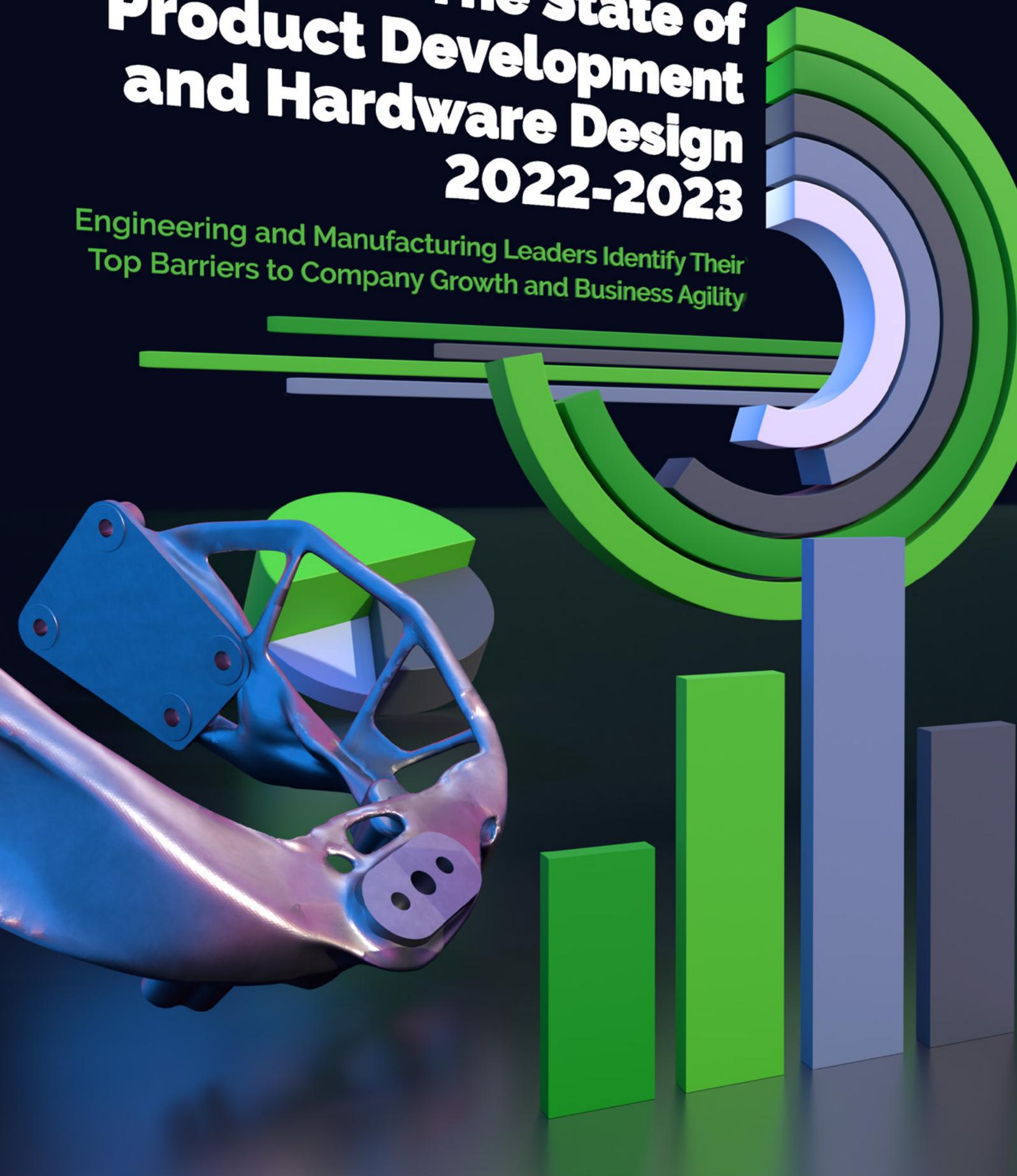
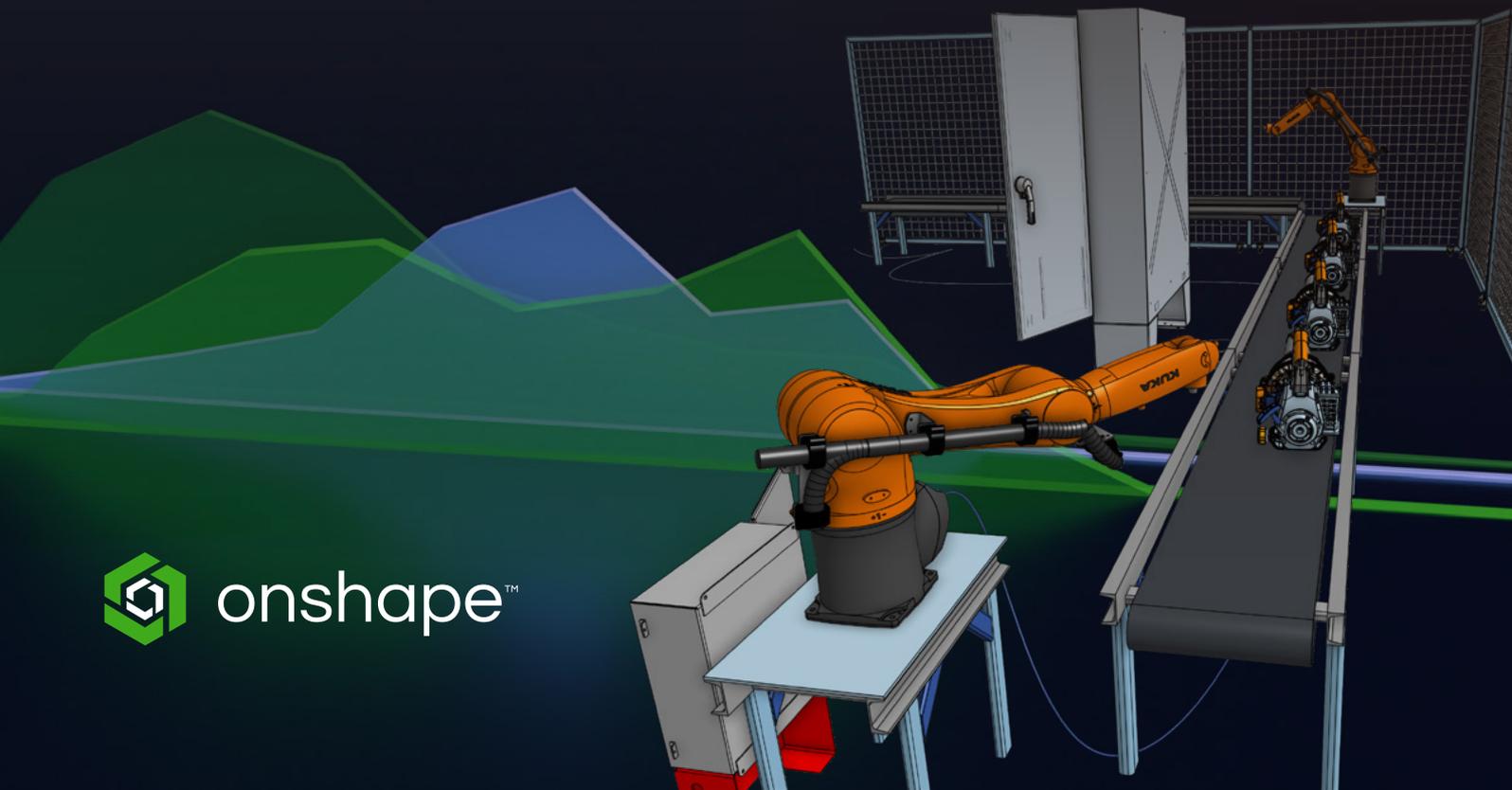


The State of Product Development and Hardware Design 2022-2023

Engineering and Manufacturing Leaders Identify Their
Top Barriers to Company Growth and Business Agility



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INTRODUCTION

What is the State of Product Development and Hardware Design right now?

Economically, this decade has gotten off to one of the roughest starts in recent history. On top of its tragic toll on human lives and health, the COVID-19 pandemic has caused a massive upheaval in the business world, forever changing the way companies think about the supply chain and affecting nearly every aspect of the workforce.

The war in Europe, soaring inflation and wildly fluctuating fuel and utility costs have complicated matters even further, magnifying fears of an imminent recession.

In this ongoing climate of uncertainty, what is the overall mindset of the product engineering and manufacturing world? Are companies still 100 percent focused on survival and crisis management? What is the level of optimism about a return to growth in the near future?

To better understand these ongoing challenges, Onshape commissioned the independent third-party research firm [Isurus](#) to conduct a broad-based product development industry survey.

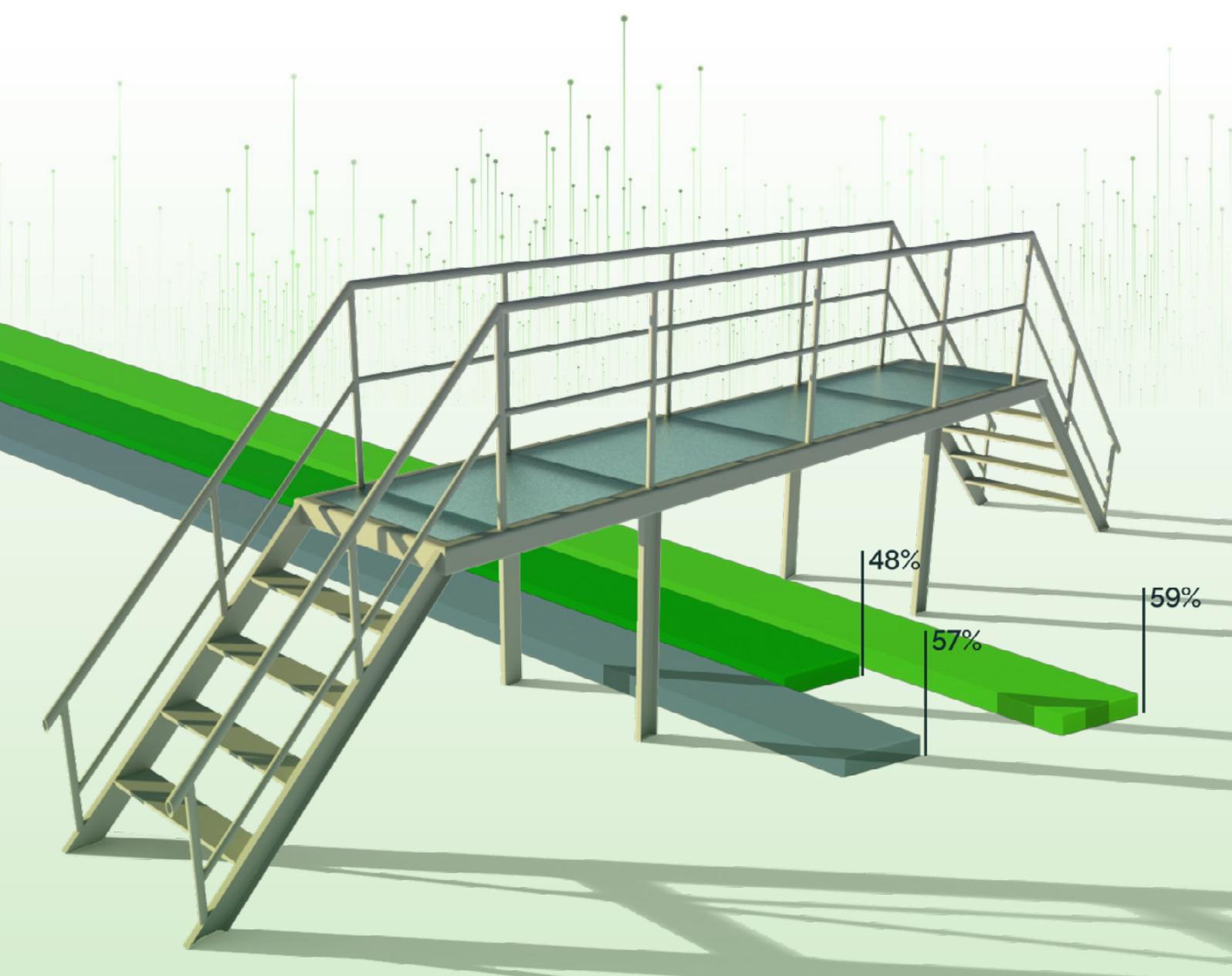
In this industry report, which took the pulse of more than 800 engineering and manufacturing professionals worldwide, you'll gain insights on the following questions:

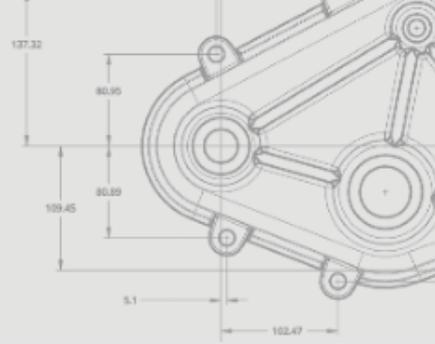
- Do manufacturers expect their business to shrink, grow, or remain flat over the next year?
- How do design professionals rate the productivity of their own companies' product development processes?
- What are perceived as the most urgent barriers to company growth?
- What are the biggest challenges for recruiting and retaining top talent?
- Do professionals believe they have influence on the product design process – and do these feelings impact employee morale?
- Does a product team's choice of design software affect their time-to-market?
- How do product developers waste the most time, and how can that "lost" time be reclaimed?
- When do engineering teams and manufacturing teams experience the most friction during design collaboration?

This survey includes perspectives from users of a broad range of product development software, including more than 14 mainstream CAD brands.

Although this report was commissioned by Onshape, only 7% of solicited opinions are from Onshape customers. (Additional demographic information about the survey respondents can be found in the [Appendix](#).)

Let's dive into **The State of Product Development and Hardware Design 2022-2023** and explore some of the top engineering, design and manufacturing issues facing companies now and moving forward.





Executive Summary

There are many geopolitical and economic forces impacting your business that remain way beyond your control. Needless to say, you can't control war, inflation, oil prices, global pandemics or the timing or severity of a recession.

What you DO have control over is your product development process and motivating your employees to be more engaged and productive – versus just doing the bare minimum to get through the day.

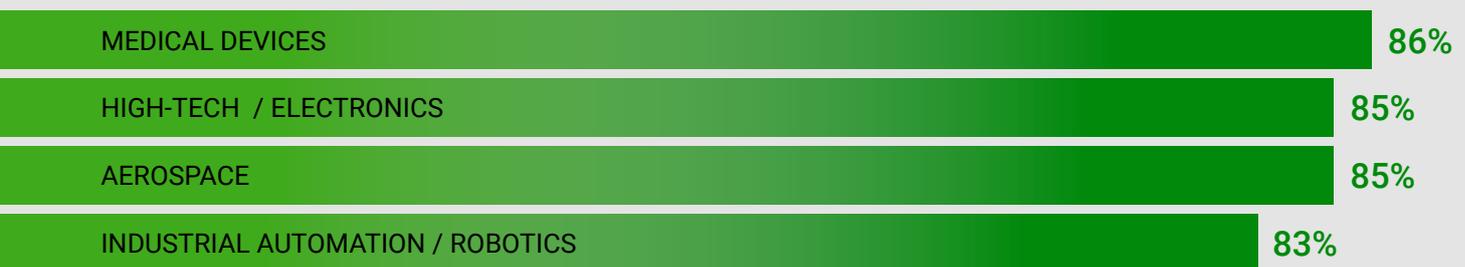
Salary and benefits aside, how employees feel about their work and their opportunities to do something meaningful can be critical for whether they decide to help your business grow – or help your competition grow.

In the **State of Product Development and Hardware Design 2022-2023** report, more than 800 engineering and manufacturing professionals weighed in on the biggest challenges facing their companies in the days ahead.

■ EXPECTATIONS FOR A “RETURN TO GROWTH”

The good news is that there is widespread confidence and optimism. Despite the economic uncertainty, 78% of design professionals expect their companies to grow over the next year. This was a consistent response from all job roles surveyed (individual contributors, managers and executives) and some industries recorded even higher confidence about the near future:

Design Professionals' Expected Growth by Industry



However, obstacles lie ahead. Design professionals identified these four issues as the top barriers to company growth:

Top Barriers to Company Growth



■ ADDRESSING TALENT RECRUITMENT AND RETENTION CHALLENGES

The so-called “[Great Resignation](#)” has not skipped over the design and manufacturing world, as white-collar and blue-collar workers alike are quitting unfulfilling jobs in larger numbers than ever before. And it’s taking longer to fill the vacancies with qualified candidates.

