems. Software and firmware problems can also make a product operationally deficient, as can unsafe or unstable designs that put the user at risk. Unattractive styling or badly designed controls constitute operational defects, if they give buyers an unfavorable impression of the product.

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Prototyping catches some of these problems, but prototypes are expensive and time consuming. Engineering software can reduce costs and keep projects on track by replacing prototypes at many junctures of the design process. Software enables designers to systematically eliminate many common causes of errors. Here are some examples:

- 3D solid models generated in CAD software can assure proper fit and detect interference between parts.
- Kinematic simulation allows designers to visualize how moving parts can interfere with one another.
- Dynamic simulation allows engineers to estimate the effects of inertial loads on high-speed machinery.
- Finite element analysis (FEA) helps engineers visualize distributions of stresses or temperatures within solid objects, and then eliminate stress concentrations or hot spots that might cause problems.
- Simulated drop testing can assist engineers in identifying weak areas in products subject to rough handling.
- Checks for manufacturability ensure designs are ready for molding, casting, machining, and sheet-metal operations before they are released for production.
- Realistic rendering allows designers to simulate the appearance of products, including materials and finishes.
- Rapid prototypes allow complex cast parts to be fabricated without tooling and let designers see how products will physically look and feel before costly tools are designed.
- Software for assessing environmental impacts, such as SolidWorks Sustainability, can help engineers make better material choices early in the product development process.

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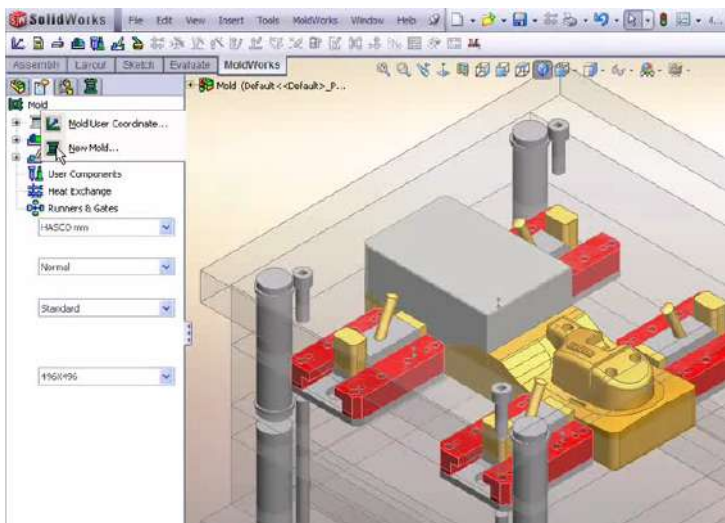
Companies can compare the environmental footprint of different materials to minimize their ecological impact.

Leveraging your CAD data

If your company is using CAD data only to make drawings, you are missing opportunities to get more value from your 3D designs. CAD models can support a variety of operations that make manufacturing less prone to errors, breakdowns, and material waste. Efficiency improvements can also help salespeople win more business by offering more accurate proposals.

Consider the potential financial and time savings that 3D CAD data can yield in tool design and fabrication. 3D CAD models can inform the design of jigs, fixtures, molds, and dies to help ensure they are cut to the right specifications the first time. If your company outsources tool design and manufacture, you can make appropriate 3D models available to your suppliers. By helping them to reduce costs, your company will be better positioned to negotiate discounts.

Production engineers can use 3D models as masters to compare with data from coordinate-measuring machines and automated point-cloud scanners to assure that tools and lot samples are within dimensional specifications. Tolerance analysis assures that manufacturing drawings include reasonable, cost-effective tolerances. Data extracted from 3D CAD models can also improve cost, weight, and manufacturing time estimates.



The dynamic preview of the initial mold base and related components can significantly reduce design time from the outset.

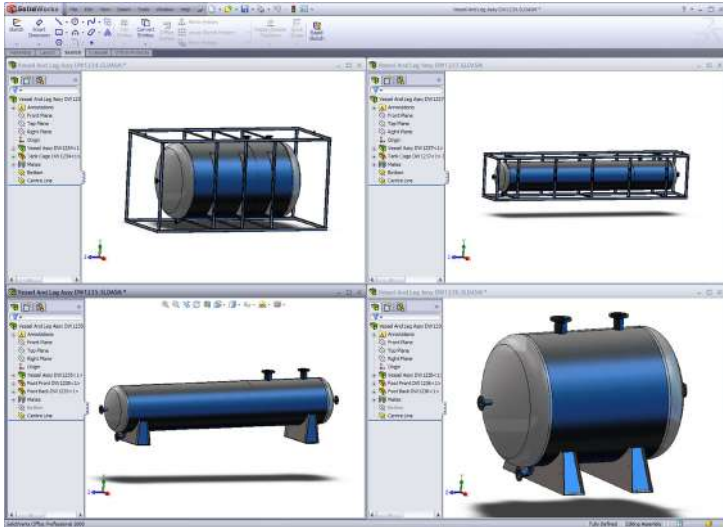
In the past, designers were responsible for creating products, while sales and marketing people sold them. With the advent of computer-aided design (CAD) and engineering, design teams can help salespeople, too. Many of the tasks that design engineers perform enable salespeople to create proposals quickly and accurately.

