

WHAT'S THE COST OF **POOR ENGINEERING COLLABORATION?**



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What's the Cost of Poor Collaboration?

Collaboration Impacts Everything

How much does poor collaboration cost your company?

Collaboration impacts every part of product development, and products cannot be developed or brought to market without it. It involves working as a team with multiple groups and departments, both internal and external to the organization. It requires successful coordination of processes, data, knowledge, ideas, schedules, communications, and more. However, collaboration is also abstract and hard to measure. How do you assess the costs of poor collaboration? Or the benefits when it is done well? What advantages can your company expect by investing in improved collaboration capabilities?

About this Study

This research study, based on a survey of 155 manufacturers, examines the cost of poor collaboration. The research identifies six areas of opportunity for collaboration improvements that can boost product profitability for your company.



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Executive Summary

Collaboration Impacts Engineering Efficiency

Survey results show that engineering efficiency is the top goal for product development success. Effective collaboration is critical for improving efficiency, yet many companies struggle with it, while others don't recognize the underlying connection between the two.

While poor collaboration is not a new problem, its cost has never been higher. Today's complex products and the ecosystems we develop them in have raised collaboration needs so much, 40% of engineering time is now directly impacted by their ability to work together. With this much time affected, poor collaboration can cost companies significantly. While many companies struggle with steep competition, shrinking margins, and uncertain economic times, this is a risk few can afford.

Poor Collaboration has a Business Cost

Unfortunately, poor collaboration is so common, engineers report they work with outdated data 28% of the time. This results in more rework, delays, and errors. These negative business impacts mean lower-quality products,

higher costs, missed deadlines, and delays in time to market.

In fact, what has traditionally worked in the past is no longer enough to stay competitive in today's market. An overwhelming 93% of companies report they need to improve collaboration with different groups. On average, engineers say they collaborate with 21 people on simple products and 35 for more complex products. Collaborators include other engineers, manufacturing, suppliers, customers, product managers, and more. On top of all the other design responsibilities, that's a lot of people to manage, work to keep track of, and risk for errors, without helpful solutions in place. No wonder the cost of poor collaboration is so high!

New Opportunities for Solutions

Many companies just live with their collaboration challenges, but as collaboration needs increase, these problems become harder and harder to ignore. As new technologies, such as the cloud and innovation platforms, break down silos and collaboration barriers, companies can benefit from new approaches to solve these challenges. Those who do should gain a competitive advantage.



An overwhelming 93% of companies report they need to improve collaboration with different groups.

What's Most Important for Design Team Success

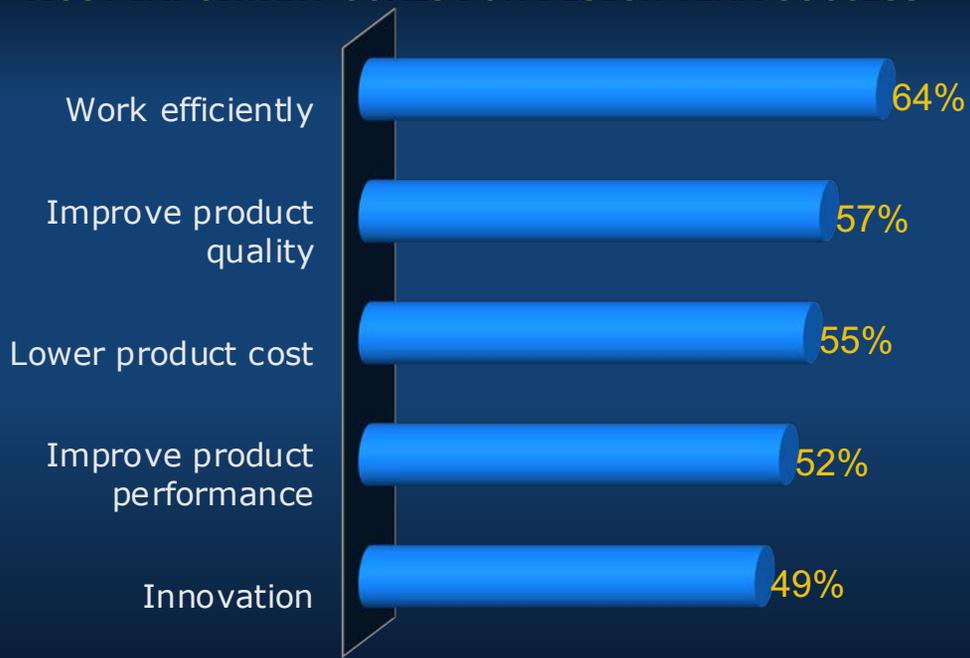
Meet Design Goals

For design teams to be successful, most companies agree that engineering efficiency is their top goal (see graph). They also must improve product quality, lower cost, improve product performance, and increase innovation.

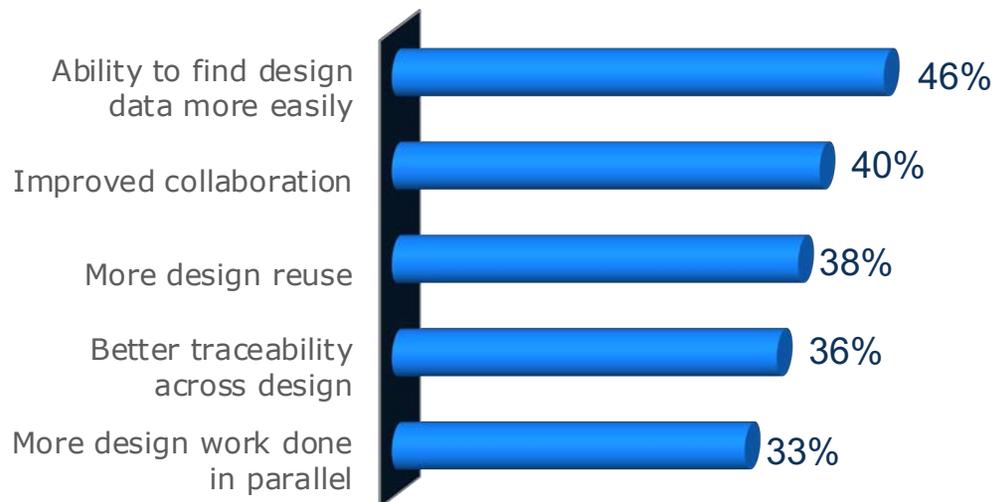
Increased efficiency is critical because it helps companies improve time to market, provides a

competitive advantage, and maximizes the window for new revenue opportunities. It also frees up bandwidth to improve upon existing functionality and ultimately make the product more successful. Balancing quality, cost, and efficiency, while developing innovative ideas is a significant challenge, especially since these factors often compete. Engineers need time to consider different options.