Of course, money is important. More than 4 out of 10 companies in our survey say they’ve lost top talent due to a competitor offering a better salary and/or benefits. But there are other major factors in play as well:

-
- 1 out of 3** *design professionals say that their CAD software impacts their company culture, personal career growth and work-life balance.*

 - 73%** *of design professionals revealed that their ability to influence the product development process impacts their job satisfaction.*

 - 64%** *of manufacturing companies acknowledge having trouble “finding candidates with specific knowledge or skills.”*

 - 39%** *report a “limited pool of talent in your geographic region.”*

 - 17%** *report that not offering flexible work hours/locations has negatively impacted employee retention.*

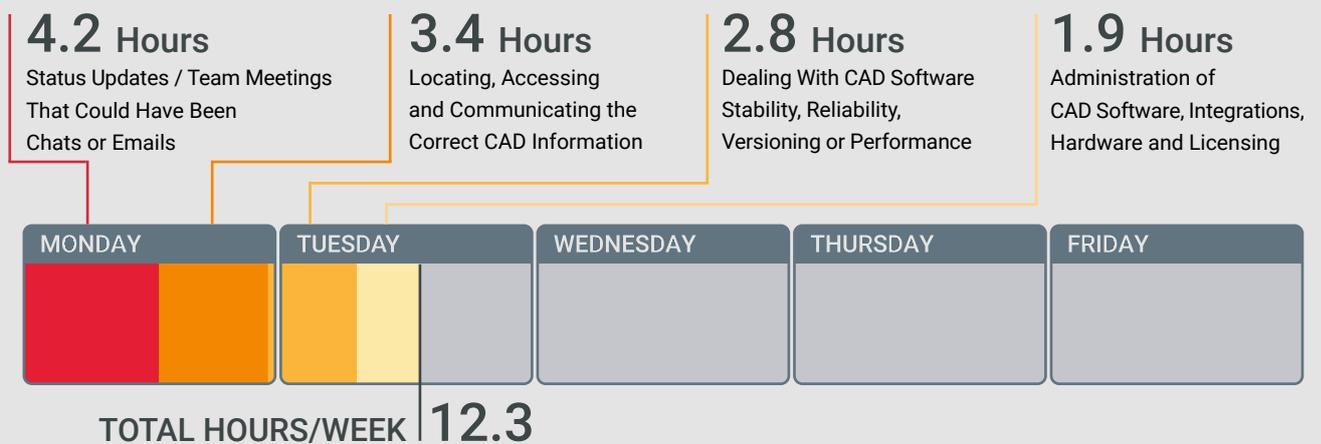
 - 17%** *reported that “not having the technology employees want to work with” has hurt retention.*
-

Managers should take notice that it is their responsibility to make sure their teams’ voices are heard. This is not a gesture of politeness. In the early conceptual stages of design, more input often leads to better ideas. It is also not surprising that CAD impacts wider workplace issues given that 64% of designers/engineers and 35% of engineering managers that we surveyed use it daily.

■ LOST PRODUCTIVITY: WHERE ARE TEAMS WASTING THE MOST TIME?

When hardware engineers sit down at their desks, they are eager to get things done. But their core proficiency – designing products – often gets undermined when their file-based CAD or PDM software interrupts their workflows. Survey respondents report they waste an average of 12.3 hours a week – **losing one-third of their working year** – spending time on non-design tasks.

Here's how those hours are “stolen” from design time each week:



With a minimum investment of \$100K per hardware engineer (not including benefits), losing one-third of their design time amounts to \$33,000+ in productivity losses per engineer per year.

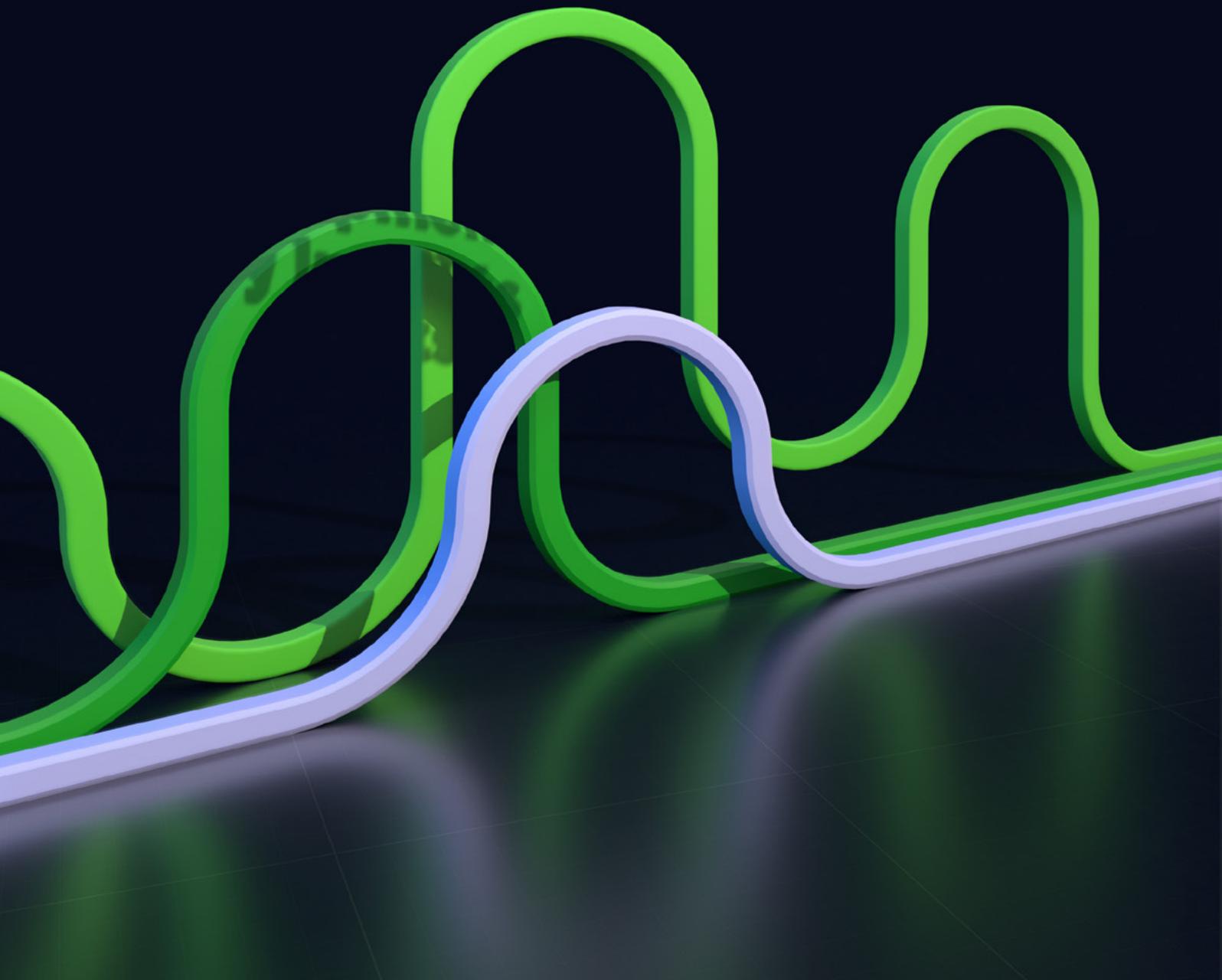
Product development teams also report wasting time when sharing design information with key stakeholders. Survey respondents say the areas where they are most inefficient is when collaborating with External Suppliers or Manufacturers (43%) or with Internal Non-CAD Stakeholders (36%) within their company.

■ HOW TO OVERCOME INEFFICIENT PROCESSES

This report also examines the benefits of cloud-native CAD and Product Data Management (PDM) tools to eliminate the most common bottlenecks that hardware engineers face every day.

Engineers and designers are not robots and their time cannot be optimized as easily as software and hardware, but the more time they can devote to designing products, the more likely a company can accelerate its time-to-market. As companies examine the best strategies for talent recruitment, retention and business growth, considering the latest collaboration tools and product development technologies should be part of the equation.

Product Development Survey Insights





Despite Economic Uncertainties, Most Design Professionals Expect Their Companies to Grow Over the Next Year

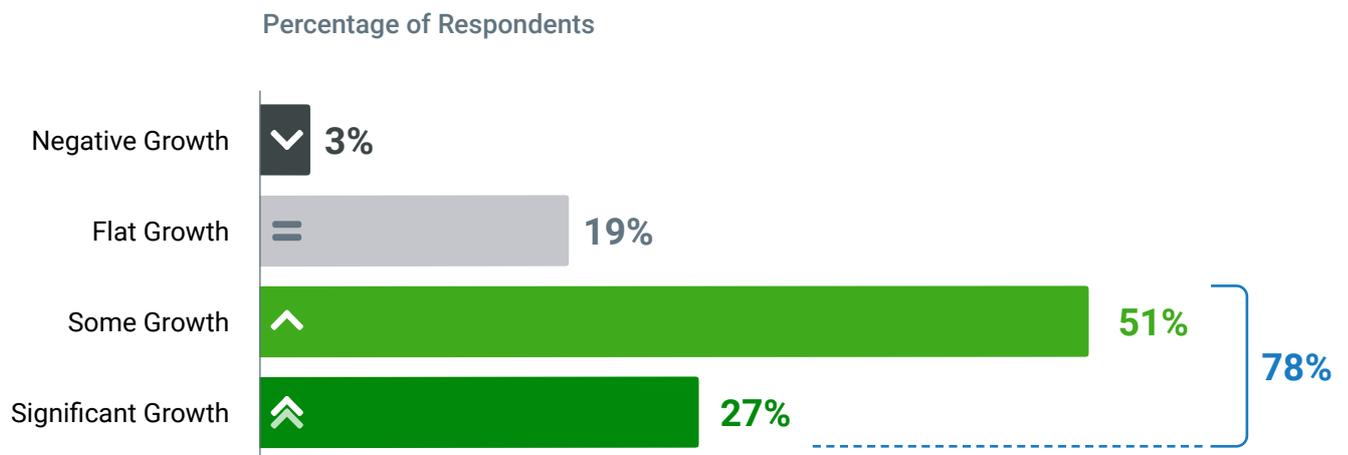
To say that the first two quarters of 2022 has been a bumpy ride for the global economy would be a gross understatement. The combination of Russia’s invasion of Ukraine and renewed COVID-19 lockdowns in China have led to wild fluctuations in oil and energy prices, continued disruptions in supply chains, a plunging stock market, and soaring inflation. At the same time, the so-called “Great Resignation,” the record number of workers quitting their jobs since the pandemic, has magnified a tight labor market.

Faced with these ongoing economic uncertainties affecting all industries, we wondered how the outlook was for product development. Although it seems unlikely that the pandemic is completely over, does the design and manufacturing world think that the worst is behind us?

An overwhelming number of survey respondents are optimistic about their company’s immediate prospects for growth:

Expectation Level of Business Growth

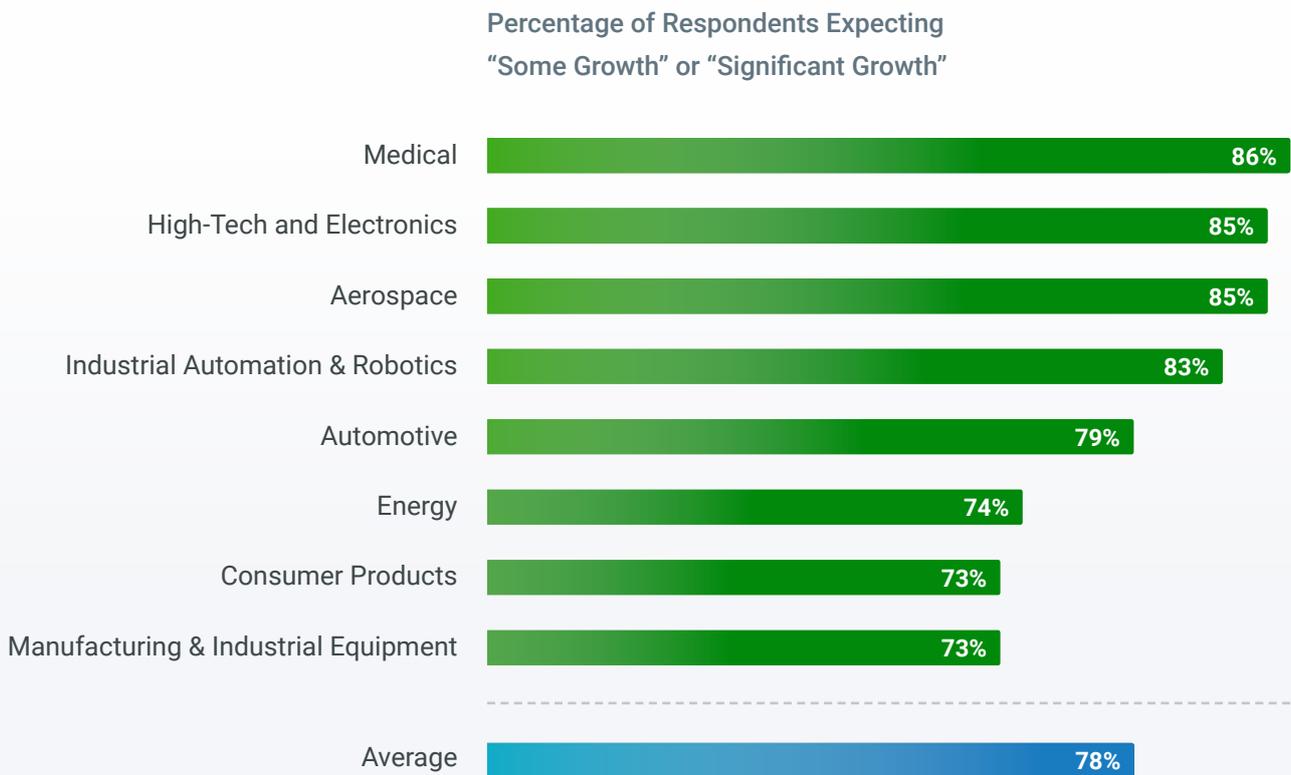
How much do you expect your company to grow over the next year?



Base: 595 respondents

A remarkable 78 percent – or 8 out of 10 of design professionals – predict business growth over the next year. This was a statistically consistent perspective across all job roles (engineers, managers and directors). And it was a statistically consistent response across multiple industries, with the Medical, High-Tech, Aerospace and Robotics sectors showing the most optimism:

Expectations of Business Growth By Industry



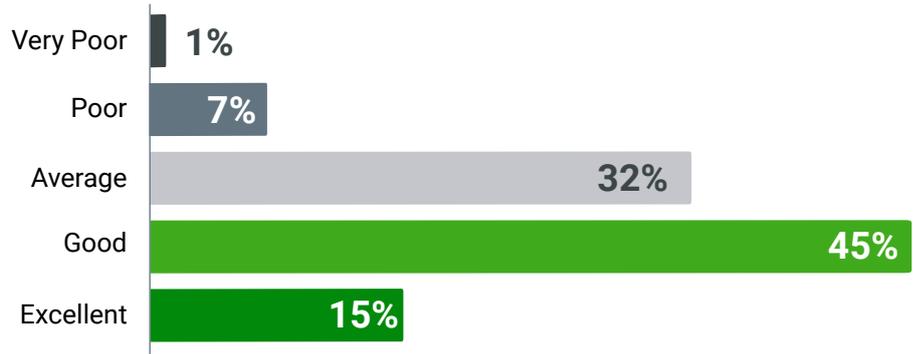
Base: 595 respondents

Before we asked design professionals to identify potential areas of improvement, we wanted to first measure their level of confidence in their own day-to-day product development processes. Perhaps this is a result of having a self-selected audience – motivated individuals tend to be far more willing to talk about their jobs – but the vast majority of respondents have an overall positive view of their company’s processes.

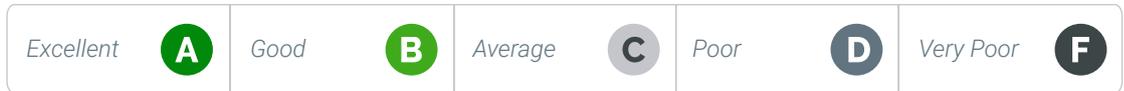
Self-Reported Productivity Ratings

How would you rate the productivity of the product development process at your company?

Base: 755 respondents



Think about these ratings in terms of the traditional grading system at school:



The fewest number of people gave themselves failing grades, followed by the second-smallest group, which is the highest achievers. These self-reported performance evaluations resemble the typical bell curve model, where most people sit comfortably in the middle and far fewer occupy the extremes. Most product development professionals participating in this survey regard their work processes as “Good” to “Average,” meaning that they recognize there is room for improvement.

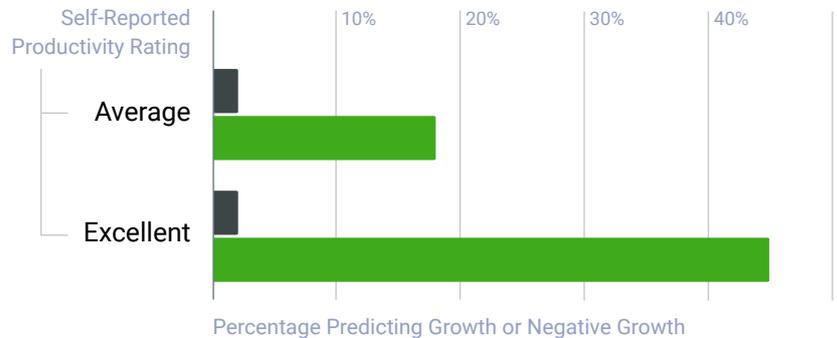
Not surprisingly, the higher one’s perception of their own product development process, the more likely they are to expect better business results.

People who rate their processes as “Excellent” are more than 2X likely to expect significant company growth versus their “Average” colleagues.

Self-Reported Productivity vs. Expectations of Company Growth

■ Negative Growth
■ Significant Growth

Base: 595 respondents



This is a self-fulfilling prophecy, as motivated professionals focused on growth are also more likely to seek improvements to their design and manufacturing processes – and be more thorough in exploring the latest technologies and tools.



Talent Recruitment/Retention is Perceived as the Most Urgent Barrier to Company Growth

Although 8 of 10 survey respondents report a bright outlook on company growth, they readily acknowledge that hurdles exist.

