



A View From 2030

Pulse of the Profession: Design for Manufacturing

The Momentum

For decades, it was normal for mechanical engineers to throw a product design over the wall to the manufacturing team—an entirely separate entity with no design input. Then came the costly reality checks, as disconnects between the design and production lines cropped up. Nonstandard components might require retooling. Material choices might delay production and time-to-market. As design rework pushed further into the product life cycle, the cumulative cost of these changes kept rising.

Thankfully, the walls between design and manufacturing have been steadily coming down, with new technologies and ways of working giving engineers full visibility into production processes and constraints. Design for Manufacturing (DfM) brings manufacturing engineering into the design process from the start. Supported by real-time data detailing specific plant capabilities and collaborations with factory-floor experts, design teams can digitally prototype parts and products—and get things right the first time. The benefits include reduced design and manufacturing costs, shortened time-to-market, and higher product success rates.

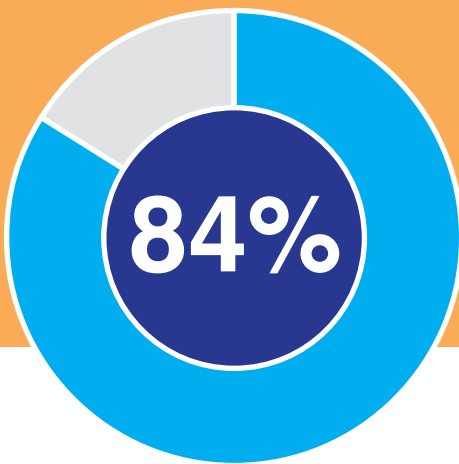
This integrated way of working is rapidly becoming the norm. Over the next 10 years, [mastery of DfM skills](#) will become foundational, becoming more and more important across all manufacturing roles, according to a recent [ASME/Autodesk report](#) on the future of manufacturing. Industry experts predict a huge rise in demand

for DfM skills: 84% say mechanical engineers will increasingly need to apply these principles in their work.

This is the third of ASME's multipart series on how the future is shaping—and will be shaped by—engineering professionals. Head here to check out earlier reports, on [Career-Ready Soft Skills](#) and [Digital Transformation](#).

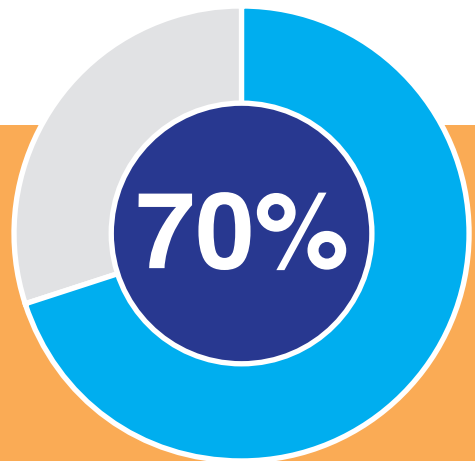
“The barriers between engineering and manufacturing are coming down. I think 10 years from now you are going to see manufacturing engineers and mechanical engineers with equivalent degrees coming out of college,” Jeffrey Reed, director of engineering at Northrop Grumman Corp., [told ASME](#). Similarly, nine out of 10 ASME/Autodesk survey respondents stated that teaching deeper DfM knowledge was the most impactful way for academia to develop the future manufacturing workforce.

Demand for DfM Rising



Of surveyed engineers say the need for increasing Design for Manufacturing (DfM) skills will grow during the next five to 10 years.

Of manufacturing engineers and mechanical engineers say that DfM-related technology initiatives are now in motion at their organization. No other Industry 4.0 manufacturing technology is so prevalent.



“The barriers between engineering and manufacturing are coming down. I think 10 years from now you are going to see manufacturing engineers and mechanical engineers with equivalent degrees coming out of college.”

— Jeffrey Reed, director of engineering at Northrop Grumman Corp.

And that shift in emphasis will be aided by equal shifts in technology. “In the future, design software will be able to consider manufacturing constraints and also perform more accurate manufacturing process simulation, reducing the difference in the work between a design engineer and a manufacturing engineer, and mitigating the risk of designs being thrown over the wall that can’t be manufactured,” Andrew Partin, innovation engineer at Stallantis, [told ASME](#).

But that’s still some years ahead, and here in the present, companies are looking to realize the many benefits of DfM today. As such, many are ramping up investments in digital tools and platforms to connect product engineering and manufacturing planning teams accordingly. Tolerance for designs that are time-consuming or costly to implement is dropping, and demand for DfM-related skills is rising.

As organizations adopt IoT-related technologies that produce valuable streams of operational data, siloes will crumble. Interdisciplinary skills will gain currency. And the realities of

manufacturing facilities and processes will need to be integrated into designs. “It’s not only designing something, but having the vision,” Raju Dandu, professor and director of the Bulk Solids Innovation Center at Kansas State University, [told ASME](#). “How will it be manufactured? How will it be handled by the users?”