MOST IMPORTANT GOALS FOR DESIGN TEAM SUCCESS



MOST HELPFUL TO ACHIEVE DESIGN SUCCESS



What Leads to Success

Interestingly, all of the top factors respondents identify as helping them achieve success improve efficiency (see graph above). The results show that the key to improvement is connecting teams better so that they can more easily share data and collaborate.

Efficient teams can easily find the data they need, when they need it, and share it with others. More design reuse saves time as engineers are not wasting efforts reinventing the wheel. However, engineers must be able to find the right data to reuse it and connect

with team members to understand what's reusable. Traceability across design information also enables better collaboration. Among the many benefits, it helps engineers identify what data is impacted by a change and who needs to know about it. Finally, doing more work in parallel allows teams to design concurrently, leading to greater efficiency and compressed development schedules. However, to be successful, teams must be well connected and have efficient means with which to collaborate.

The Cost of Poor Collaboration on Engineers

Collaboration Is Critical

If teams cannot collaborate well, they will have trouble executing on the factors that help them become more successful. Not only will it hurt efficiency, but there are also many other costs.

Poor Collaboration Leads to Outdated Data

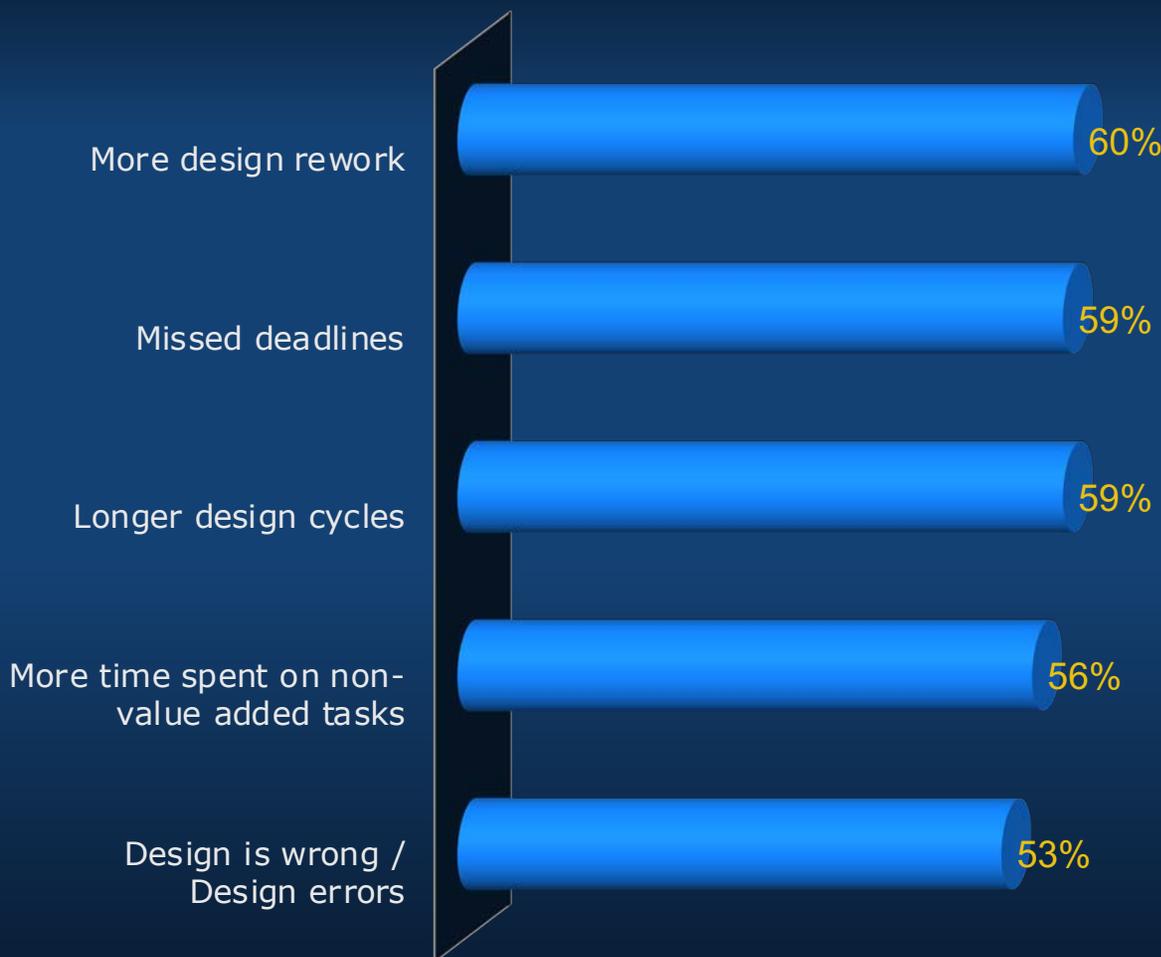
Today's products are increasingly complex, with many interdependent components. If engineers do not collaborate well, when changes to one component impact another engineer's component, design data will quickly become outdated, and there will be errors. Working with outdated data is surprisingly common, with survey respondents reporting engineers work with outdated information 28% of the time.

The Cost to Engineers

Fixing these errors requires time-consuming design rework, which puts deadlines at risk. Poor collaboration slows efficiency, and engineers must waste valuable time on non-value-added tasks. This also takes away precious time engineers could have used to improve quality, performance, and innovation. The result is less opportunity to devote to the features that will create customer demand for the product. All of this comes at a cost to the business.