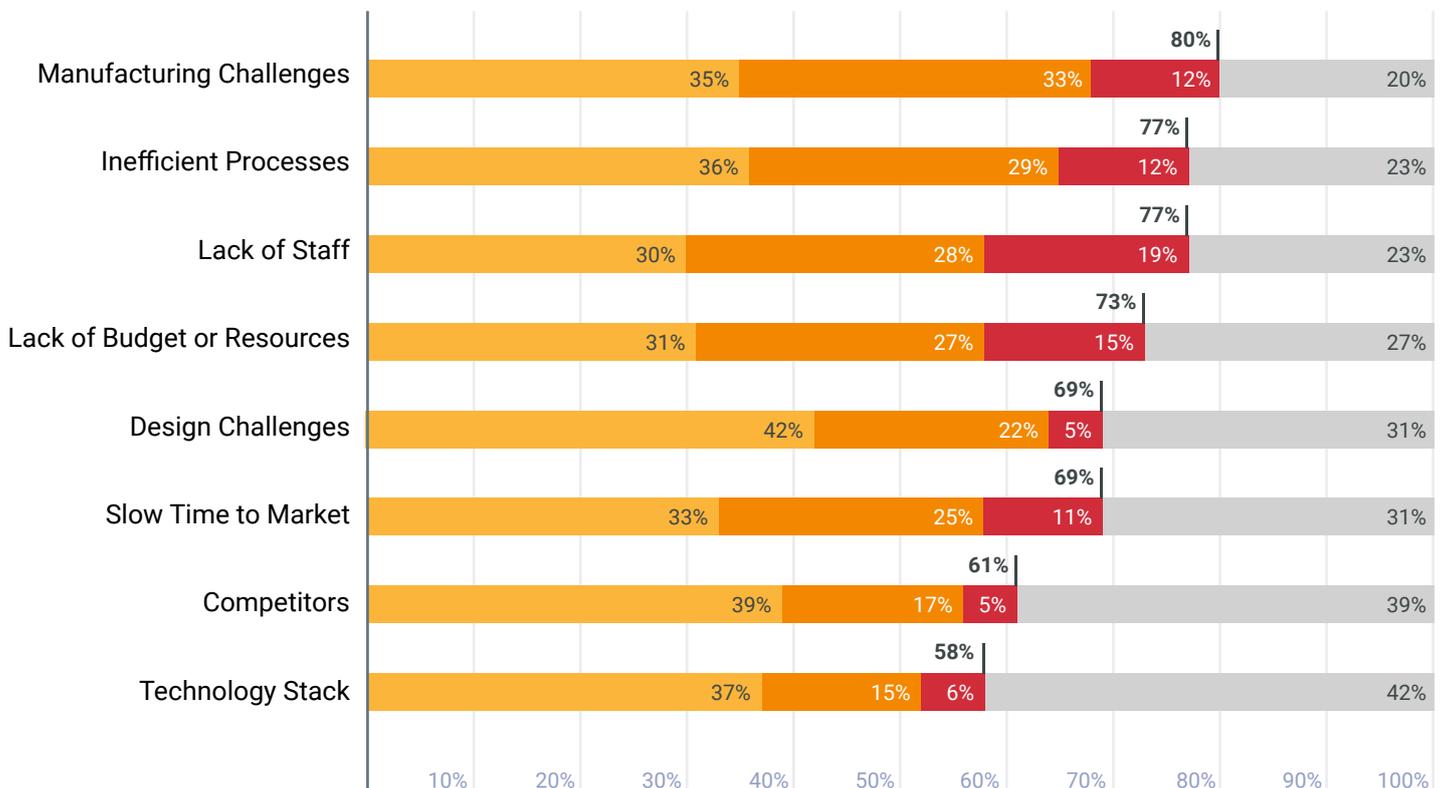
Which hurdles are presenting the most difficulty right now? We asked design professionals to rate their most common challenges in terms of severity: No Barrier, Slight Barrier, Moderate Barrier and Significant Barrier.

Top Barriers to Company Growth

Rate the following as they impact your ability to achieve your growth goals

Percentage recognizing a barrier to company growth

■ Slight Barrier ■ Moderate Barrier ■ Significant Barrier ■ Not a Barrier



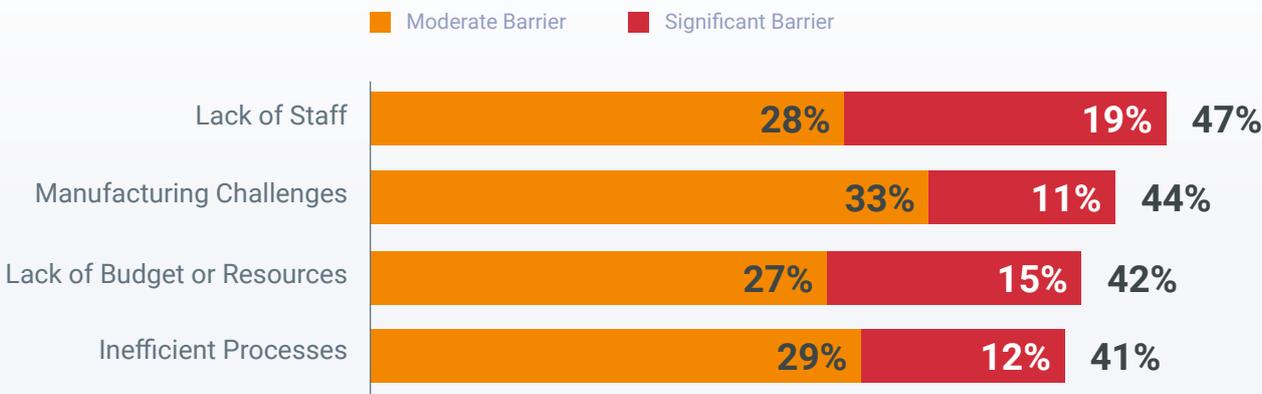
Base: 475-534 respondents

When adding all three affirmative categories (Slight/Moderate/Significant), the top four barriers to growth were Manufacturing Challenges (80%), Inefficient Processes (77%), Lack of Staff (77%), and Lack of Budget or Resources (73%). These issues are all consistent with today’s news headlines about supply chain problems and tight competition for hiring skilled employees.

If we eliminate the Slight Barrier responses, and focus on those who reported heavier concerns about their challenges ahead, “Lack of Staff” leapfrogs above the other factors.

Most Urgent Barriers to Company Growth

Rate the following as they impact your ability to achieve your growth goals



Base: 505-570 respondents

Many design professionals view inadequate staffing as their most urgent obstacle to boosting revenues. Companies need to find new ways to attract and retain talent.

All of these potential roadblocks are intertwined. Manufacturing challenges and inefficient design processes (which are addressed with Insights #4 and #5 later in this report) are also perceived as top blockers to growth, but companies first need to have the right staff in place before worrying about workflows.

When companies have budget or resource limitations, inefficient processes become even more of a problem because they need to do more with less. Every wasted minute takes on more importance.

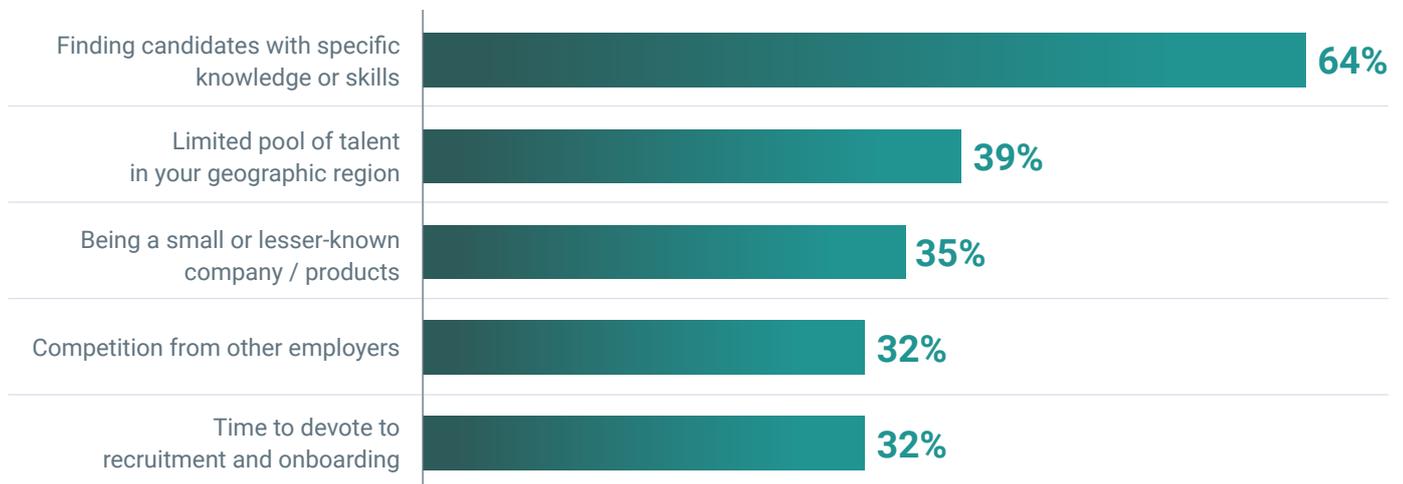
Interestingly, regardless of their expectations of business growth, design professionals see the same barriers ahead of them. A lack of staff is as much of an issue for companies that expect flat growth as those that expect significant growth.

The so-called “Great Resignation” has not skipped over the design and manufacturing world, as white-collar and blue-collar workers alike are quitting unfulfilling jobs in larger numbers than ever before. And it’s taking longer to fill the vacancies with qualified candidates.

With nearly 8 of 10 product development firms citing recruitment and employee retention as top obstacles to achieving their goals, let’s take a look at causation. Why is getting and keeping talent so tough right now?

Biggest Challenges For Attracting Top Talent

Does your company face any of the following recruiting challenges?



Base: 423 respondents

Most respondents report they simply aren’t connecting with the right applicants.

Not being able to find enough qualified candidates for a job opening is a frustrating dilemma for the Human Resources department, which might be inclined to expand its search to a wider geographical area. However, the further the candidate, the more variables arise. Will candidates be willing to tolerate a much longer commute or will they be willing to relocate?

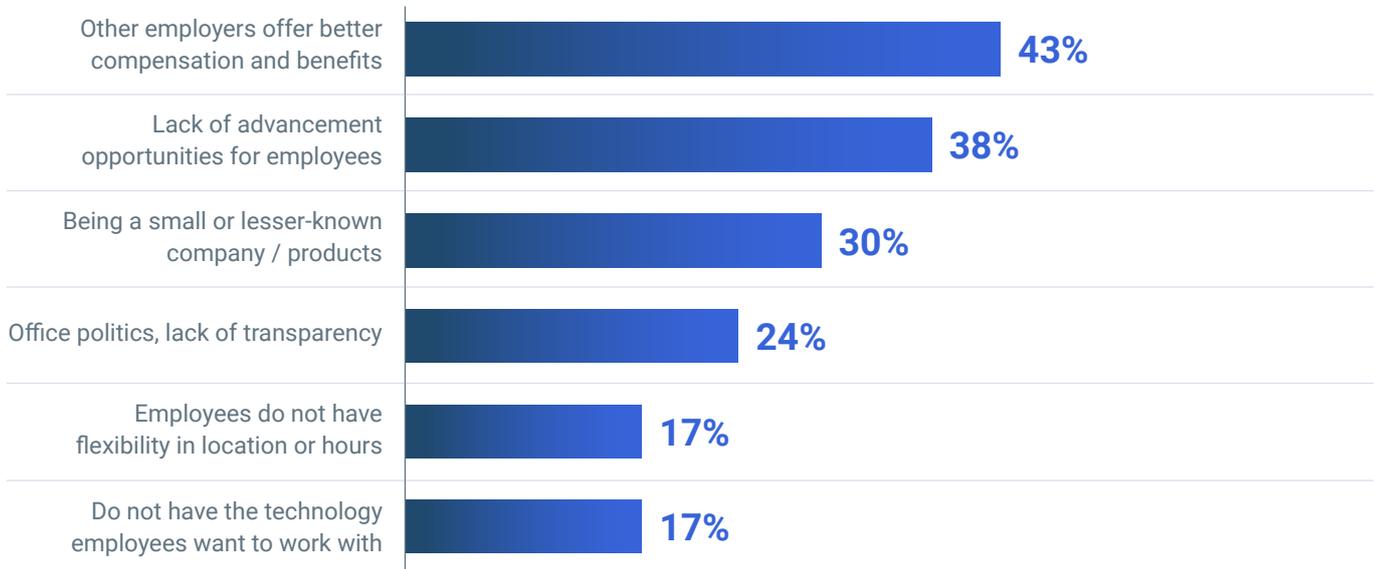
Some product development jobs can be done remotely, but some cannot – particularly frontline manufacturing jobs and even some engineering/design jobs that use software not meant for remote work.

So once companies DO have the right people in place, what can they do to keep them there?

Is it all about the money? Partially, yes, but dollar signs don’t tell the full story.

Biggest Challenges For Retaining Top Talent

Does your company face any of the following challenges for retaining valued employees?



Base: 422 respondents

In a tight job market where the competition is fierce for top talent, companies cannot always meet the needs of employees in terms of compensation, benefits, advancement opportunities or prestige. Companies cannot control the outcome of a bidding war, nor can it give promotions to everyone.

Other factors? Office politics is a byproduct of human nature and is unlikely to completely disappear anywhere. Being a small or lesser-known company is a marketing problem, not an engineering or manufacturing problem.

What companies DO have control over is influencing their employees' work-life balance and making sure they are providing the best technology to make their jobs easier and more productive.

Ultimately, how employees feel about their work, their co-workers and their supervisors can be critical for whether they decide to stay or go. In the case of highly valued employees, who could choose to work anywhere based on their experience and skill set, finding meaningful projects is especially important – as is whether or not they believe their voice is truly being heard.

We'll explore those issues in Insight #3.

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3

Employees' Ability to Influence the Design Process has a Significant Impact on Job Satisfaction and Company Morale

Product development is a true team sport. No one designs or manufactures a product alone. The bigger the team, the easier it is for an individual voice to get lost. As a whole, do engineering and manufacturing professionals feel that their input makes a difference?

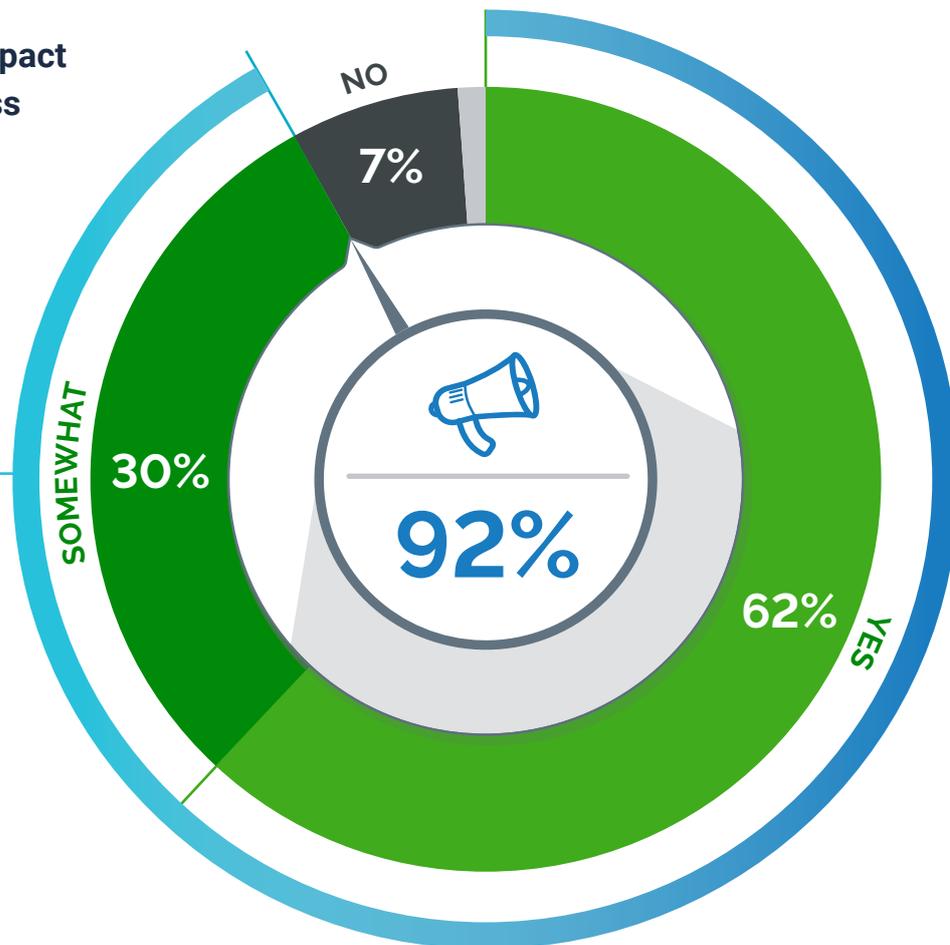
We asked survey participants if their companies ever present them with opportunities to “influence, improve or change” their product development process:

Do You Have Opportunities to Impact the Product Development Process at Your Company?