The need to answer such questions shouldn’t surprise today’s mechanical engineers. They have a front-row view of the ways in which Industry 4.0 technologies—including DfM, product lifecycle management, AI/ML and data analytics platforms—are reshaping the profession and accelerating change. Indeed, 70% of surveyed manufacturing and mechanical engineers say that DfM-related technology initiatives are now in motion at their organization. In this environment, static skillsets are a losing proposition. But almost every mechanical engineer understands that professional success often depends on quickly learning something new.



Future-Ready DfM Skills

The big promise of Design for Manufacturing (DfM) is simple: more efficient workflows that head off rework and speed up value realization. But getting there is just a little bit harder than flipping a switch. It requires nothing less than converging the product design and production stages—which is only possible if individuals and teams think and act in new ways.

As organizations look to build future-ready engineering teams and winning products, here are four DfM-related skills to prioritize and pursue. Note: They're a mix of hard and soft skills, because no matter how high-tech manufacturing becomes, technical skills alone are never enough. Engineering is a team sport—and teamwork requires interpersonal acuity. Here's what to focus on now to reap greater benefits in the future.



Generative Design

Leveraging cloud computing and AI/ML, generative design allows engineers to explore and optimize designs for specific manufacturing processes, constraints, and requirements. The iterative design process has huge potential to reduce time-to-market and material use, while still ensuring high performance. No wonder, then, that a sizable majority (65%) of engineers believe that mechanical engineers will need to master generative design techniques within the next five to 10 years, according to an ASME/Autodesk survey.

Process planning

A brilliant design idea is useless if it can't be reasonably manufactured, from a DfM perspective. For this reason, knowledge of manufacturing processes is crucial for engineers involved in the design phase. What's most appropriate: injection molding, thermoforming, or additive manufacturing? Finding the answer adds complexity to the design process, to be sure—but new technologies supported by predictive modeling and machine learning can help build advanced models. Assessing a range of factors (e.g., product material, tolerance, and surface finish) and accounting for different constraints present at different manufacturing facilities can be a part of the planning process.



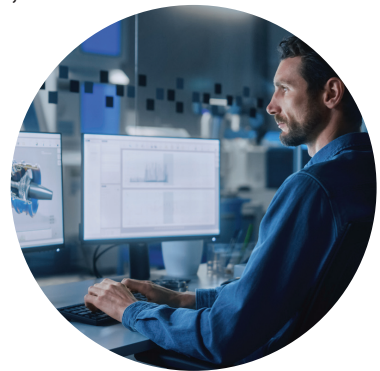


Collaboration

With the barrier between design and manufacturing teams removed to facilitate DfM, effective collaboration becomes key to understanding the value and limitations of a particular project. Designers may need to gather feedback on designs from manufacturing engineers, machinists, and material suppliers. In this new silo-free world of work, more collaborative ways of working should naturally emerge, requiring stronger interpersonal acuity. An ASME/Autodesk survey found that 90% of industry experts strongly believe mechanical engineers will need to improve soft skills (including collaboration) to succeed in a DfM environment.

Effective Cost-Modeling

Most of a part or product's cost (70%+) is fixed once the design is finalized. This is a big reason why DfM can unlock so much value: engineers are able to optimize design for manufacturability. Cost modeling is an essential skill in this process, allowing design teams to estimate the cost of manufacturing while accounting for materials used, tooling costs, and labor. There are certainly off-the-shelf cost estimation software tools to help with this—but engineers still need to understand the cost implications of specific design choices.



5 Ways to Strengthen Your DfM Skills

The DfM future is arriving now—but it's OK if you're not yet up to speed. What matters most is a growth mindset and taking purposeful action to fill skill gaps. Stay focused on reaching goals relevant to your career and organization, and you'll be ahead of the competition faster than you can say “manufacturability.”

1. Make sure that company leadership knows your desire to grow.

Chances are good that your organization understands the value of DfM. Let your manager or HR department know that you're looking to level up your skills—they may be able to offer in-house resources or reimbursement for external learning opportunities. And don't be shy about perceived skills deficits: any good boss should appreciate your proactive desire to grow and become more future-ready.

2. Turn to an association.

Professional associations have always supported members' skill development, and ASME is no exception. The organization offers a wide range of learning and development courses, offering practical job-relevant skills that help enable and sustain career success. Hard skills, soft skills, virtual classroom instruction, self-guided study courses—there's something for everyone, no matter your schedule or area of interest.

3. Find a DfM mentor.

Mentors are invaluable professional development allies. They can help you define and reach learning goals, provide feedback and advice, and cheer you on. Don't know where to start, in terms of finding a colleague with deep DfM knowledge? Ramp up strategic networking, whether within your organization or externally. Find someone with the skills you're targeting and start with a simple question: “How did you gain the knowledge you have today?”