Engineers work with **outdated information 28% of the time.**

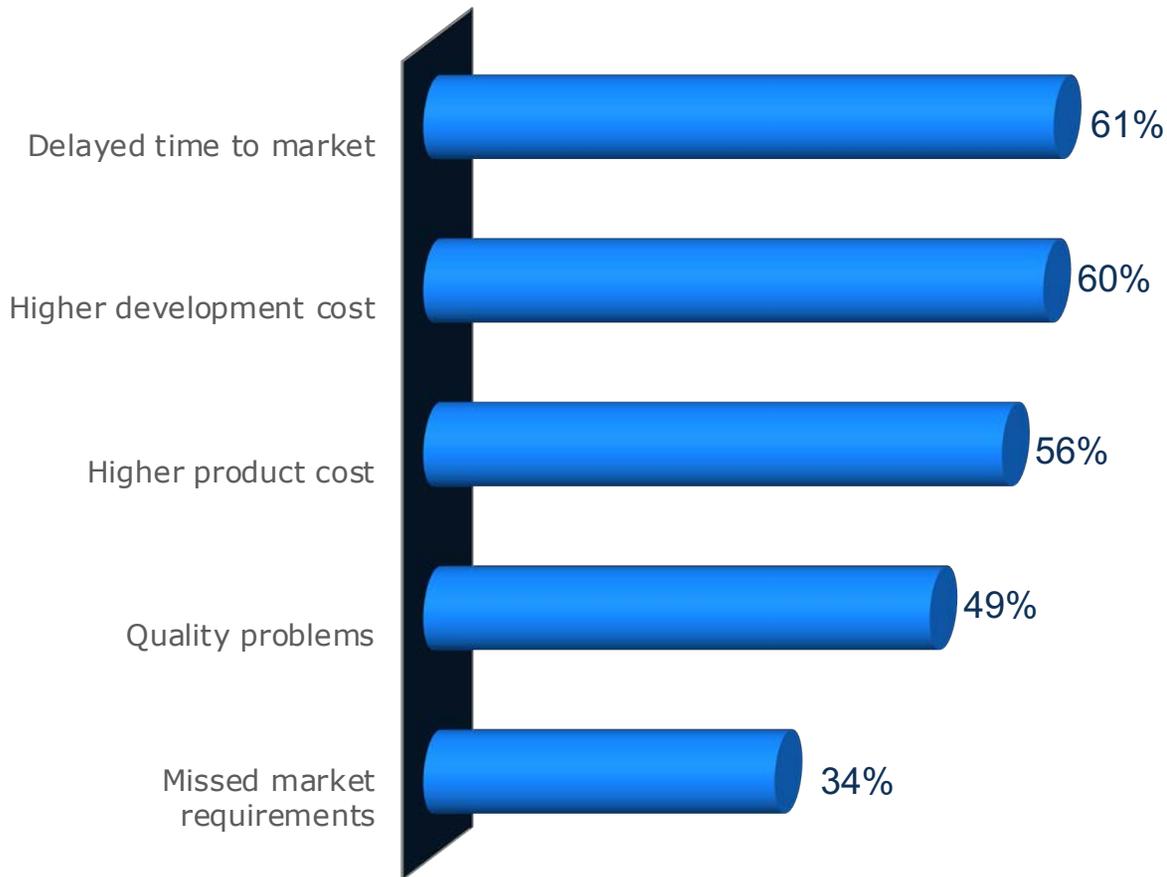
IMPACT OF POOR COLLABORATION ON ENGINEERING



The Cost of Poor Collaboration on the Business

With reductions in both top-line revenue and bottom-line costs, poor collaboration has a significant **negative impact on profitability.**

IMPACT OF POOR COLLABORATION ON THE BUSINESS



Engineering Work Directly Impacts the Business

When engineers need more time and miss deadlines, products will be late to market. This means businesses lose to competitors who beat them to market and steal market share. Plus, it shortens the window of opportunity businesses can collect revenue on a product before a new product supersedes it.

The Cost to the Business

The extra development time also increases development costs. Further, the errors and rework result in higher product costs and lower quality, both of which are critical to product success. Design errors found late in the design cycle have fewer remaining options to correct them. With time running out, design engineers must go with the fastest solution, which may not be ideal. The solution may not be economical, may compromise quality, and may even require dropping innovative features that will drive revenue. This all leads to a product that is more likely to miss market requirements and consequently, fail to meet revenue expectations.

With reductions in both top-line revenue and bottom-line costs, poor collaboration has a significant negative impact on profitability.

Why Collaboration Is So Critical

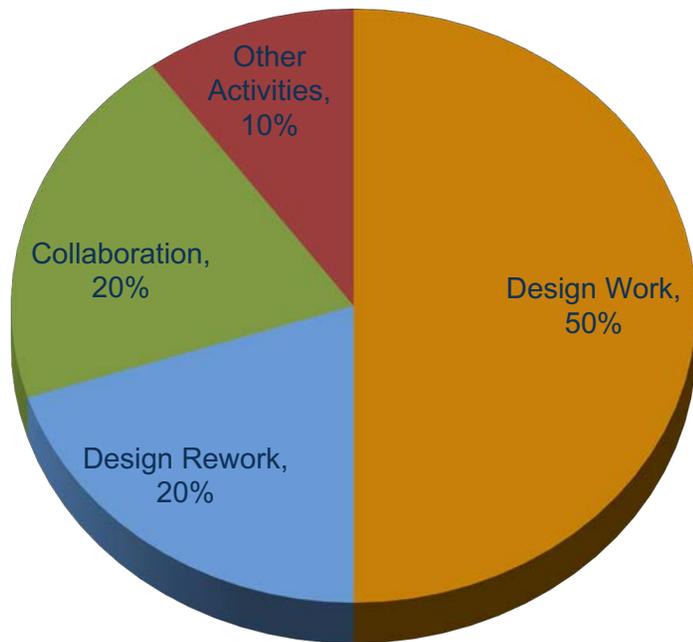
Collaboration Accounts for Up to 40% of Engineering Time

Why does poor collaboration cost companies in so many ways? It consumes a significant amount of engineering time.