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Automating bid and proposal processes

If your company sells made-to-order products, the more details you can provide to the customer with your proposal, the more likely your company is to win the business. CAD software enables design teams to produce configurable product designs in minutes instead of hours or days. Knowledge applications such as DriveWorksXpress and DriveWorks can estimate costs and automate proposal preparation with simple-to-use forms.



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Automation makes it easy to capture and reuse CAD data for made-to-order design projects that are similar yet different.

Offering product models online

If your company sells components that are used in other systems, having 3D models online along with product specifications can boost sales. Your customers' design engineers will be more likely to specify your products if you offer them 3D models in common formats that are easily integrated into their designs.

Helping customers visualize products

The appearance of your products is important. Use CAD models to produce realistic renderings to show your products in the best possible light. Renderings help product marketing people design websites and literature without waiting for photographs of physical prototypes. Enabling salespeople to visualize your designs sooner will allow them to solicit customer reactions and generate buyer interest sooner.



Photorealistic rendering allows your salespeople and customers to accurately envision your product without physical prototypes.

Automating your scheduling

Few work conditions can be more demoralizing to design teams than not being given adequate time to complete their work. This situation is even worse when designers are repeatedly pulled from one project to another before completing any of them.

Computer scheduling software gives managers the data they need to make objective decisions. It enables managers and group leaders to quickly assess the effect of delays or the shifting of people from one project to another. By preventing workers from being held to unreasonable schedules, it raises productivity and morale.

Many project scheduling programs are commercially available. For an engineering office, choose one that allows you to define resources (the people in your design group) and apply those resources to multiple projects. Examples of scheduling software suitable for design offices include FastTrack Schedule 9, Microsoft® Project, and Primavera P6. When looking for software, be aware that so-called “employee scheduling programs” may not be suitable for project-based scheduling. These programs are intended for continuous operations, such as retail outlets, call centers, warehouses, and medical centers.

Software developers appreciate the opportunity to learn from their customers.

Working with your software suppliers

Software developers need suggestions from their customers about how to make their products better. Providing this feedback costs customers time and therefore money. However, in the spirit of continuous improvement, the time spent today will make designers more productive in the future. Here are actions your design team can take to help improve the software they use:

1. Join in performance-monitoring programs that help suppliers improve speed and reliability. Participation requires little effort and costs nothing.
2. Formally report errors you and your workers encounter. Bugs won't get fixed if they're not reported.
3. Meet with software developers to suggest improvements that would raise productivity. Submit suggestions online and follow up with project managers at regional or national user groups.
4. Invite suppliers to study your work processes and data in your office. Show them how you use their software and the activities that could be made more efficient. Software developers appreciate the opportunity to learn from their customers.

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Finding free training dollars

If 20 designers each waste just 30 minutes per day as a result of poor training, the cost will be about \$100,000 per year (0.5 hour/person X 20 people X \$40/hour X 250 working days per year). In contrast, if your company devotes one day per worker per month to training, the labor cost would be about \$76,800 (20 people X \$40/hour X 96 hours). The \$23,200 difference could be spent on additional training and instructional materials. The productivity of better trained workers will continue to accrue in future years, whereas time wasted cannot be recovered.

When planning your training, consider these basic principles:

1. Teach people only the features and functions needed to do their jobs.
2. Give prospective training dealers or consultants an outline of topics that pertain to your company's business.
3. Customize programmed self-training aids for your company's design practices.
4. Learn about curricula at local schools and free dealer classes to discover how these resources can complement your home-grown training efforts.

One of the most important and overlooked forms of training is the sharing of new ways to use existing software. Engineering software is complex and sophisticated. Nobody can expect to master every feature. Sharing ideas spreads these discoveries throughout the design team. Organize weekly, bi-weekly, or monthly user-productivity meetings to share ideas. Have the meeting in a room where everyone can see the computer display, and encourage designers to demonstrate what they have learned. Offer a prize for the best suggestions. Set up a blog or online forums where users can share ideas or seek solutions to problems unique to your company. Online forums are most effective when design teams are geographically disbursed.

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Conclusion

A motivated, activist design team can be a manufacturing company's greatest asset. Product design and the data it generates make manufacturing more productive and help bring sales through the door. Whether through easily accessible product data to plan tooling, or models ready to drop into customer designs, design teams create intellectual property that yields enormous value when properly channeled. Companies that continuously improve their design operations will continuously improve their fortunes.

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¹Wysack, Roy A., *The Smart Manager's Guide to Effective CAD Management*, CAD/CAM Publishing, p. 157.

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