92%

of Design Professionals Feel Their Voice is Heard

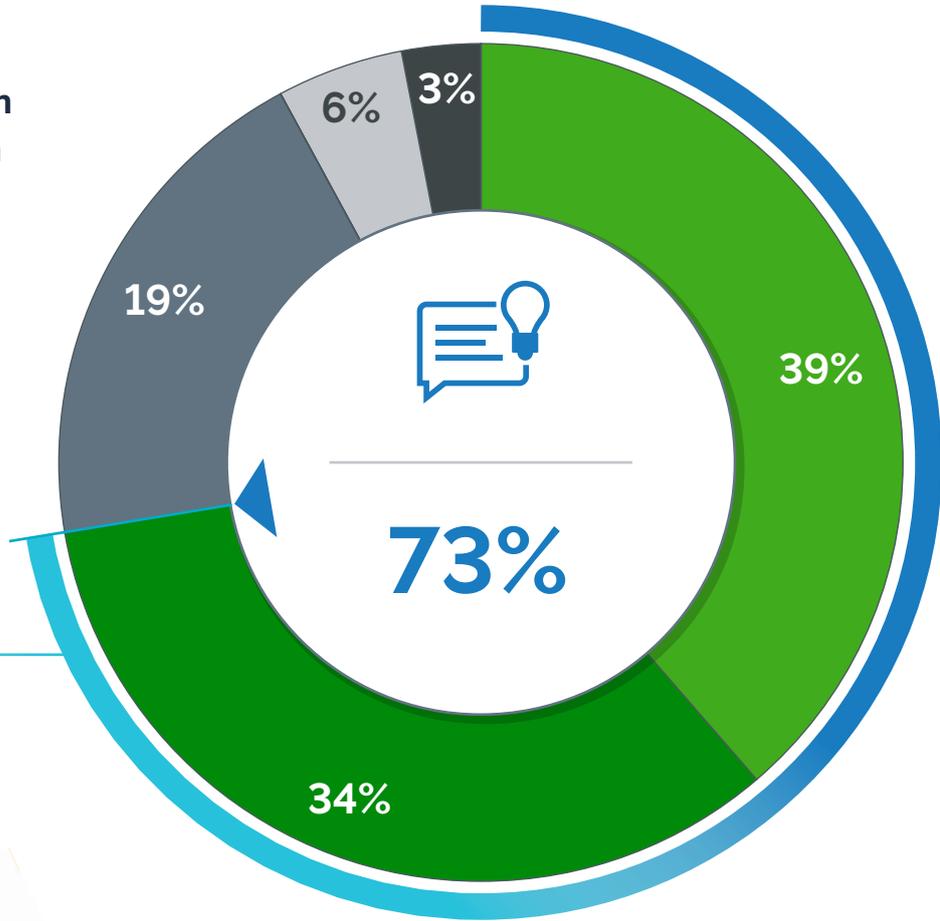
Base: 717 respondents
Excluding “Don’t know” and “Prefer not to say” answers



More than 9 of 10 design professionals believe that their company does consider their suggestions and expertise at critical stages of development. Furthermore, they believe that this ability to influence the design process affects their level of job satisfaction and/or creates opportunities for career advancement:

Impact of Ability to Change Product Development Process on Job Satisfaction / Career Growth

- 39% Significant Impact
- 34% Moderate Impact
- 19% Neutral
- 6% Little Impact
- 3% No Impact at All



73%

of Design Professionals Believe their Design Input has an Impact on Job Satisfaction

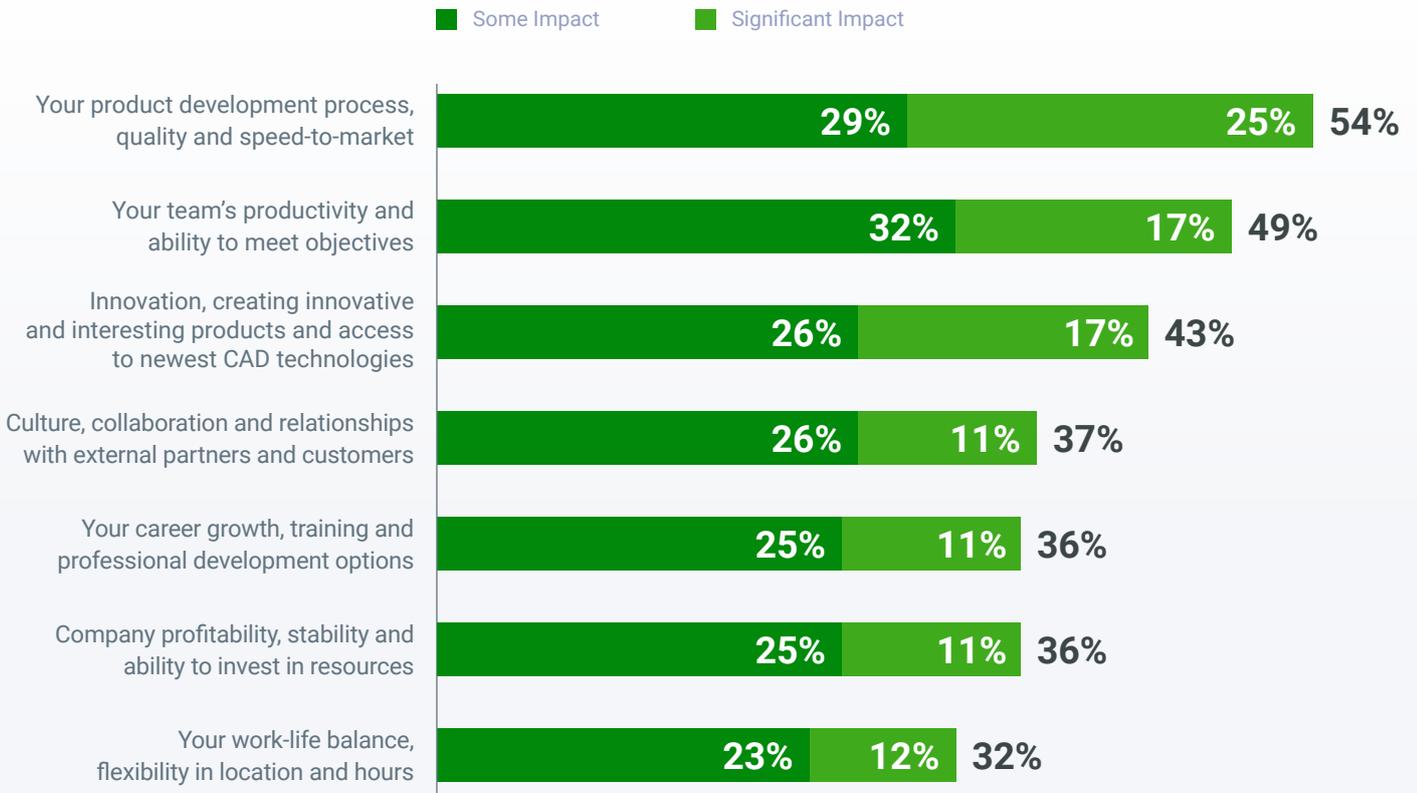
Base: 755 respondents



Because product development professionals, particularly frontline engineers and designers, spend much of their working hours in their CAD system, it's not surprising that roughly one-third of respondents also believe that the software impacts their company culture, personal career growth and work-life balance.

Impact of CAD Solution on Employees/Company

To what degree do you think your CAD solution(s) impact you and your company on the following dimensions?



Base: 520 - 540 respondents - "Unknown" answers excluded

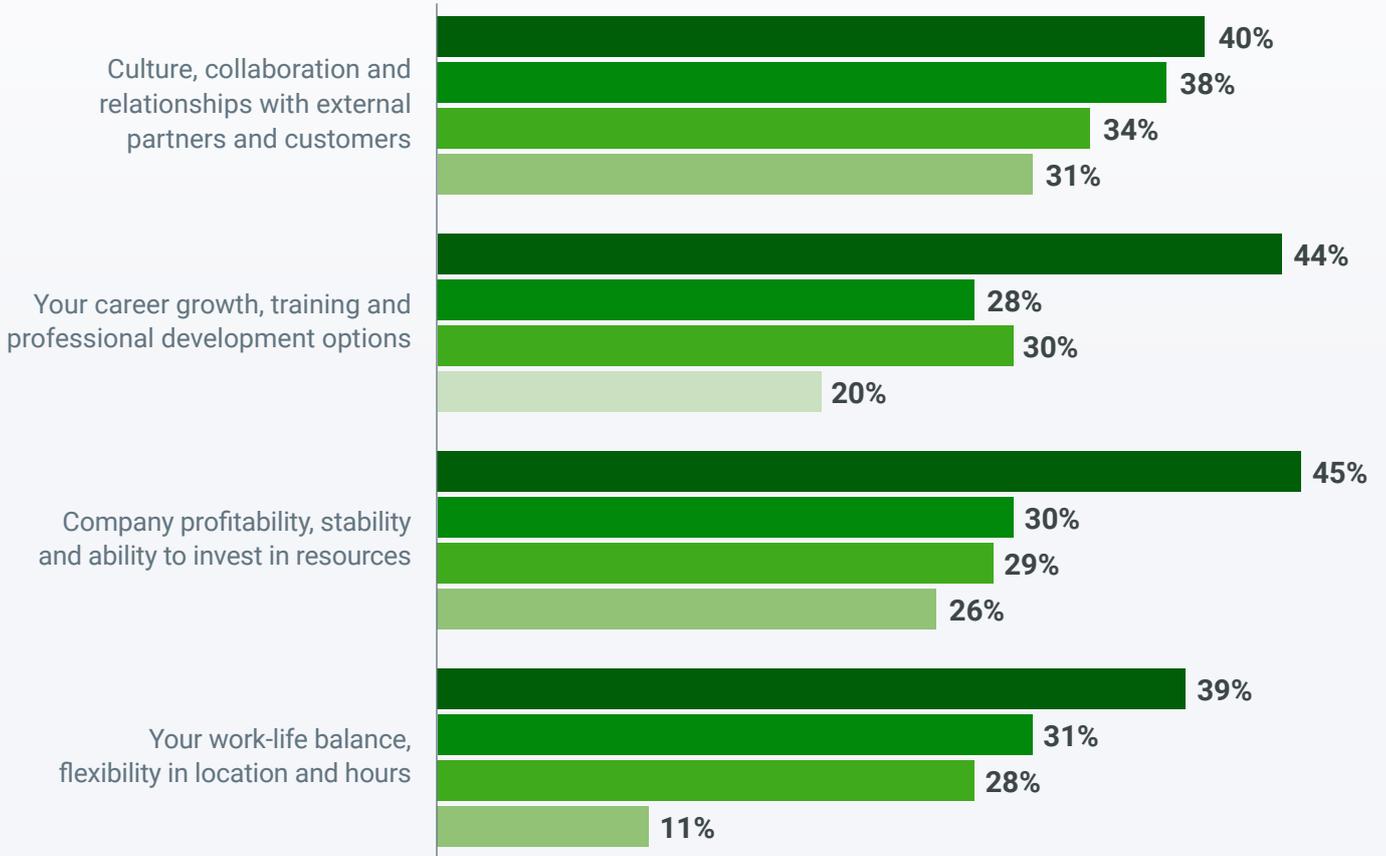
The more often respondents use CAD, the stronger their belief that their design software impacts culture, career growth and work-life balance.

Perceived Impact of CAD Solution on Employees/Company Based on Frequency of Use

To what degree do you think your CAD solution(s) impact you and your company on the following dimensions?

Frequency of CAD Use

■ Daily ■ Weekly ■ 1-3 Times a Month ■ Less Than Once a Month



Base: Daily (272-283 Respondents), Weekly (114-121 Respondents), 1-3x/Month (74-78 Respondents), Less Than Once a Month (56-64 Respondents)

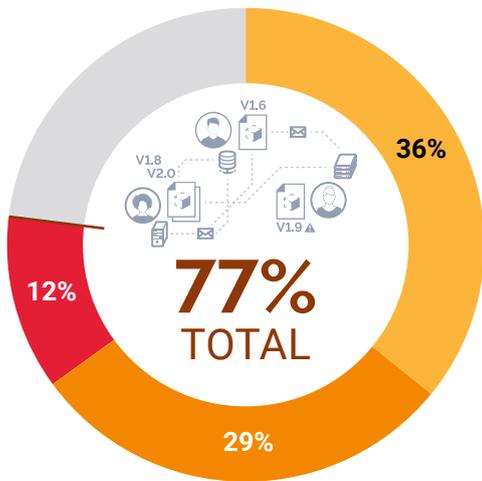
The starkest differences in perspective between infrequent CAD users (1-3 times a month) and daily CAD users are about CAD's impact on both career growth and company profitability.

When making decisions about design tools and software, executives should strongly consider feedback from the daily users – as it impacts employee morale along with productivity.

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4

Product Developers Waste an Average of One-Third Their Time on Non-Design Tasks

In our discussion of [Insight #2](#), we noted that nearly 8 out of 10 product development professionals considered “inefficient processes” a potential barrier to company growth.



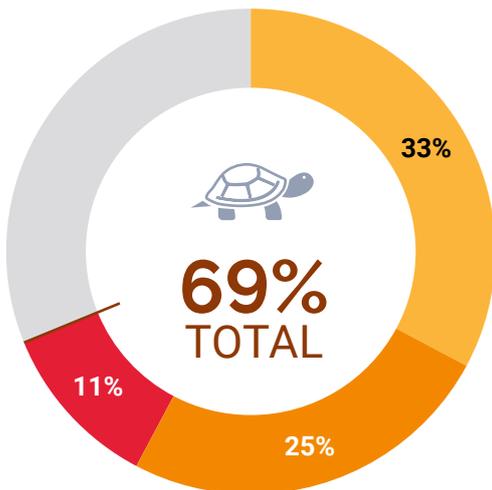
Inefficient Processes Recognized as a Growth Barrier

Percentage of Respondents

- 36% Slight Barrier
- 29% Moderate Barrier
- 12% Significant Barrier

Base: 560 respondents

And we noted that nearly 7 out of 10 respondents considered “slow time-to-market” as an obstacle that could hinder growth.



Slow Time-to-Market Recognized as a Growth Barrier

Percentage of Respondents

- 33% Slight Barrier
- 25% Moderate Barrier
- 11% Significant Barrier

Base: 545 respondents

In many industries, especially for consumer products, how fast you get your products on the shelf determines the market leader. With supply chain issues now creating inexplicable “shortages” of different products week to week, sometimes just being first on the shelf convinces impatient consumers to try your brand when they otherwise would have remained loyal to another one.

There are many factors throughout a product’s lifecycle that determine speed-to-market, but the design and manufacturing stages are at the heart of the challenge. If companies are not as efficient as possible when creating and producing their products, the best marketing, sales and logistics teams in the world won’t be able to overcome the slow start.

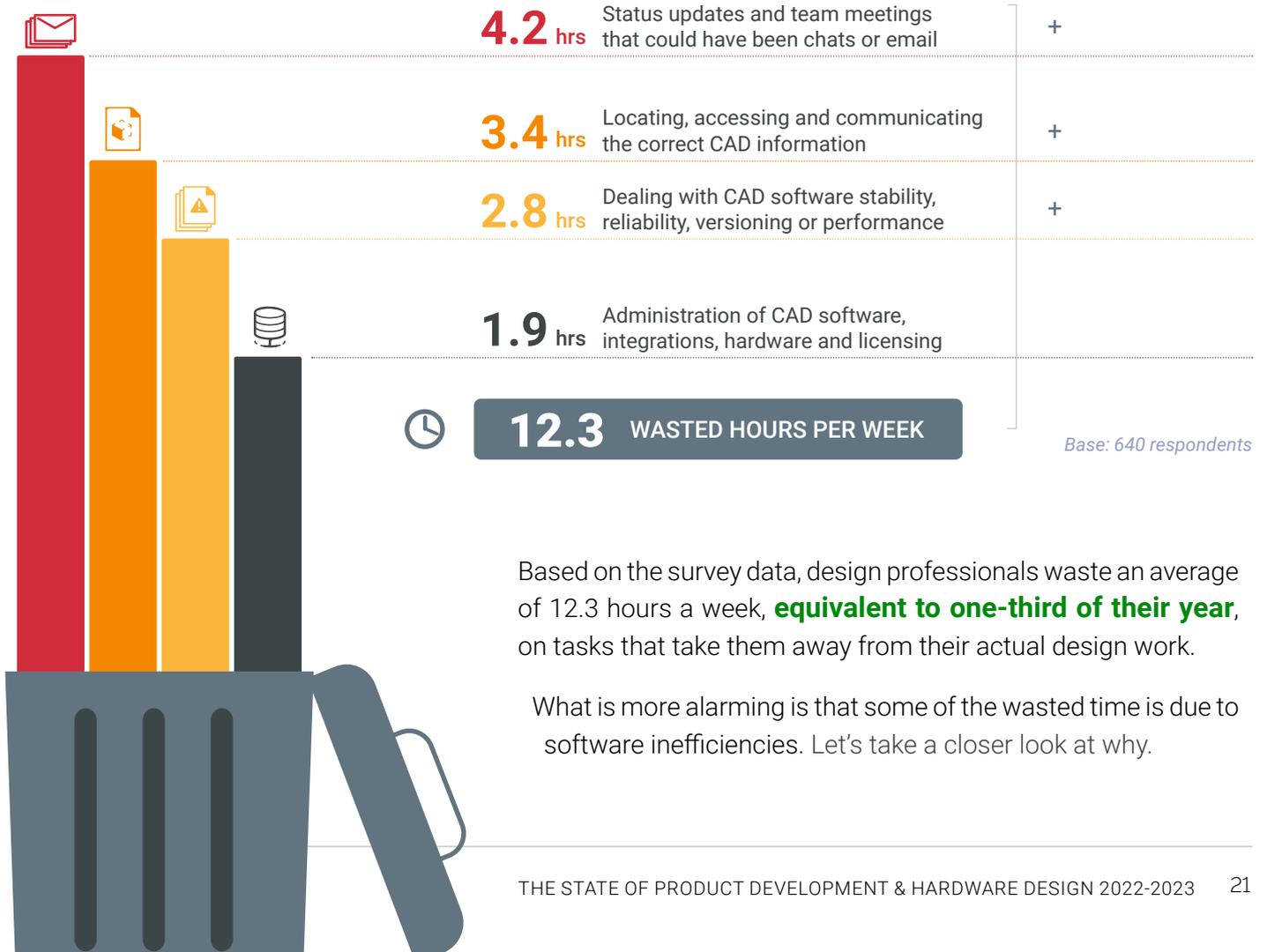
■ **How Do Product Development Teams “Waste” Valuable Design Time?**

A common denominator for these barriers to company growth is wasted time. By “wasted time,” we aren’t suggesting that employees are slacking off on social media or doing online shopping when they are supposed to be working. Rather, we are accounting for all the hours that designers and engineers should be designing, but they are interrupted by other tasks.

To find out where valuable design time is being siphoned, we asked survey participants to estimate how much time they wasted each week on four common tasks:

Average Time Wasted per Week on Non-Design Tasks

Estimated Average for Each Task, in Hours



Based on the survey data, design professionals waste an average of 12.3 hours a week, **equivalent to one-third of their year**, on tasks that take them away from their actual design work.