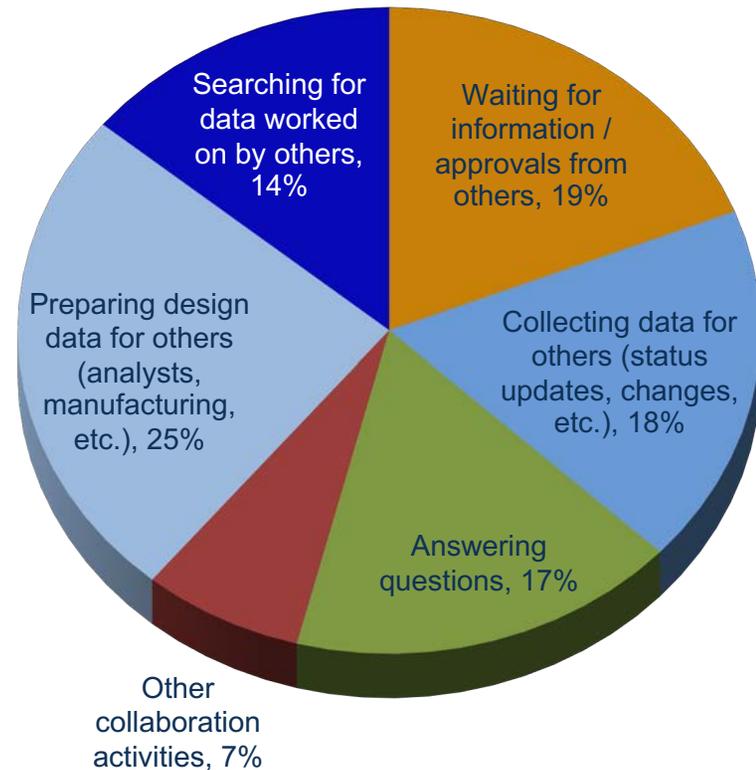
Design work accounts for only 50% of engineering time (see lower graph). Engineers report they spend 20% of their time on collaboration activities. These activities can be seen in the pie chart on the right. Much of this time could be reduced with better collaboration tools or methods.

Another 20% of engineering time is due to rework, which is largely a direct result of poor collaboration. Rework is often a consequence of design errors and mistakes. Some errors may be due to designing with outdated information. Others design problems may have been caught with greater use of simulation

HOW ENGINEERS SPEND THEIR TIME



COLLABORATION ACTIVITIES THAT CONSUME ENGINEERING TIME



and coordinating with an analyst. Rework resulting from problems found during manufacturing might have been noticed by working more closely with manufacturing. Even rework due to market or customer changes could be avoided by connecting with customers.

Collaboration Consumes Nearly As Much Time As Designing

Together, collaboration and rework equate to 40% of engineering time, nearly as much as engineers spend on actual design work. Imagine how much more efficient engineers could be if they spent more of that time on value-added design work?

Increased Collaboration Requirements

What Worked Before May No Longer Be Enough

With collaboration being such a big part of product development, why do so many companies still struggle with it? Poor collaboration has been a common challenge for years. Why does it matter so much now? Let's look at some of the factors that contribute.

First, companies can still get products out despite poor collaboration; many companies have just lived with the problems. However, with uncertain economic times combined with thinner margins and the costs associated with poorly coordinated teams, companies who solve their collaboration challenges will have a definite competitive advantage.

Increasing Complexity

Beyond this, products have gotten more complex. There are more components, configurations, and

engineering disciplines involved. This is an ongoing trend that shows no sign of slowing down. With that, today's modern product development ecosystem have also gotten more complex, exacerbating the problem.

Tech-Clarity measured the complexity of the ecosystem based on the amount of outsourcing as well as the number of locations and engineers involved. As ecosystems become more complex, the more likely engineers are to work with outdated information, making the need for better collaboration even more critical. The table shows the percentage of time engineers find they work with obsolete information. Even in a simple ecosystems, engineers spend one day a week working with outdated information.



With the costs associated with poorly coordinated teams, companies who **solve their collaboration challenges will have a competitive advantage.**