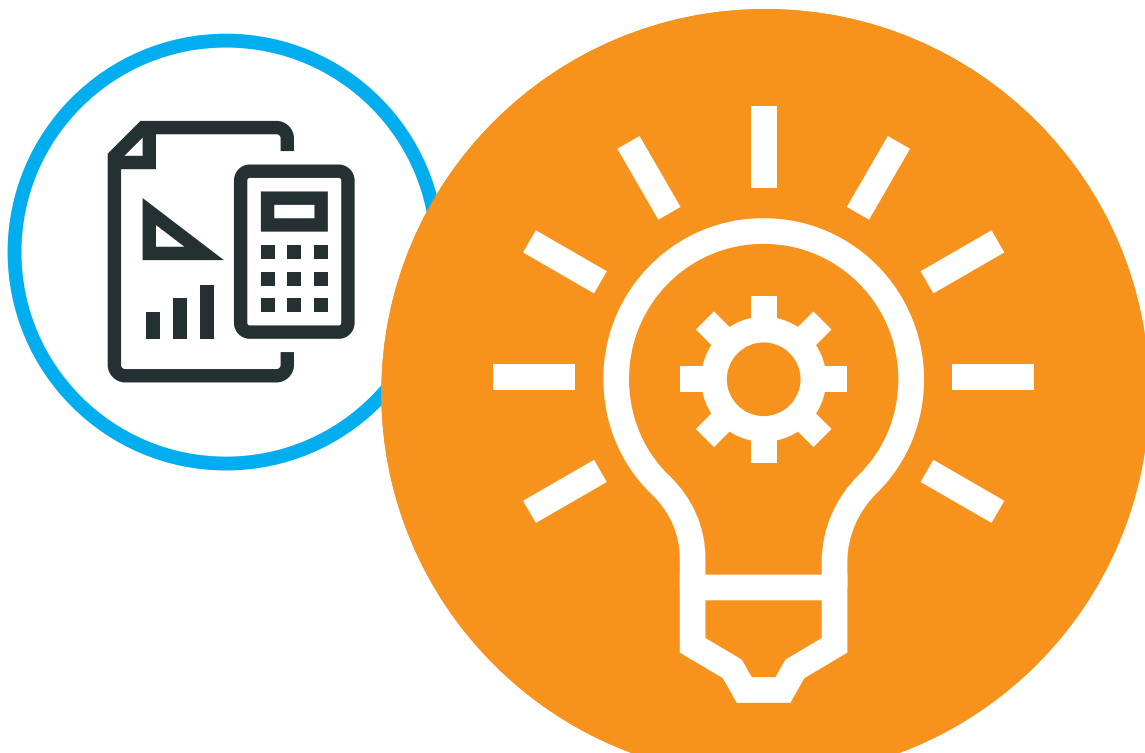


4. Look for applied learning opportunities.

For engineers in the workforce who need to stay on top of the rapidly changing technologies reshaping the profession, applied learning is a great fit. It combines theoretical knowledge, practical experience, and compliance education. [This overview](#) from ASME explains how mechanical engineers can benefit.

5. Check out online courses.

Various organizations, and not only educational ones, offer courses on both DfM and adjacent topics. For example, Autodesk, a leading provider of software for engineers and manufacturers, offers an [Introduction to Design for Manufacturing](#) course. Coursera, the massive open online course provider, offers a free course on [Generative Design for Manufacturing Specialization](#). ASME's own popular [Design for Additive Manufacturing with Metals Professional Package](#).



Future? Ready!

Change, it seems, is on the wind—and those organizations within the manufacturing and mechanical engineering industries would do well to take notice. But digitization efforts can't merely be tied to vague hopes about working faster, smarter, or more cheaply.

To excel at this vital conversion, organizations need to gravitate toward the technologies with the greatest potential to transform their ways of working, to set themselves up for success long before the first piece of software is ever installed, and to make intentional and thoughtful changes at a rate they can profitably sustain. Accomplish this, and you'll be well on your way toward the coming digital future.

About ASME

ASME helps the global engineering community develop solutions to real world challenges. Founded in 1880 as the American Society of Mechanical Engineers, ASME is a not-for-profit professional organization that enables collaboration, knowledge sharing, and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education, and professional development programs provide a foundation for advancing technical knowledge and a safer world. In 2020, ASME formed the International Society of Interdisciplinary Engineers (ISIE) LLC, a new for-profit subsidiary to house business ventures that will bring new and innovative products, services, and technologies to the engineering community, and later established the holding company, Global Knowledge Solutions LLC. In 2021, ASME launched a second for-profit subsidiary, Metrix Connect LLC, an industry events and content platform to accelerate Additive Manufacturing in the engineering community. For more information, visit www.asme.org.

Your Step-by-Step Guide to Taking the Next Step

The ability to apply design-for-manufacture principles to your projects is a crucial skill--and it's one you can hone with our [members-only guide](#) to using this framework in your work.

Not a member?

Join ASME today to gain access to member-exclusive content. Head to asme.org/membership for details.