What is more alarming is that some of the wasted time is due to software inefficiencies. Let’s take a closer look at why.

■ The Biggest Time-Wasting Tasks

When hardware engineers sit down at their desks, they are eager to get things done. But their core proficiency – designing products – often gets undermined when their CAD or PDM software interrupts their workflows. Corresponding with the time-wasters in the survey, here are some of the most common ways those delays happen when using legacy file-based design software.



- 1 Status Updates/Team Meetings That Could Have Been Chats or Emails** – Unless two engineers are physically sitting next to each other, it is difficult to simultaneously collaborate on the same 3D model. Clunky solutions exist that involve sharing a computer screen on a videoconferencing site and getting on the phone. However, multiple engineers cannot access or work on the same product design at the same time. They have to work serially, one person at a time.

In this scenario, there is no transparency between colleagues, who have no way to see what each other is working on without regular in-person design reviews. While no one likes long or frequent meetings, sharing detailed project updates through screenshots or an email is rarely an adequate substitute.



- 2 Locating, Accessing and Communicating the Correct CAD Information** – CAD data is usually edited by multiple people in multiple places. Particularly with large assemblies, there are lots of files to keep track of. You save a version, make some changes and rename the file. Copies are emailed to suppliers or customers and get copied everywhere. There's never really a way to know if you truly have the latest version.

Some design teams rely on naming conventions like Part1-v1, Part1-v2, etc. and then settle on a "final" name when they're done. But changing the names of files as their contents change can often cause broken assemblies, because file names are used as references.

Even if you use a complex, add-on Product Data Management ([PDM](#)) system – requiring engineers to check-in and check-out files like they are in a bank vault – all you can see are the designs that are in the vault. There's absolutely no way to know if someone else has a copy outside of it. Is the data in the PDM system up to date? Nobody knows because the data in the PDM vault doesn't update in real time. The data only updates when people go through the trouble of checking in the data to update it, often retroactively at the very end of the project.

Manufacturing the wrong version of a design is an expensive proposition, leading to wasted materials, avoidable rework, production delays and potential liability issues. Knowing which version of your work is the final one shouldn't be a guessing game.



3 Dealing With CAD Software Stability, Reliability, Versioning or Performance – Users of file-based CAD platforms are no strangers to software crashes. Recreating lost work is not only aggravating, it's a step backwards for everyone on your team.

Why does file-based CAD software crash so often? It's because the mathematical computations going on in the background to create 3D geometry is far more demanding on the hardware than most other business-critical software. Furthermore, it's impossible for developers to test every possible combination of hardware, software and geometry out there, so compatibility problems are inevitable. Even just installing a new kind of software, such as an innocuous Windows update, can interfere with a file-based CAD system.

With traditional CAD, saving your data too frequently also increases the odds of corrupting your files. If your computer crashes while you are saving, the file structure will be incomplete (and therefore, corrupt). And if you have to recreate corrupt files, you may also have to fix other parts, assemblies and drawings that reference those corrupt files.

In addition, even if you and your external partners (designers, manufacturers, suppliers) are using the same file-based CAD vendor, if you're using software version 2022 and they are using version 2020, you will not be able to read each other's files. You will both be stuck in limbo until your partner pays for a forced upgrade and then installs it. Or you might be the one who needs to upgrade before work can resume.



4 Administration of CAD Software, Integrations, Hardware and Licensing – It's not uncommon for project managers to seemingly wait forever to give new engineers access to CAD. They first need to buy a new license code from their Value Added Reseller (VAR), a process that can take days or weeks depending on the VAR's responsiveness. Then the IT department needs to provision a computer and devote several hours for installation per CAD seat. **When engineers are ready to CAD, the CAD usually isn't ready for them.**

Also, with file-based CAD systems, access is tied to the license, not the user. So engineers are tied to their office computers and cannot work on any other device. Furthermore, Mac users have not been able to use most file-based CAD systems without first installing virtualization software to run Windows. This extra layer of software can lead to additional compatibility problems, making crashes even more likely.

With all these time-draining tasks piling on top of each other, it's no wonder why the typical engineer's "To Do" list keeps getting longer.

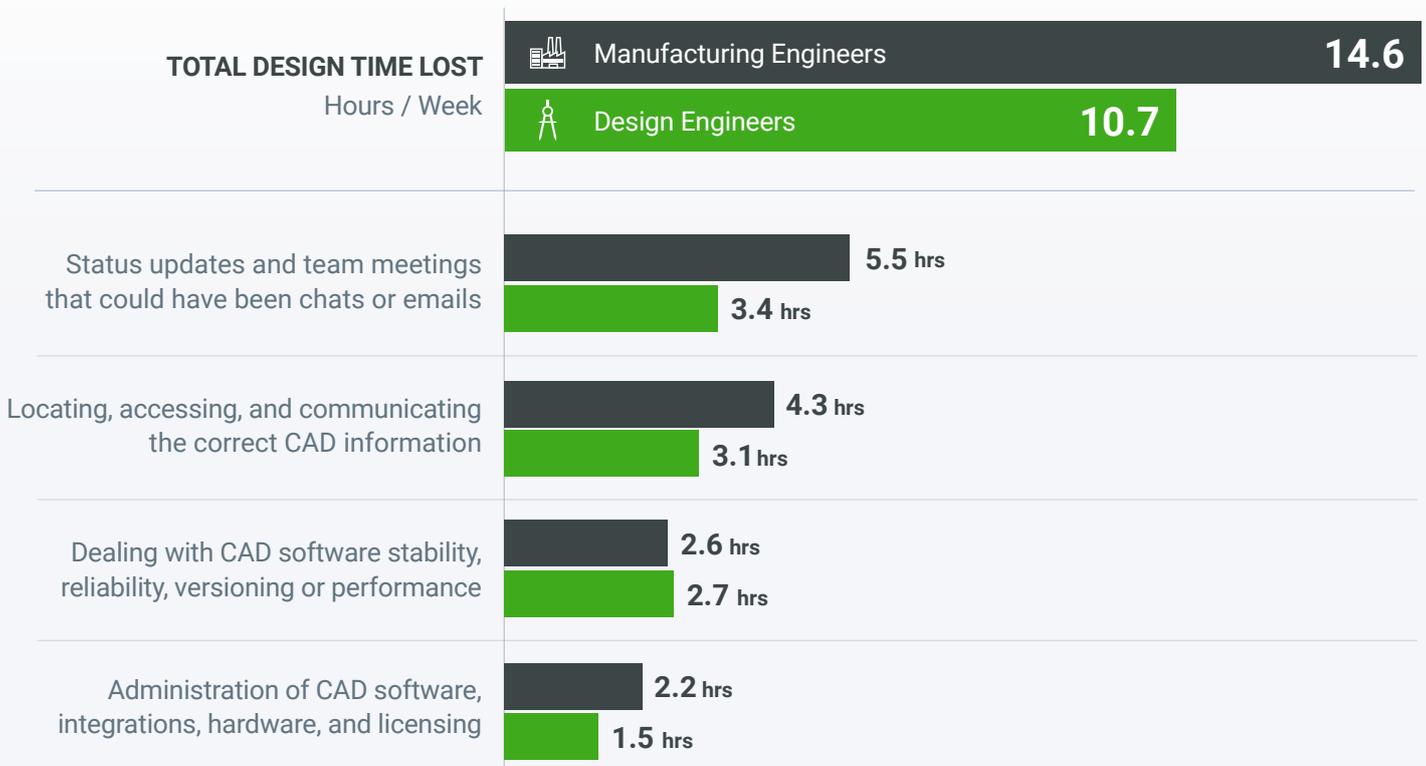
■ Efficiency of Manufacturing Engineers vs. Design Engineers

This time-suck is even more pronounced for manufacturing engineers compared to product designers:

Product Development Time Lost to Non-Design Tasks

Hours Per Week

■ Hours Wasted by Manufacturing Engineers ■ Hours Wasted by Design Engineers



Base: 640 respondents

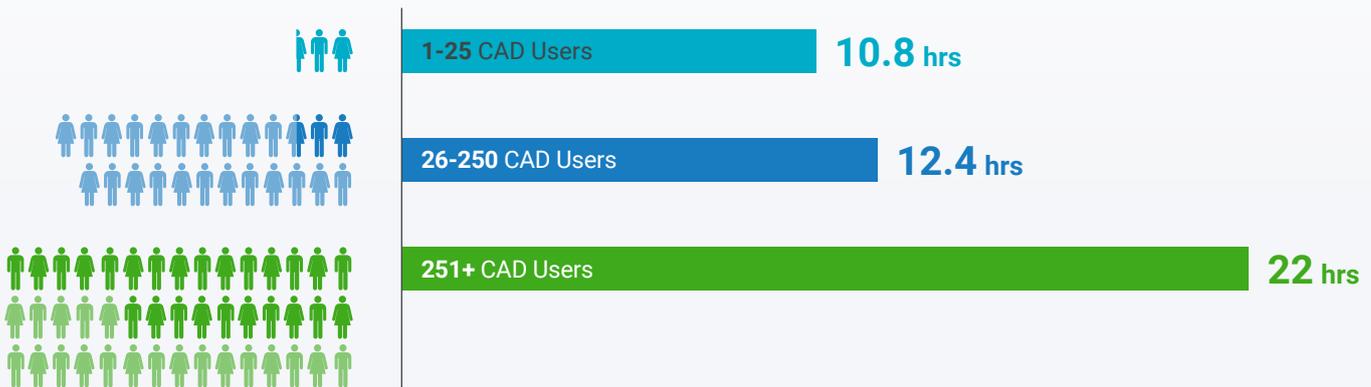
In general, manufacturing engineers waste more time than designers in locating data, communicating information, and providing updates while preparing CAD models for manufacturing.

Interestingly, CAD crashes and software incompatibility – which brings all work to a screeching halt – seems to be frustrating design engineers and manufacturing engineers equally.

On a final note, the bigger the company, the more time gets wasted on non-design tasks:

Average Hours Wasted on Non-Design Work (By Company Size)

Average Hours Wasted Per Week



Base: 1-25 CAD Users (377 Respondents), 26-250 CAD Users (103 Respondents), 251+ CAD Users (57 Respondents)

Note that 22 hours a week for product developers at larger companies amounts to half their design time being stripped away!

Obviously, it's a complete fantasy for 100 percent of working hours to be devoted to actual design work. Engineers and designers are not chained to their desks, some meetings are unavoidable, and all software occasionally has glitches.

But there is considerable potential to reclaim a number of lost hours each week through efficiency gains. One product development area where this is especially true is design collaboration between teams, **which we'll explore in Insight #5.**

insight
5

Engineering Teams Have the Most Friction Collaborating With External Manufacturers and Non-CAD Stakeholders Within the Company

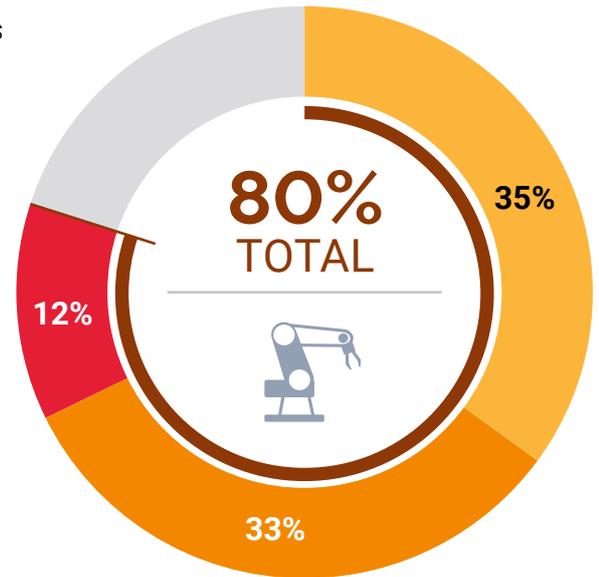
In our discussion of [Insight #2](#), we noted that 8 out of 10 product development professionals considered “manufacturing challenges” a potential barrier to company growth.

Manufacturing Challenges Recognized as a Growth Barrier

Percentage of Respondents

- 35% Slight Barrier
- 33% Moderate Barrier
- 12% Significant Barrier

Base: 562 respondents



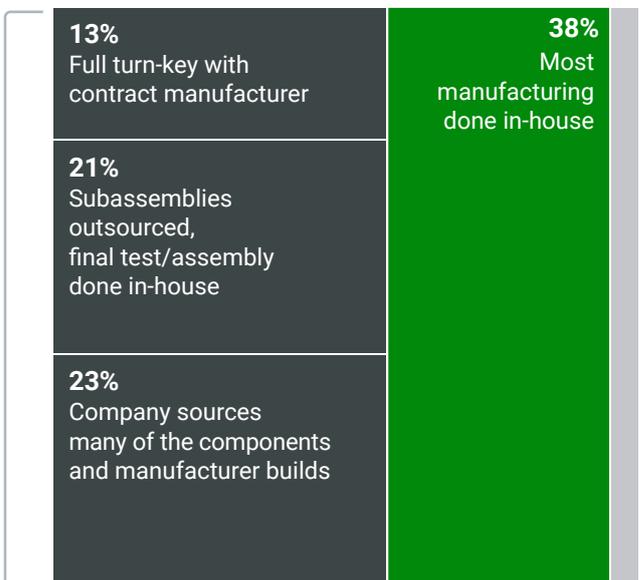
As we’ve noted earlier in this report, product development is a team sport. Most companies work with partners to manufacture their products. Here’s the breakdown:

How Companies Work With Manufacturing Partners

Percentage of Respondents

Base: 594 respondents

57%
Use External Manufacturing Process

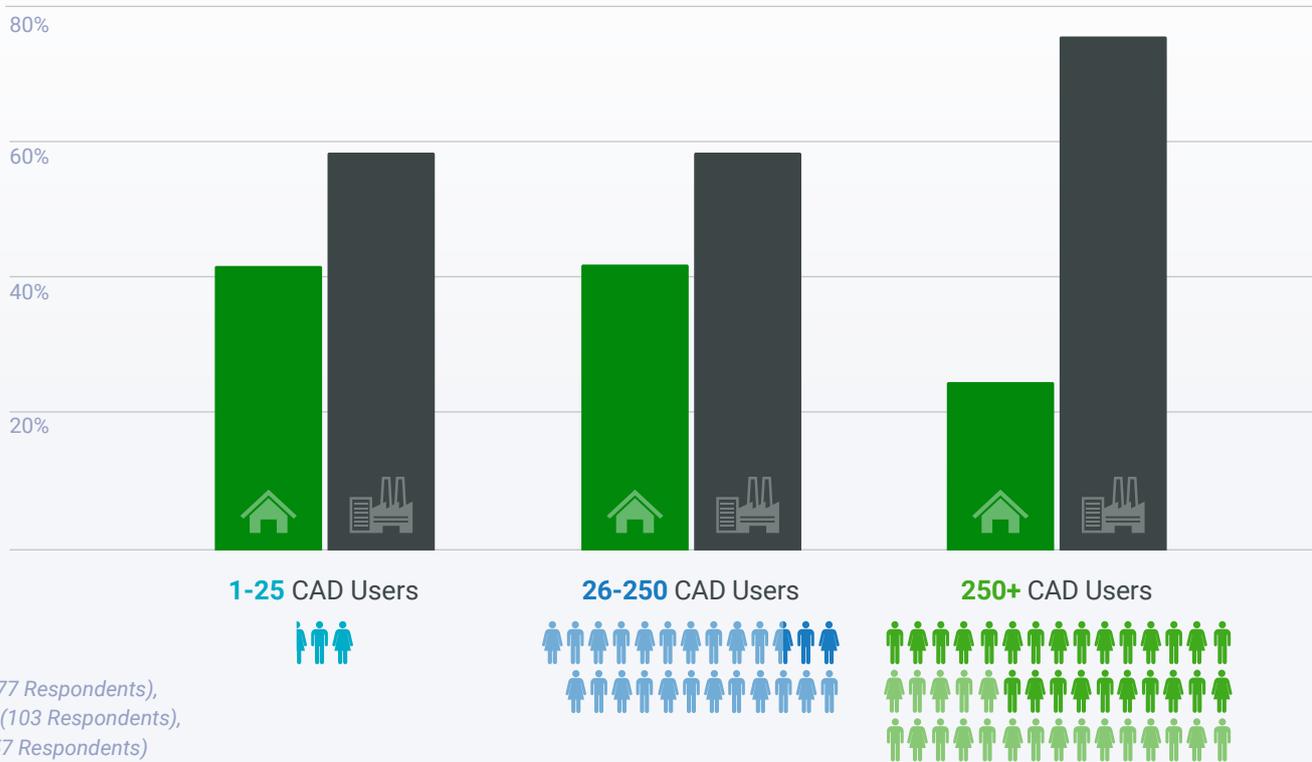


In general, companies with larger engineering teams gravitate toward outsourcing their production lines. They are half as likely as companies with small and medium-sized teams to keep their manufacturing in-house.