COMPLEXITY OF ECOSYSTEM

FREQUENCY ENGINEERS WORK WITH OUTDATED INFORMATION

Simple

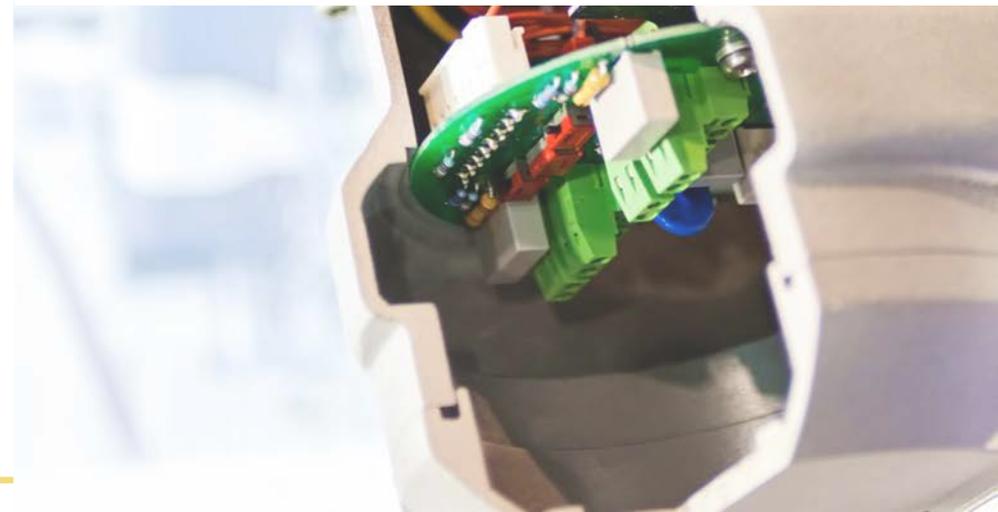
20%

Medium

23%

Complexity

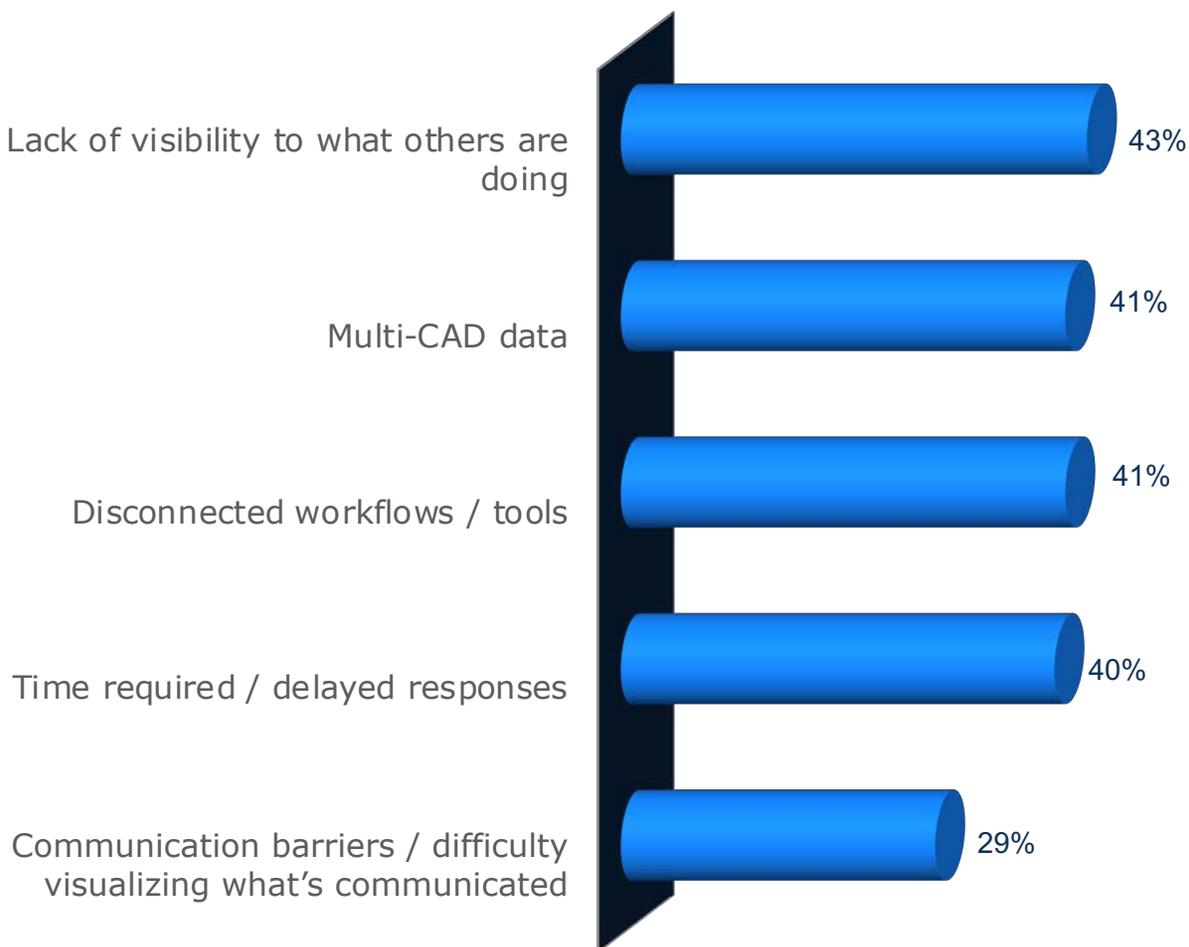
44%



What Makes Collaboration So Hard?

Unfortunately, 59% rate their ability to **synchronize design data with third parties** as "moderate" to "not at all effective."

WHY COLLABORATION IS HARD



Third Parties

In addition to more internal groups involved, manufacturers also rely on third parties. Respondents report they develop 84% of their design internally, depending on outsourcing or purchased components for the remaining 16%. Beyond the design, companies also rely on suppliers to produce some components, or they are part of their customer's supply chain. All of this requires good synchronization of design data with third parties. Unfortunately, most companies find this extremely difficult, with 59% rating their ability to synchronize design data with third parties as "moderate" to "not at all effective."

New Solution Opportunities

All of these issues contribute to factors that make collaboration difficult (see graph). Engineers need methods

that make it easier to see what others are doing and allow them to manage their workflows and data across multiple groups and locations. This will lead to improved communication and greater efficiency, but it has been hard to achieve. Now with modern technologies such as the cloud and integrated development platforms, companies have new opportunities to finally solve these challenges.

Introducing Six Areas

The research pointed to six areas of opportunity to improve collaboration. These areas were identified based on some of the most significant differences between Top Performers and Others. Before revealing these areas, we will first look at how Top Performers were defined.

Identifying Best Practices

How Top Performers Were Defined

Tech-Clarity defined Top Performers as the top 25% of companies that outperform their competitors in metrics that indicate product development success. These metrics are the ability to develop:

- High quality products
- Innovative products
- Products efficiently
- Products that meet cost targets

We then focused on what Top Performers do differently to identify factors that contribute to their success.

The Top Performer Advantage

Top Performers have the right practices in place, so they do a better job than their competitors of hitting their targets. By managing their processes better, they are more likely to meet deadlines and cost targets while staying on budget, helping them become more profitable (see table).

The six areas of opportunity for better collaboration all contribute to Top Performers' ability to beat their competitors.



METRIC	TOP PERFORMER	OTHERS
Product development budget	Within 12% of Target	Within 19% of Target
Product cost targets	Within 10% of Target	Within 17% of Target
Due dates	Within 15% of Target	Within 20% of Target



1. Improve Engineering Efficiency

Keep Data in Sync

Improving collaboration is a crucial way to improve engineering efficiency. When engineers do not coordinate well, they waste efforts working with outdated data, waiting for information from others, or searching for needed details. Even some of the most common engineering processes do not work well for most companies.

For example, Top Performing companies are 97% more likely than their peers to rate their collaboration process with other CAD users as "Very" or "Extremely" Effective. Top Performers are also 87% more likely to rate their change management processes highly.

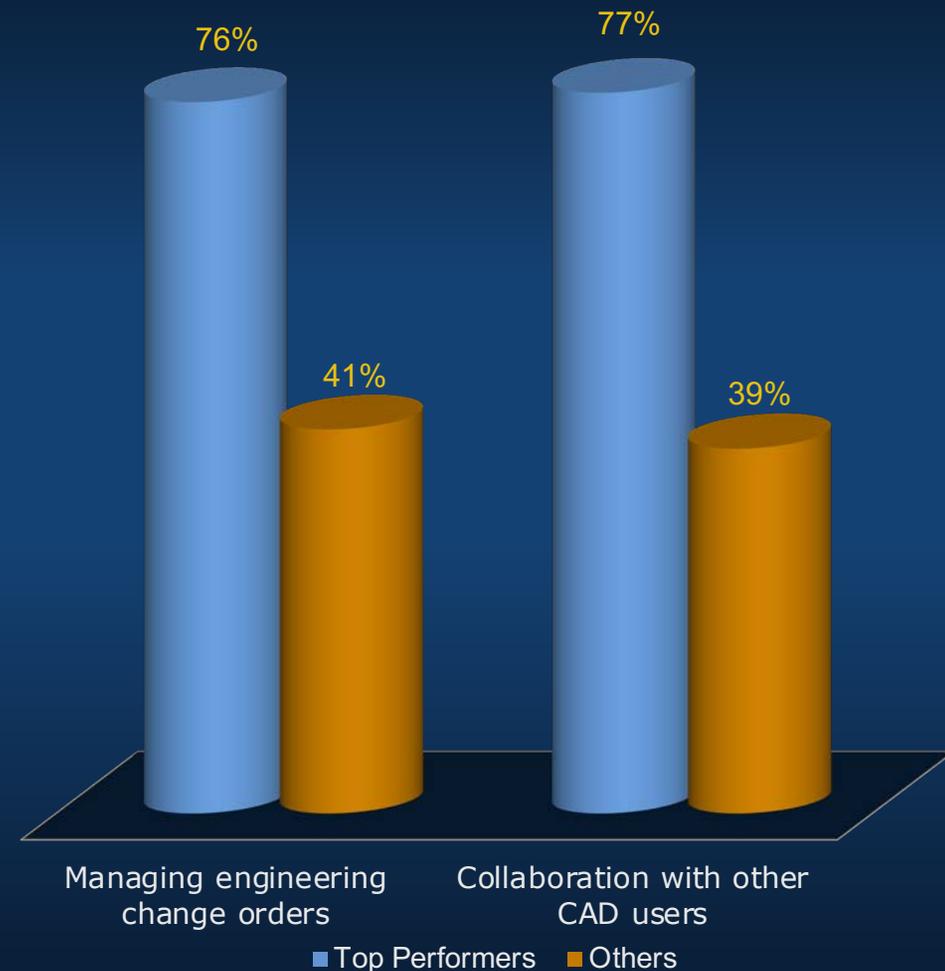
Instantaneous File Sharing

Because Top Performers easily collaborate with other CAD users, they avoid much of the non-value-added work that their competitors waste energy on. Effective change management processes mean the team coordinate well enough that engineers know what's impacted by a change and who needs the updated data.

The ability to quickly synchronize CAD data is so critical, 78% of respondents agree that instantaneous file-sharing would help and save time.

78% of respondents agree that **instantaneous file-sharing** would help and save time.

PROCESSES THAT ARE EXTREMELY OR VERY EFFECTIVE



2. Recognize Collaboration Requirements

Widespread Impact

Poor collaboration has such a high cost because it impacts so many people and processes. It doesn't matter whether products are simple or complex; collaboration is critical. Tech-Clarity defined product complexity based on the number of components, configurations, and engineering disciplines.

93% Want Improvement

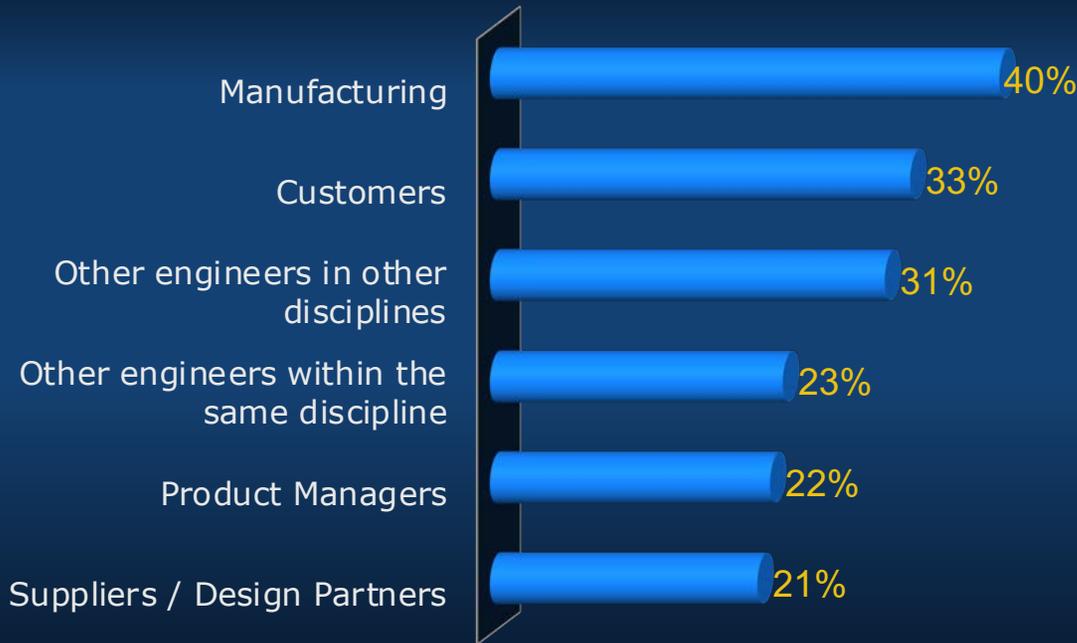
Yet, despite the crucial requirements, 93% of

companies agree they need to improve collaboration with different groups, including manufacturing, customers, and other engineers (see graph on left).