The chart below compares manufacturing strategies by the number of CAD users per company:

Manufacturing Approach (By Company Size)

■ In-House Manufacturing ■ External Manufacturing



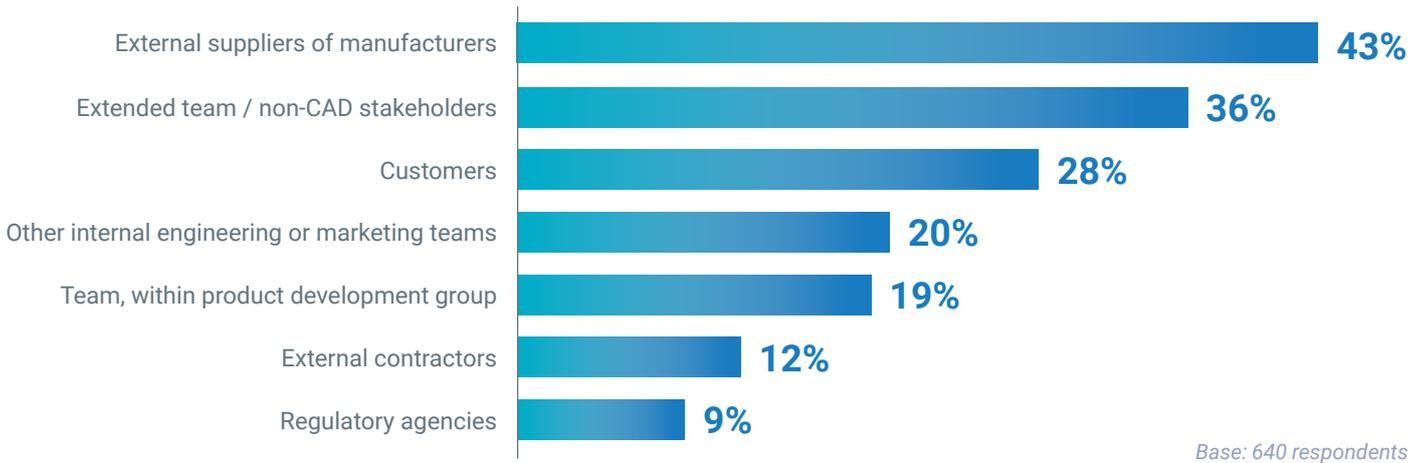
Regardless of whether design and manufacturing is done under the same roof, or with distributed teams across multiple locations, communicating the most up-to-date information is paramount to incorporate internal stakeholder input and avoid production errors.

In addition to communicating with the manufacturing team (in-house or external), the core design team must also sometimes share CAD data with non-CAD users such as executives, customers, suppliers, marketing and sales.

With this in mind, we asked companies where they were experiencing the most friction in the design collaboration process.

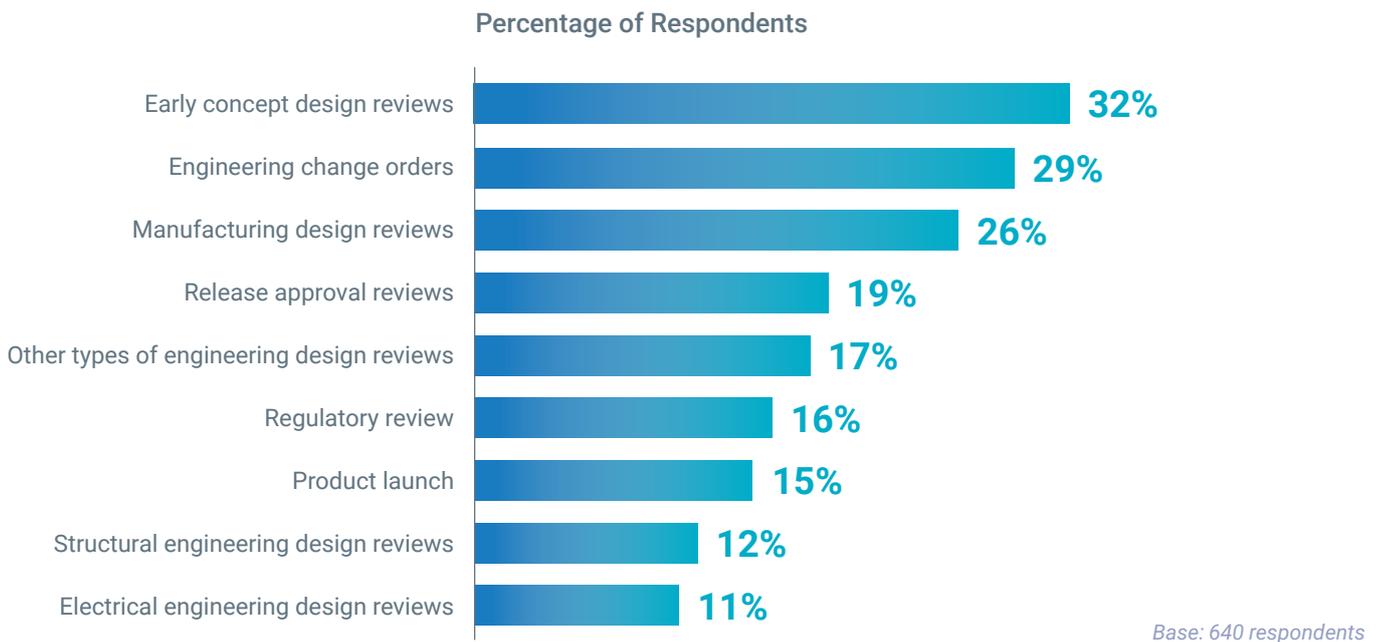
Sources of Friction During Product Design Collaboration

When collaborating on product designs, with whom do you have the most friction, delays or challenges?"



And we asked design and manufacturing professionals to identify which stages of the product development process where they waste the most time:

Most Inefficient Stages of Product Development



■ When Does Design Collaboration Eat Up the Most Time?

Let’s take a look at the top two areas that respondents identified as culprits for slowing down product development: early concept design reviews and Engineering Change Orders (ECOs).

Early concept design reviews require the most back-and-forth communication as designers and engineers play a game of “telephone” between extended stakeholders – such as executives, customers, sales and marketing teams – and external manufacturing partners.

Early Concept Design Reviews: Who’s Collaborating With Who?



During this conceptual stage, the engineering team is taking requirements from customers and sales/marketing to develop an **ideal** product design, balancing form and fit with engineering requirements such as structural integrity and safety. At the same time, the design team must consider input about manufacturability and costs.

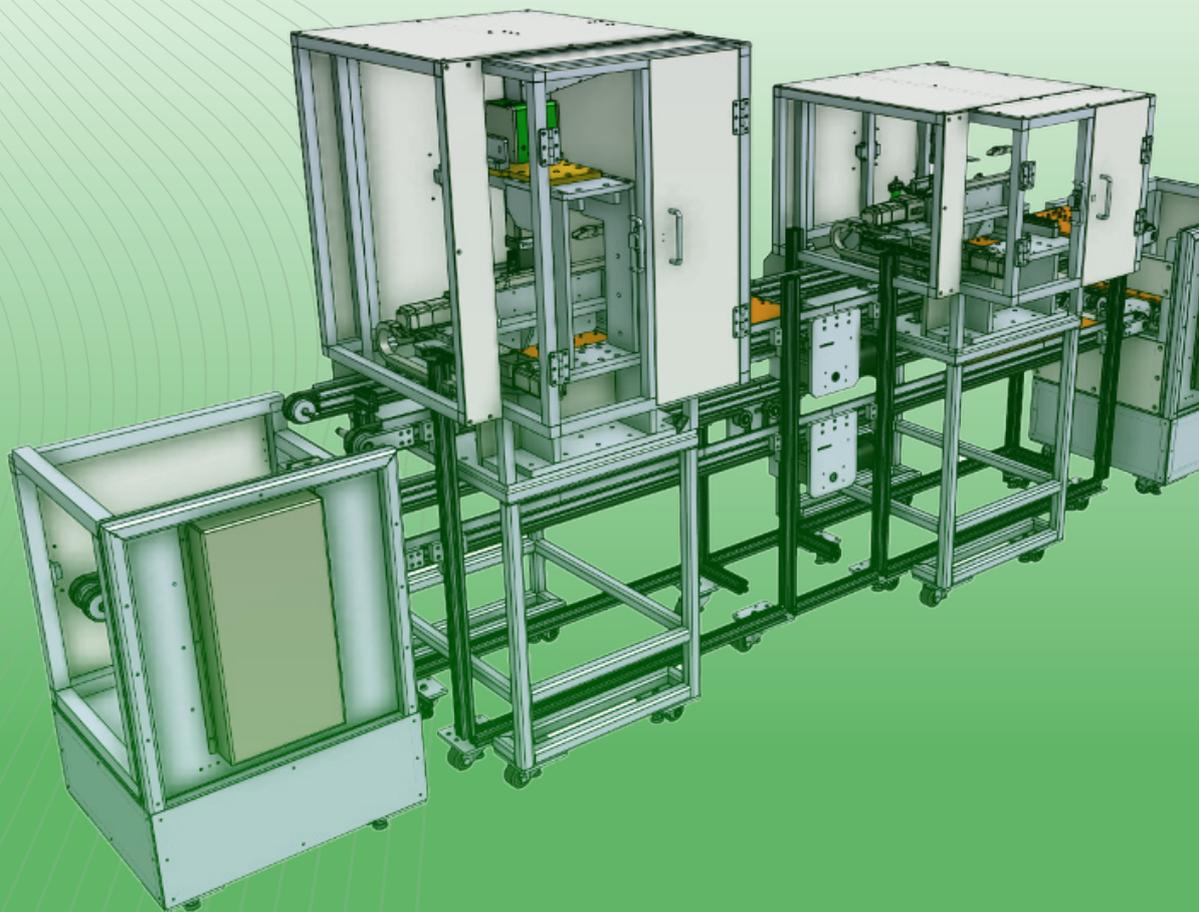
It’s imperative for product development teams to spend more time upfront, “measure twice and cut once,” to avoid manufacturing errors, reduce wasted materials and minimize the risk of product failure in the market. However, the greater number of players involved increases the odds of miscommunication and chances of accidentally sending the wrong version of design data to colleagues or partners.

It also can be challenging to solicit and incorporate complex feedback on a 3D model, particularly with non-CAD users, making conceptual design reviews one of the most inefficient stages of product development.

Engineering Change Orders (ECOs) happen on the opposite end of the process, after a product design has been released for manufacturing. No design is perfect the first time and improvements are often needed, whether they be improvements to the design or changes required for manufacturing.

An ECO is effectively rework. When changes are made to one area of a product, inevitably other aspects of the design are also affected. All ECOs are carefully vetted in design reviews to make sure the late-stage changes are warranted.

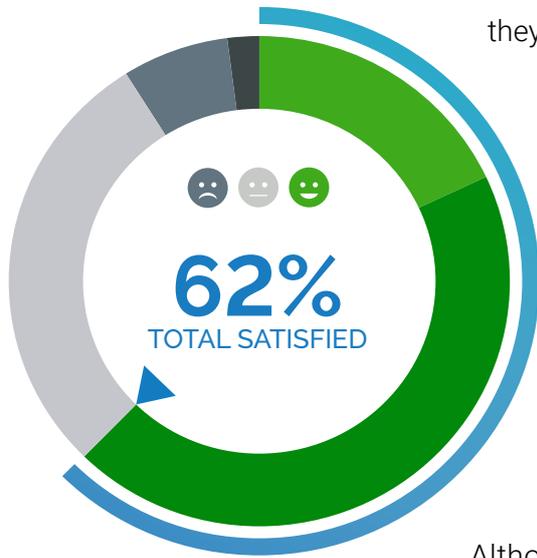
The reason ECOs can cause production delays is because most companies are using a file-locking Product Data Management (PDM) system that forces teams to work one person at a time. Engineers need to check files in and out of a “vault” and no one else can access them until work is completed. This serial workflow can easily cause [design bottlenecks](#). Making sure the shop floor has immediate access to the latest, most accurate information is paramount.



insight
6

Most Companies are Generally Satisfied With Their Current CAD Software, Despite Acknowledging Inefficient Design Processes

Users of 14 different CAD systems participated in the State of Product Development and Hardware Design 2022-2023 report, providing a broad cross-section of designers and manufacturers. And overall, respondents are generally content with the software they are currently using:



Satisfaction With Your CAD System

How satisfied are you with your company's CAD solution(s)?

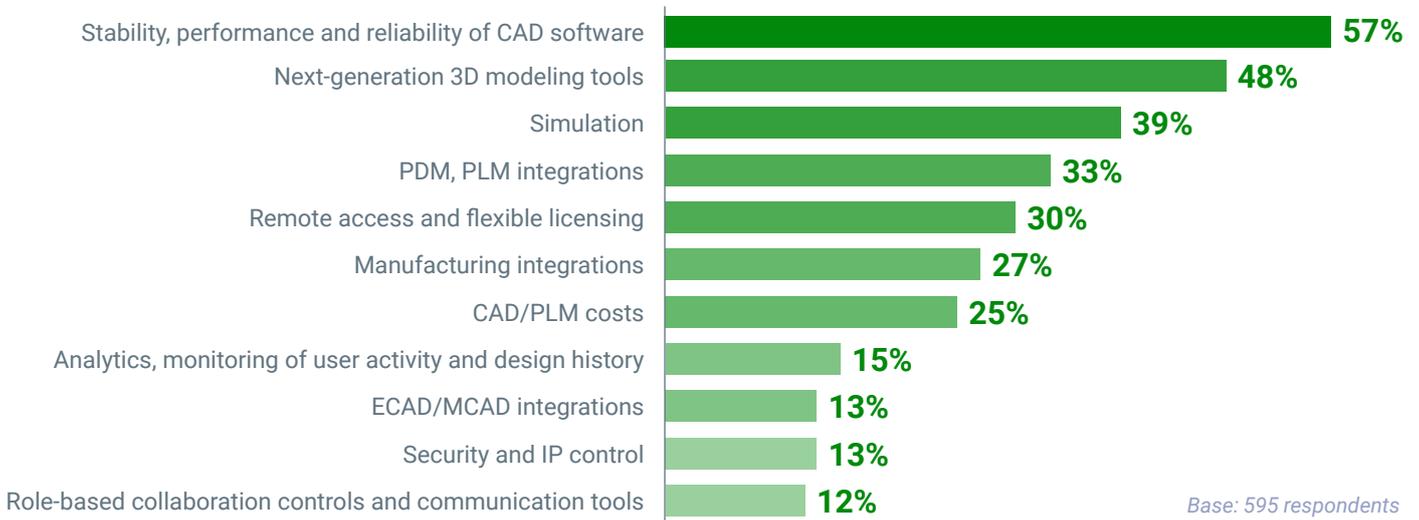


Base: 742 respondents

Although 62% of respondents report little motivation to change software, here are the criteria they would value most in a new CAD system:

Most Important Features/Tools in a Future CAD Solution

If you could improve three aspects of your CAD solution to better support your product design team's process, what would they be?



Base: 595 respondents

Respondents were limited to choosing up to three features, so a low percentage doesn't necessarily mean it carries no importance in a purchase decision. Buying criteria vary by job role and company size. For example, engineers and engineering managers are more likely to focus on the CAD functionality itself, while integrations are the top priority for IT/CAD administrators.

What's especially notable is that CAD stability scored highest across all respondents, rating twice as important (or more) as most other criteria. CAD system crashes, and the lost work associated with them, is a universal pain point.

In this survey, 80% of product development professionals reported "manufacturing challenges" to be a primary barrier to company growth, while 77% found "inefficient processes" to be a top barrier.

This survey reveals that both barriers are very much present in product developers' lives. Consider that:

-
- **43%** of respondents report collaboration friction with external suppliers or manufacturers.
-
- **26%** of respondents cite manufacturing design reviews as the most inefficient stage of product development.
-
- Respondents waste an average of **4.2 hours per week** on "status updates and team meetings that could have been chats or emails."
-
- Respondents waste an average of **3.4 hours per week** "locating, accessing, and communicating the correct CAD information."
-
- Respondents waste an average of **2.8 hours per week** on "time lost to CAD software stability, reliability, versioning or performance."
-
- Respondents waste an average of **1.9 hours per week** on "administration of CAD software, integrations, hardware and licensing."
-
- In total, respondents waste an average of **12.3 hours per week** on non-design tasks, or **one-third of their work year**.
-

So it's rather incongruous that the same group of professionals who reported the above inefficiencies would not attribute any "blame" on the design tools they use daily.

However, all of these inefficiencies are inseparable from a company’s CAD software – where all the product design ultimately happens. Consider the salaries of today’s hardware engineers, self-reported data aggregated by [Glassdoor.com](https://www.glassdoor.com):

Hardware Engineer Salaries in the United States

August 2022



Time is money. At a time when companies face steep competition for talent, each experienced engineer becomes all the more valuable. With the minimum investment of about \$100K for an engineer (not including benefits), **losing one-third of their design time amounts to \$33,000+ in productivity losses per engineer per year.**

More difficult to measure are the opportunity costs. When a company reclaims 49 hours of design time a month (per engineer), how could that newfound time be invested? Perhaps it could result in further exploration of alternative designs, leading to a new product improvement. Or perhaps engineers could finish their projects earlier, giving them time to take on the next assignment earlier. Ideally, more engineers would be emboldened to take more creative risks versus just focusing on finishing the job.

Engineers and designers are not robots and their time cannot be optimized as easily as software and hardware, but the more time they can devote to designing products, the more likely a company can accelerate its time-to-market. As companies examine the best strategies for talent recruitment, retention and business growth, considering the latest collaboration tools and product development technologies should be part of the equation.



Labor Pains: Why Recruiting and Retaining Talent is Especially Tough Right Now

As reported in [Insight #2](#), nearly 8 out of 10 product development professionals regard “Lack of Staff” as a barrier to company growth.

That perception is underscored by some major trends happening in the workforce right now:

- **The “Great Resignation”** – Spurred by the pandemic, record numbers of workers in the U.S., Canada, Europe, India and China have voluntarily quit their jobs, many seeking a better work-life balance.
- **“Quiet Quitting”** – A viral social media phenomenon is highlighting stressed-out workers who admit doing only the bare minimum at their jobs and not caring about exceeding expectations.
- **Remote Worker Backlash** – After proving they could be productive working from home during the pandemic, many remote workers are resisting a full-time return to the office.

Let’s explore each trend in more detail.

LABOR PAINS:
WHY RECRUITING AND
RETAINING TALENT IS
ESPECIALLY TOUGH
RIGHT NOW

Also dubbed the “Great Reshuffle” or the “Big Quit” by the media, the [“Great Resignation”](#) describes the record-breaking numbers of employees quitting their jobs for better opportunities. [CNBC](#) notes that companies have responded to this unprecedented turnover problem with “signing bonuses, higher salaries, the option to work remotely and expanding their geographic hiring boundaries for teleworkers.”