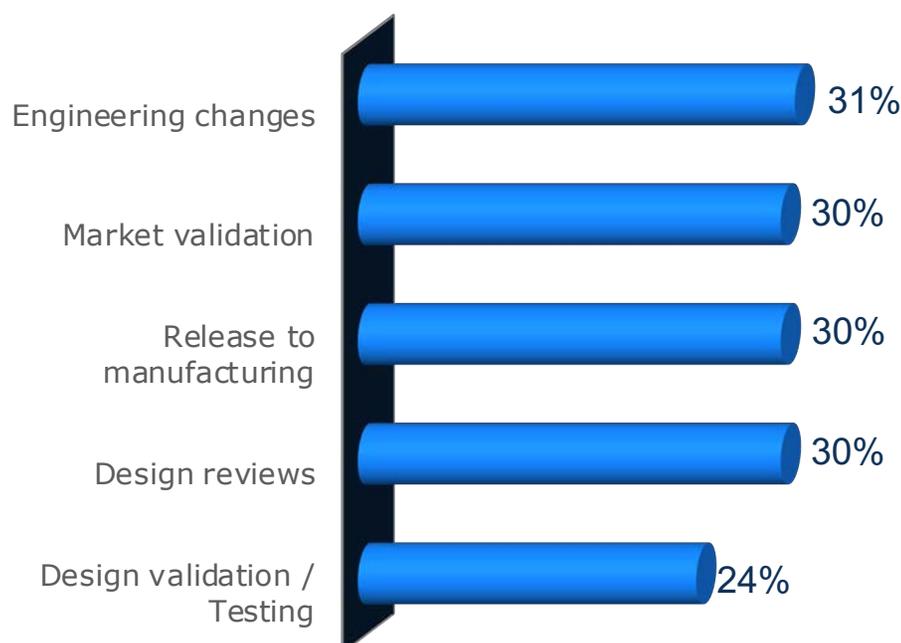
Beyond the expansive network of people that engineers must work with, numerous processes also depend on engineering collaboration. The right-side graph shows the top processes that need improved collaboration.

METRIC	SIMPLE PRODUCTS	MEDIUM PRODUCTS	COMPLEX PRODUCTS
Number of engineering locations	2 Locations	3 Locations	6 Locations
Number of collaborators during a project	13 People	21 People	35 People
Number of engineering disciplines involved	3 Disciplines	4 Disciplines	5 Disciplines

GROUPS THAT NEED IMPROVED COLLABORATION



PROCESSES THAT NEED IMPROVED COLLABORATION



3. Provide Non-CAD Users Visibility to CAD

Unlock CAD Model Value

An overwhelming 89% agree that better collaboration with non-CAD users would help them, yet 81% report that it does not work well today. The lower graph shows the top benefits companies can expect by improving collaboration with non-CAD users.

Sharing design data with non-CAD users is challenging since those outside of engineering tend not to have the training or knowledge to use CAD, nor

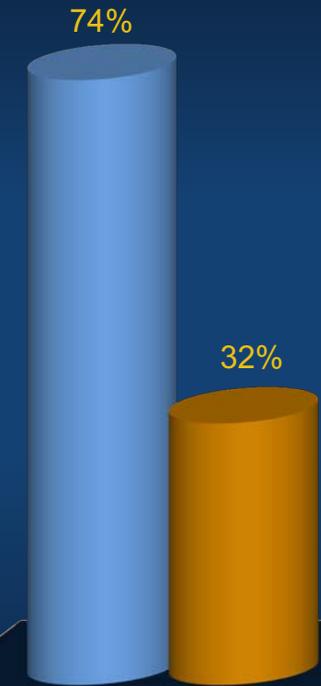
do they have access to native CAD tools. However, there is significant value in the data locked inside CAD models that those outside of engineering need. Consequently, there is much benefit to providing non-CAD users visibility to CAD models in an easy-to-use, approachable way such as in a web browser-based viewer. This makes the CAD data accessible without requiring access to a CAD tool or additional training.

Top Performers Collaborate Well with Non-CAD Users

Providing non-CAD users with visibility to CAD is a major differentiator for Top Performers. Top Performers are 2.3 times more likely than Others to share design details with internal staff outside of engineering. Top Performers are also 3.6 times more likely than Others to report that collaboration with non-CAD users is "very" or "extremely" effective.

89% agree that better collaboration with **non-CAD users** would help

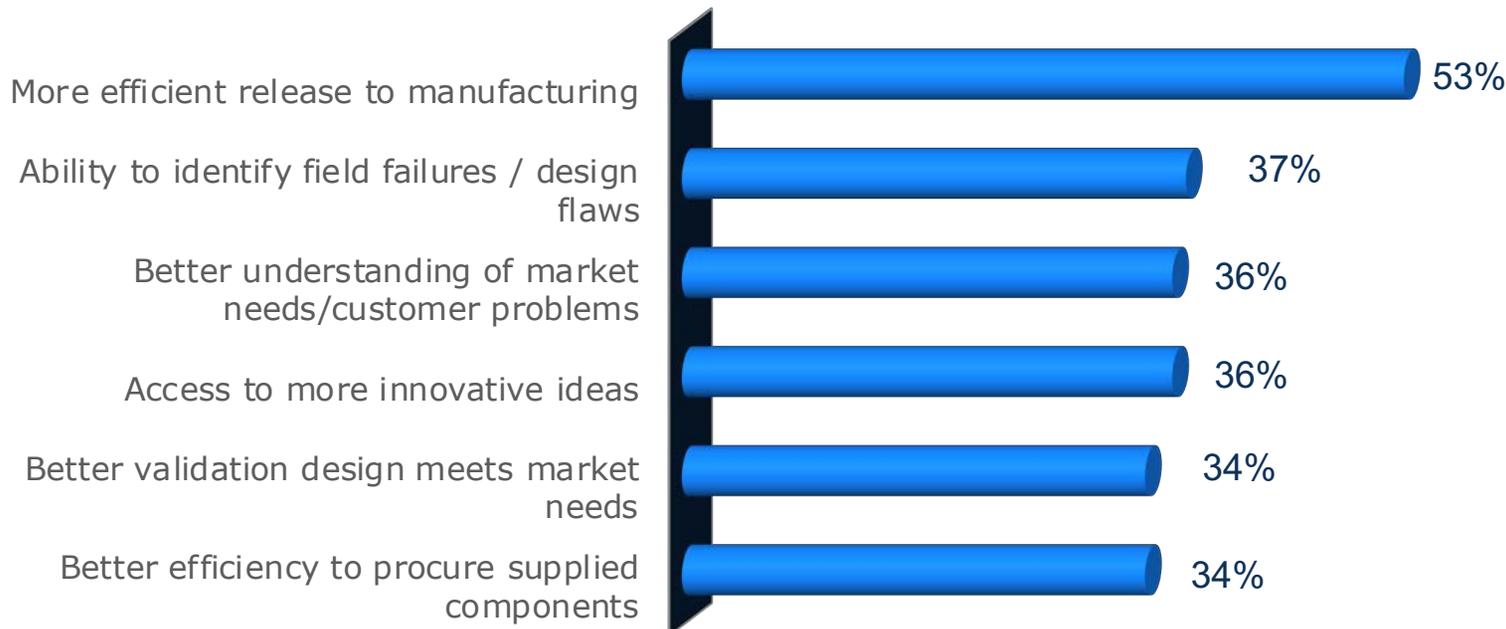
PROCESSES THAT ARE EXTREMELY OR VERY EFFECTIVE