According to the [U.S. Bureau of Labor Statistics](#), 47.4 million American workers quit their jobs in 2021, a 34% increase from 2020 and a 13% increase from 2019 – which at the time was the highest amount of employee quits on record. The [2022 Retention Report](#), an annual human resources study by the [Work Institute](#), attributed 47% of all job-related reasons for quitting to “workload and stress.”

If you believe the worker confessions on TikTok, you don’t actually need to formally leave your job in order to quit. As [The Wall Street Journal](#) reports, TikTok videos with the hashtag [#quietquitting](#) have attracted more than 22 million views, with testimonies of workers confessing they do the bare minimum at their jobs. One “quiet quitter” explained the philosophy this way: “You’re quitting the idea of going above and beyond.”

Or put another way, their message is that productivity is overrated. Perhaps the quest for underachievement is due to a perception that there are few opportunities for career advancement at their company. Survey respondents cited this exact reason ([see page 15](#)) as their second biggest challenge for retaining top talent.

While it might be tempting to dismiss this TikTok talk as typical youthful rebellion, [Gallup](#) recently found that only 34% of employees consider themselves “engaged” by their work, while another 16% define themselves as “actively disengaged.” Gallup regularly measures [employee engagement](#) with their “Q12” survey inquiring if workers feel their role is important, if their opinions “seem to count,” if there are “opportunities to learn and grow” and if their supervisor “cares about me as a person.”

Where those engaged and disengaged employees do their work continues to be in flux. [The Washington Post](#) reports that about one-third of all work was done remotely in 2021 and the first half of 2022, compared to two-thirds of all work being done from home at the peak of the pandemic in 2020. But as companies now try to get their employees back to the office, there is some pushback from workers who prefer the flexibility of remote work and a stress-free, zero-cost commute.

**LABOR PAINS:
WHY RECRUITING AND
RETAINING TALENT IS
ESPECIALLY TOUGH
RIGHT NOW**

[AppleTogether](#), a “global solidarity union” of Apple employees, recently launched a petition protesting the company’s policy mandating three days a week in the office as of Labor Day 2022. More than 800 employees signed the petition, asking that flexible work arrangements be made with immediate managers, citing “many compelling reasons and circumstances: from disabilities (visible or not); family care; safety, health, and environmental concerns; financial considerations; to just plain being happier and more productive.”

While all three of these trends – the “Great Resignation,” “Quiet Quitting,” and Remote Worker Backlash – span across all job sectors and are not specific to product development, they do spark some important questions for manufacturing companies.

**What are YOU doing to keep your employees engaged?
In this tight job market, why would top-tier talent want
to join your company vs. a competitor? And if you are
lucky enough to hire your top candidates,
what will you do differently
moving forward to keep them?**





How Cloud-Native Onshape Can Help Manufacturing Companies “Return to Growth”

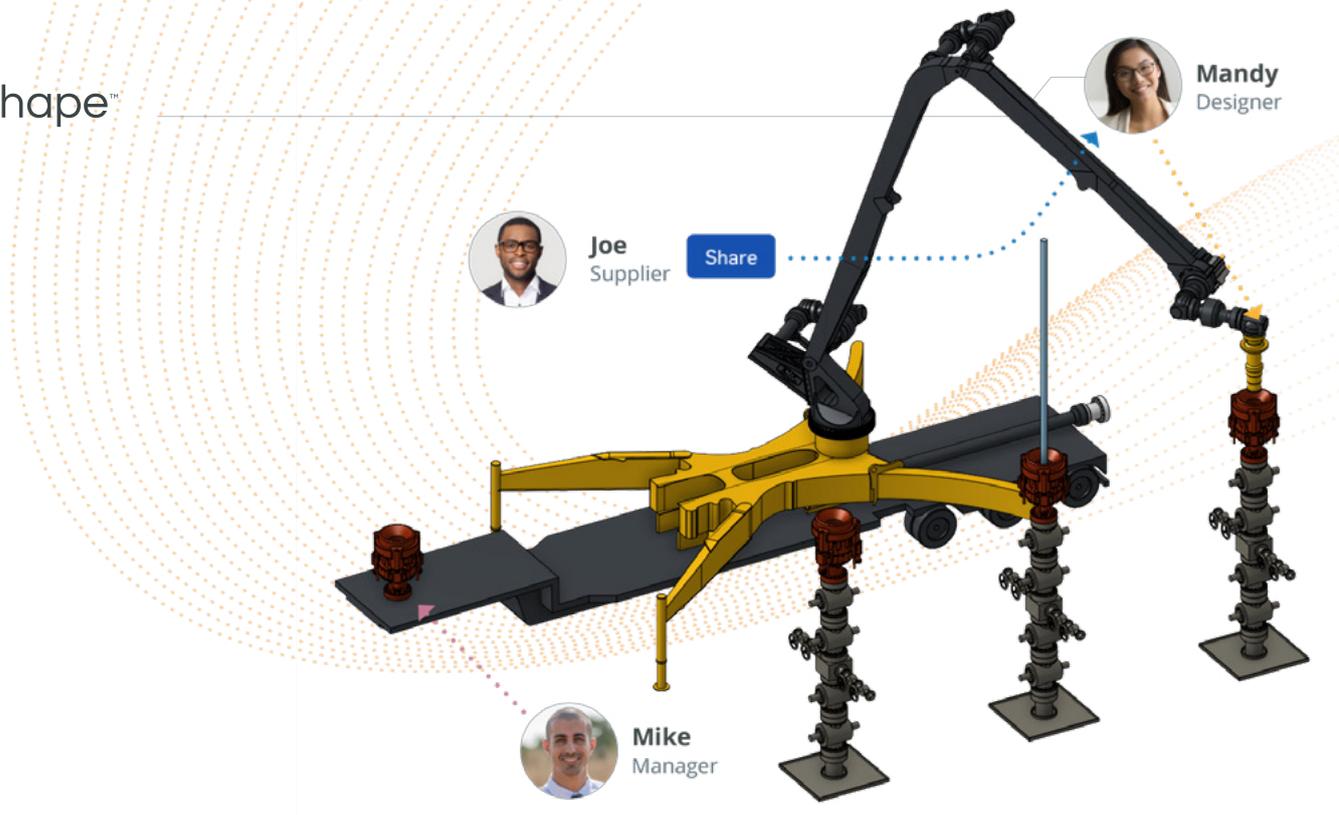
Ambitions and goals are nice, but companies that struggle to hire the right talent (and enough talent) are doomed to keep running in place. In [Insight #2](#), survey respondents identified the following challenges as the biggest obstacles to employee recruitment:

- 1. Finding candidates with specific knowledge or skills.*
- 2. Limited pool of talent in your geographical region.*

One surefire way for companies to overcome both these challenges is to eliminate geography as a job criteria altogether. When it comes to attracting and retaining the best engineering talent, why settle for the best candidates within a 50-mile radius when you can expand your search pool to the best in the world?

Giving your product development team access to cloud-native design and collaboration tools frees them up to work from anywhere and reclaim hours of wasted time embedded in traditional file-based CAD workflows.

Certainly, not all product development jobs can be done remotely (frontline manufacturing roles immediately come to mind), but offering flexible work hours and locations when possible can have a positive impact on employee morale. Reducing time-wasting and monotonous work –freeing up designers and engineers to spend more time with creative tasks – can boost personal engagement with your company’s mission.



Be More Agile

Onshape is a [cloud-native CAD](#) and data management platform that speeds up product development by eliminating the most common obstacles that slow companies down. As has been the case for years in software development, agility has become absolutely vital for hardware companies. Now more than ever, organizations need to improve their ability to respond quickly to unexpected or unforeseen conditions.

[Cloud-native product development](#) platforms give distributed design teams the flexibility to work together from any location. Engineers can instantly access their work and their design software from any computer, tablet or phone via a web browser or mobile app (iOS or Android) without delay. If one computer crashes or malfunctions, work can continue uninterrupted on another device.

Regardless of where an engineering team is working – on different floors, different office buildings, different states or different countries – cloud-native product development tools allow team members to work as if they are in the same room looking over each other’s shoulders. Unlike with file-based installed CAD and PDM systems, multiple engineers can work on the same 3D CAD model simultaneously and provide immediate feedback as easily as making a comment on social media.

There is no need to email screenshots back and forth or deal with downloading file attachments. There is no need to schedule time-wasting meetings to communicate information that can be accessed with the click of a mouse.

When engineers’ downtime is minimized, IT overhead is reduced to zero, and communication is streamlined, product design teams can devote much more of their time to what they were hired to do – design!

BE MORE AGILE

Here's how Onshape addresses some of the biggest issues identified in this survey:**Empowering Companies to Support Flexible “Work From Anywhere”**

Team members can instantly access their CAD system and CAD data on any computer, tablet or phone – eliminating the barrier of needing a high-performance workstation to do engineering work. Onshape's [SaaS delivery](#) means that teams no longer require IT support for maintenance and upgrades and can keep working uninterrupted from anywhere. Having full [CAD for Mobile](#) capability is not only beneficial for working at home, but also for frontline service engineers who may need to access designs on the factory floor at client sites.

**Improving Early-Stage Internal Collaboration**

In product development, more stakeholder voices and input usually results in more innovative products. By offering easy online access to designs, product engineering teams can get earlier feedback from sales, marketing, executive leadership and also their customers, who may normally have no access to CAD. Giving more people influence over the design process not only improves your product, but also leads to more engaged employees.

**Streamlining Communication with External Manufacturing Partners and Suppliers**

Onshape's secure [Sharing feature](#) gives external partners immediate view-only, commenting or editing access to your latest designs – without the burden of installing any special viewing software. Partners also instantly see design changes as they happen, and can access a comprehensive Edit History, eliminating the risk of miscommunication and costly manufacturing errors. Live chat and commenting enable more frequent real-time feedback, eliminating the delays of email communication and scheduled calls.

**Reducing Wasted Time Spent on Non-Design Tasks**

Engineers are never wasting time searching for the latest version of a design because there is only one [single source of truth](#) – their Onshape Document, which they can access the moment they sign in. Because Onshape is a cloud-native Software-as-a-Service (SaaS) platform, there is [zero IT overhead](#). There are no downloads, installs, license codes or upgrades to worry about – engineers can spend more time being engineers. [Simultaneous editing](#) means that teams can also say goodbye to productivity-killing serial workflows.

BE MORE AGILE

**CAD Software Stability, Reliability and Compatibility**

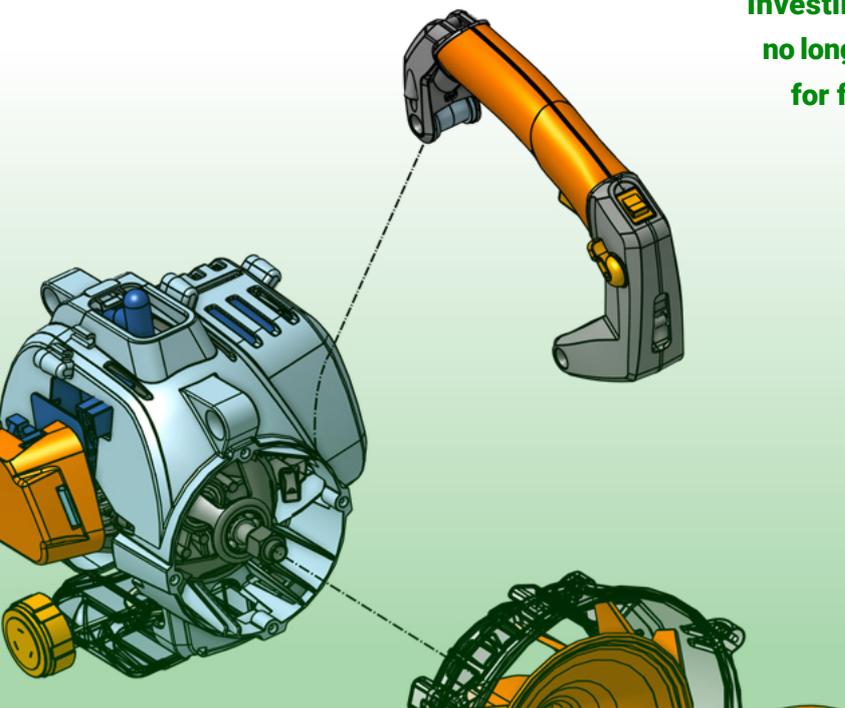
Onshape users never experience the negative impact of crashes. Although no software is 100% crash-proof, on the rare instances when Onshape does crash, your data is already saved on redundant servers and a new instance of the failed software component takes over in just a few milliseconds. Onshape also automatically upgrades in the cloud every three weeks. Every Onshape user in the world is always on the latest software version.

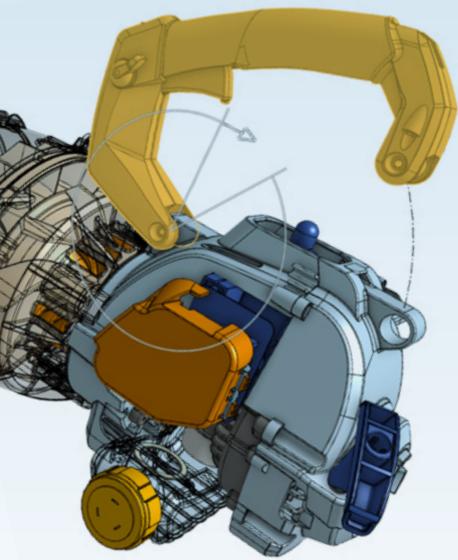
**Full Visibility/Transparency Across an Organization**

If you are an executive or manager overseeing product development teams with multiple projects spread across multiple locations and time zones, it is impossible to have any real-time understanding of where things stand. With file-based CAD and PDM, colleagues, too, have zero visibility on what everyone is working on without scheduling formal design reviews. With Onshape's [real-time analytics](#), you can see up-to-the-minute progress reports on a design's status, including updates on each team member's contributions. These live CAD analytics, only possible with a cloud-native platform, enable you to make data-driven business decisions, identify [product design bottlenecks](#) earlier and reallocate resources when and where they are needed most.

The pandemic has rapidly accelerated transitions in technology and workplace culture that were already happening. Companies that ignore or dismiss these seismic shifts will be left behind.

Investing in a cloud-native CAD and PDM platform is no longer a “nice-to-have,” but a “must-have” technology for forward-thinking manufacturers.





The Benefits of Cloud: How Manufacturers Are Saving Design Time and Money

Here are a few examples of product development teams experiencing significant savings after switching from file-based tools to cloud-native CAD and PDM. For more information, visit the [Onshape Case Studies](#) page.

CUSTOMER STORY

Avidbots™



Industry:
ROBOTICS

Benefit:

Reclaimed 50% of its product design time which used to be devoted to syncing CAD changes across the organization.

[Avidbots](#) is the developer of Neo, the world's leading fully autonomous floor-scrubbing robot for large commercial spaces – such as airports, shopping malls, hospitals and warehouses. The product development team was seeking a better way to share its updated CAD data across their internal departments and external partners worldwide.

According to Avidbots senior mechanical engineer Ian Gardiner, the company switched to cloud-native Onshape because their primary file-based CAD system was slowing down communication.

“Email and spreadsheets were our typical way of sharing information, but with these older CAD systems, a lot of your data gets buried within the system,” he says. “You have to purchase extra licenses and/or add-ons to make CAD available to people. So we would export PDF drawings and put them into folders that people could access. But these are disconnected from the real models that are being developed day by day.”

“Half our team’s time used to be spent constantly reproducing and updating changes,” Gardiner adds.

Onshape’s real-time data management provides one single source of truth for product designs across the organization. Whenever one member of the team makes a change, everyone else can instantly see it. A comprehensive Edit History tracks who made what change and when, allowing teams to return to any prior state of the design process if desired. In addition, Onshape’s Sharing feature also allows design teams to instantly share CAD models with external partners with just a web link.

CUSTOMER STORY



Industry:
ROBOTICS,
INDUSTRIAL
AUTOMATION

Benefit:

Since adopting Onshape, **collaboration is 60 to 70 percent faster** between the core design team and external partners.

Based in the UK, [VIKASO](#) is an industrial automation startup specializing in integrating collaborative robots (“cobots”) into manufacturers’ production lines to automate repetitive tasks. VIKASO’s customers include companies of all sizes, ranging from fellow startups to iconic global brands such as Rolls-Royce, BMW and MINI.

Preparing to quadruple its engineering team in 2020, VIKASO was seeking a CAD and PDM solution that could resolve the version control issues it was experiencing with only one engineer collaborating with suppliers and customers.

VIKASO reports that cloud-native Onshape’s real-time collaboration tools has sped up communication by 60 to 70 percent between its core design team and external partners. Customers can now monitor the latest designs 24/7 without the pre-cloud delays of sending updated files back and forth.

“Transparency is very important to us,” says Director Vaibhav Boricha. “Onshape’s Comments feature lets us easily record why we’ve done what we’ve done – so we can still work at a rapid pace, while taking on some really risky, innovative and disruptive projects.”

CUSTOMER STORY



Industry:
INDUSTRIAL
EQUIPMENT

Benefit:

\$80,000 to \$120,000 in upfront savings by subscribing to cloud-native CAD and PDM for the same cost of traditional CAD.

[Amphenol Fiber Optic Products](#) is one of the world’s leading providers of connectivity equipment for the communications, IT/datacom, mobile and medical device industries. The global engineering team was seeking a Product Data Management (PDM) system to keep track of design changes for hundreds of products between its teams in the United States, Mexico, China and Vietnam.

Switching to Onshape allowed Amphenol to get cloud-native CAD with built-in PDM for the same cost they were previously paying for file-based CAD alone – resulting in \$80,000 to \$120,000 in immediate savings.

As a Software-as-a-Service (SaaS) platform, Onshape also reduces IT overhead, eliminating the need for installs, upgrades, licenses, servers, networking equipment and the time required to manage them.

“There are so many facets to conventional PDM systems that all just get smoothed out with Onshape,” says Ken Capozzi, Global Director of Engineering. “Instead of thinking about IT, I can now focus more on R&D and manufacturing.”

CUSTOMER STORY

Loop



Industry:
MEDICAL DEVICES

Benefit:

Reclaimed 30% of engineering time lost to previous IT overhead

[Loop Medical](#) is a startup developing a new minimally invasive device to extract blood from capillaries just below the skin versus conventional methods that collect from the vein. The breakthrough technology is aimed at simplifying blood diagnostic testing in developing nations where medical resources and standards are often subpar.

Loop CEO Arthur Queval credits Onshape for streamlining collaboration between his engineering teams in Switzerland, Germany and France.

“(With our old system), sharing design files used to be very frustrating because partners would always be working on a different version of the CAD system and we couldn’t open up each other’s work without having long email conversations or using Google Drive,” he says.

“Onshape’s workflow is really smooth and it’s much easier to share our work and move on to the next task,” Queval adds. “I can always see the status of a design and comment or address problems in real time.”

The CEO notes another huge business benefit is that Onshape requires no installs, downloads, licenses or other time-sucking IT tasks.

“Just before we switched to Onshape, our system crashed and we had to install and reinstall our CAD software multiple times. We lost maybe three days trying to install the new updated version,” he says. “I like that Onshape delivers its new updates in the cloud and that everything just works.”

“Before, IT issues would take up 30 percent of our engineering team’s time or we’d need to dedicate one IT person for the R&D team,” says Queval. “We don’t need to do that now. So we’re saving on overhead while also being much more efficient.”

CUSTOMER STORY



Industry:
FURNITURE

Benefit:

Reclaimed 50% to 75% of design time by programming their own Onshape custom features to eliminate repetitive tasks.

Furniture manufacturer [Premier Custom-Built](#) makes custom cabinetry for luxury homes and yachts, designing every job from scratch. Onshape’s open-source programming language, [FeatureScript](#), enables Premier to create their own custom industry-specific CAD features that combine multiple steps and automate repetitive design tasks.

“FeatureScript saves us 50 to 75 percent of the time to make multiple cabinets as opposed to have to model them one cabinet at a time,” says IT Manager Kevin Hertzog.

The engineering team is also relying on Onshape to help create a paperless manufacturing floor, aiming to migrate their cabinetry product specs currently in 3-ring binders to 3D CAD models. Having product engineers, the IT team, and the shop floor all instantly accessing a single source of truth reduces the risk of miscommunication and manufacturing errors.

CUSTOMER STORY



Benefit:

Designed and **manufactured an emergency ventilator from scratch in 21 days**, a product development cycle that typically requires many months.

In the earliest days of the COVID-19 pandemic, U.S. government officials asked stealth hardware startup [Meter](#) to design an affordable and scalable hospital-grade ventilator to address anticipated nationwide shortages. Complicating matters, the engineering team was forced to work from home by the pandemic's shelter-in-place mandates.

Including Meter's core team of a dozen engineers, about 50 people were involved in the development of the Rise Emergency Ventilator, which was manufactured from scratch in an unprecedented three weeks. Meter went through six design iterations, producing a new improved version of the ventilator every three-and-a-half days. The extended team included 3D-printing experts, hospital clinicians, software developers and sheet metal fabricators.

Industry:
MEDICAL DEVICES

Meter co-founder Eduardo Torrealba credits Onshape's real-time CAD collaboration tools for rapidly streamlining communication between all the different contributors.

"Onshape was just incredibly valuable for us," he says. "We were moving way too fast to deal with emailing files around or setting up servers and a lot of the other things that we would need to do to have that same level of collaboration if we had been using other CAD packages."

It's time to stop wasting time and money.
How can cloud-native CAD accelerate
YOUR product development processes?



Sign up today for a free
Onshape Professional Trial

Get Started ➔

Appendix: Survey Demographics

To better understand the current State of Product Development & Hardware Design, we analyzed the survey responses of

818 product design and manufacturing professionals

with the following **JOB ROLES:**

50%

Product Designer / Engineer



19%

Director, VP or Executive



15%

Engineering Manager



9%

Manufacturing Engineer



4%

IT / CAD Administrator



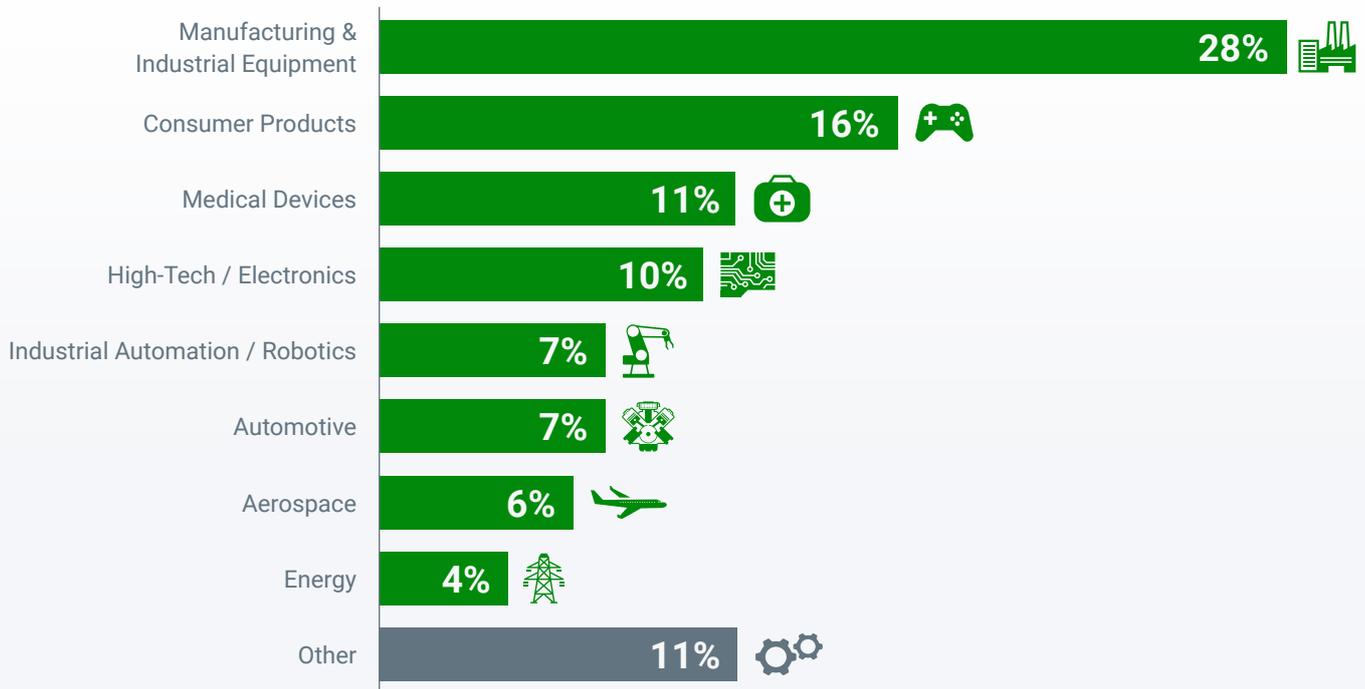
3%

Other

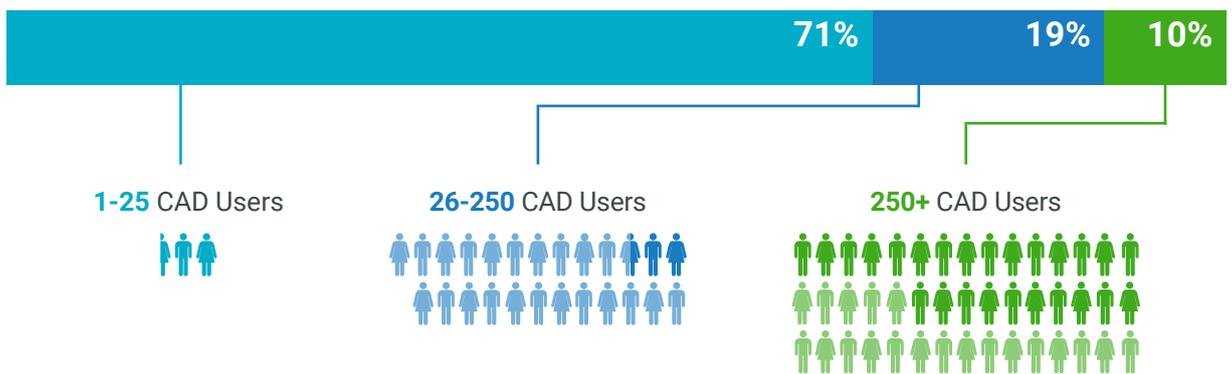


Slightly over one-third of respondents are executives, managers or team leaders, with the balance serving as individual contributors. All participants in the survey work for a company that designs or manufactures products, across various industries and company sizes.

■ Represented Industries



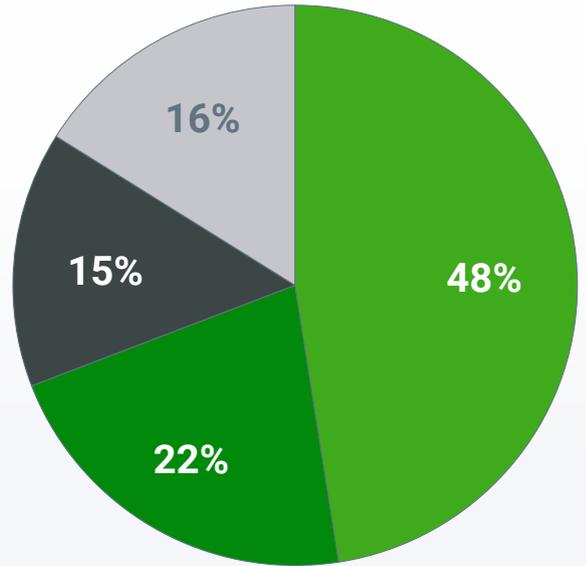
■ Size of Product Development Team



Nearly one-third of respondents work for engineering and manufacturing teams with 25 or more CAD users.

■ Frequency of CAD Usage

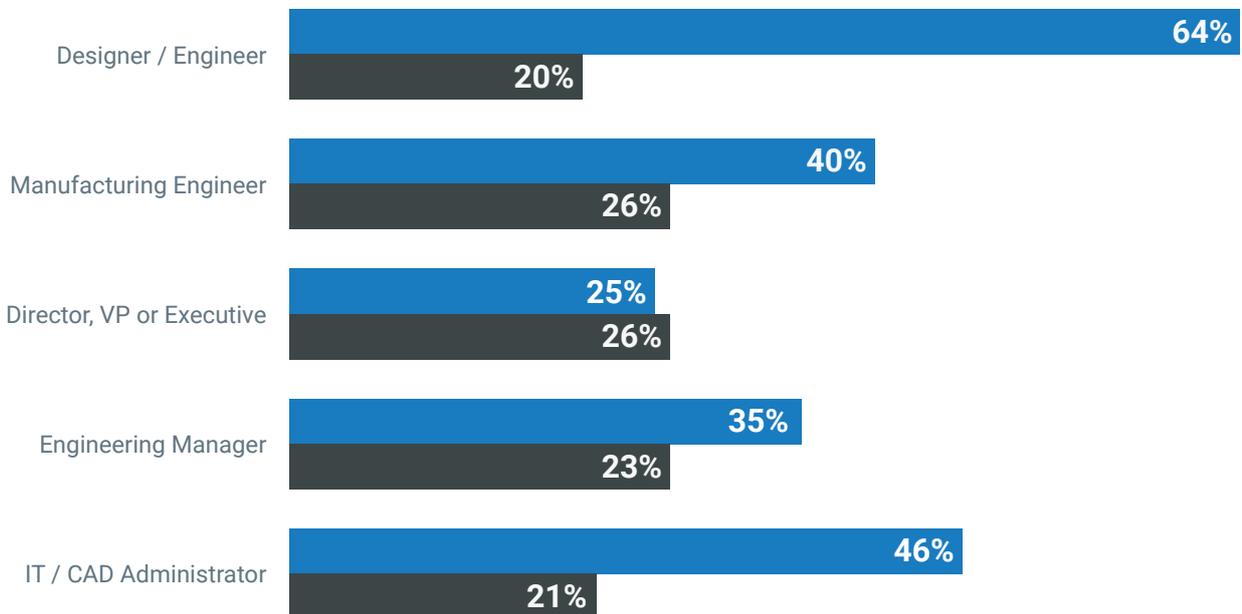
- 48% Daily
- 22% Weekly
- 15% 1 to 3 Times a month
- 16% Less than once a month



About half of respondents are daily users of CAD software, but not all frequent users are individual contributors.

■ Frequency of CAD Usage by Job Role

- Daily
- Weekly



1 out of 4 Directors or Executives use CAD daily.
 1 out of 3 Engineering Managers use CAD daily.
 Nearly 1 out of 2 IT/CAD Admins use CAD daily.

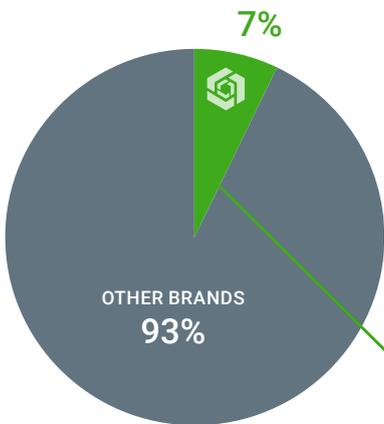
■ Career Experience in Product Development

Survey respondents include a roughly even distribution between early career, mid-career and veteran professionals.



■ Representation of Product Development Software Brands

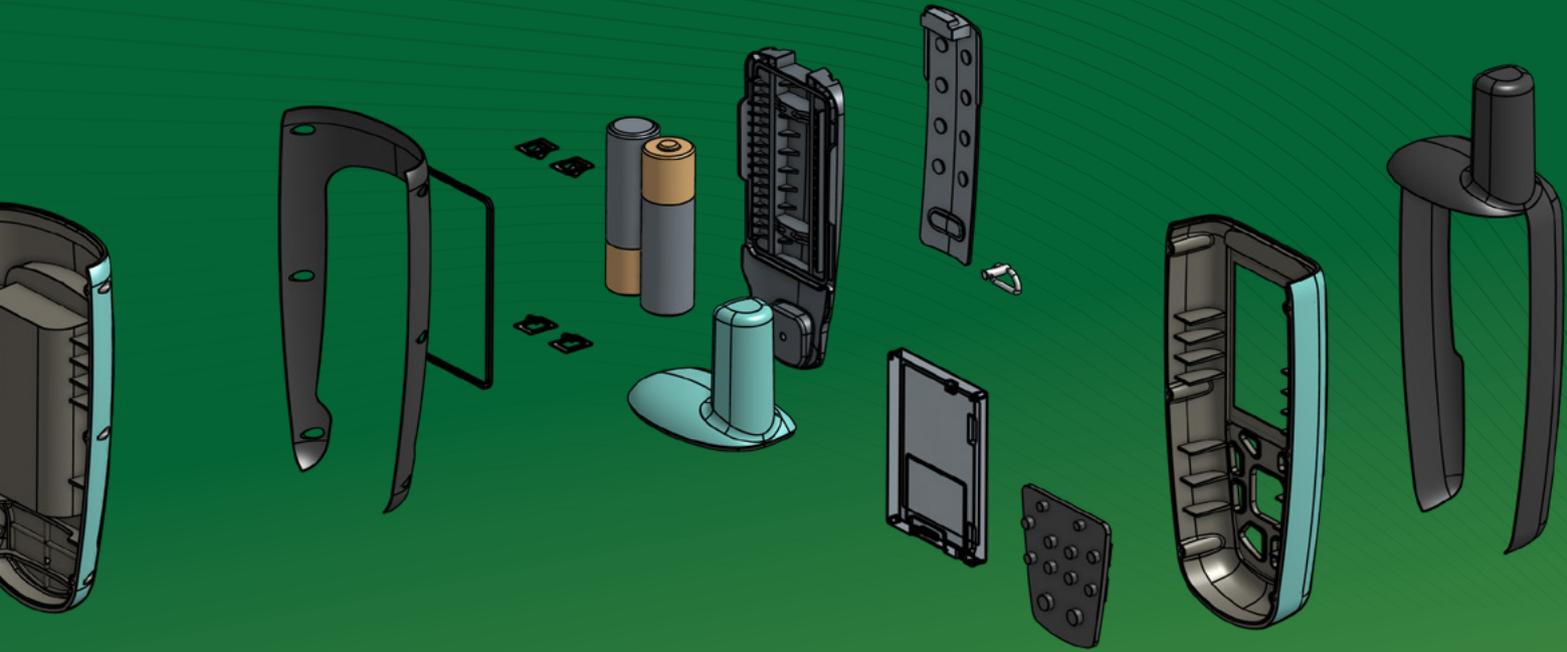
This survey includes perspectives from users of a broad range of product development software, including more than 14 mainstream brands. Respondents include customers of SOLIDWORKS, 3DEXPERIENCE SOLIDWORKS, CATIA V5, 3DEXPERIENCE CATIA, Autodesk Fusion 360, Autodesk Inventor, AutoCAD, Altium, Rhino, FreeCAD, Siemens NX, Siemens Solid Edge, PTC Creo and Onshape.



Although this independent industry survey was commissioned by Onshape, only 7% of solicited opinions are from Onshape customers.

■ Survey Methodology

✓	Data was collected from June 6 – July 7, 2022, using an online survey methodology.
✓	The survey consisted of 40 single-response or multiple-response questions.
✓	818 completed or partially completed surveys are included in the data set.



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