Sharing design info with non-engineering staff

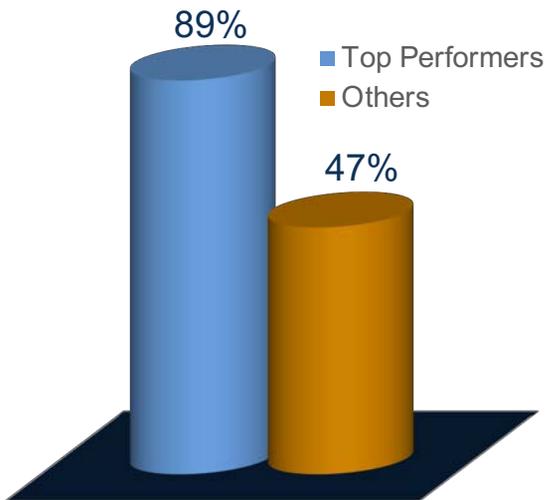
■ Top Performers ■ Others

NON-CAD USERS COLLABORATION BENEFITS



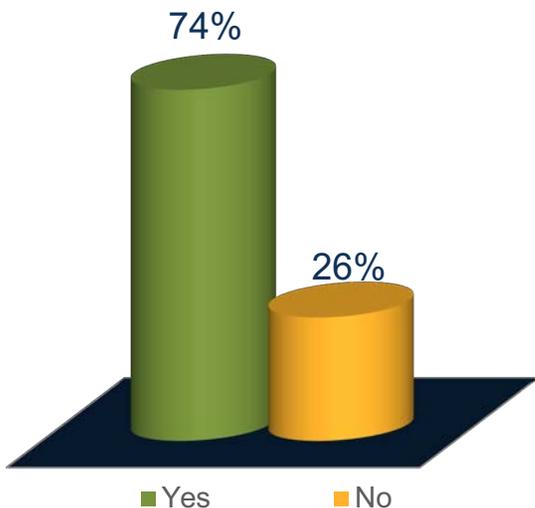
4. Improve Engineering / Manufacturing Collaboration

PROCESSES THAT ARE EXTREMELY OR VERY EFFECTIVE



Providing the correct design information to manufacturing

WOULD EARLIER MANUFACTURING INPUT HELP?



Need Smooth Hand-offs

A smooth hand-off between engineering and manufacturing is critical for product success. However, only 26% of companies say their collaboration during release-to-manufacturing is very effective. This can create significant challenges for companies, especially if the data released to manufacturing is not correct since working with outdated data can lead to scrap and rework, which drives up costs.

Managing It Better

Highlighting the importance, Top Performers are 90% more likely than Others to rate their ability to provide manufacturing correct design information as "very" or "extremely" effective. Sound engineering and manufacturing coordination can also improve efficiency and help to identify potential manufacturability issues. Top Performers are 89% more likely than Others to rate their collaboration with manufacturing during release

as "very" or "extremely" effective.

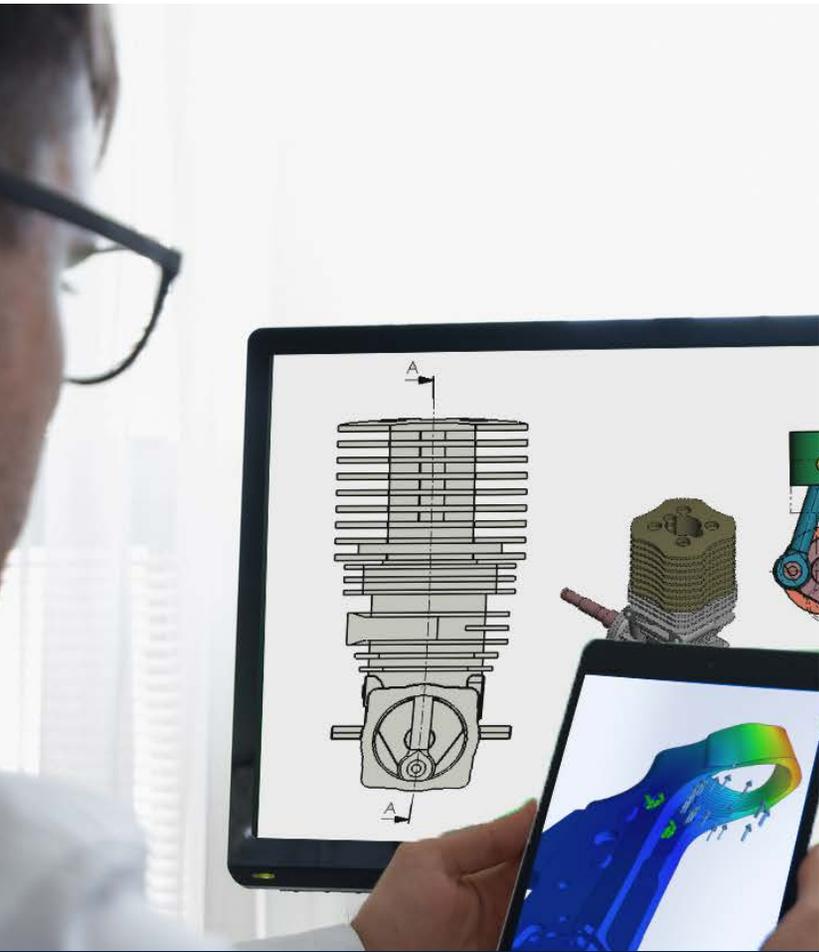
Early Manufacturing Visibility Helps

A fundamental way to improve collaboration is to provide manufacturing with earlier visibility to design information, and 74% agree that earlier manufacturing input would help. This is becoming increasingly important as the most knowledgeable staff who are more familiar with manufacturing processes approach retirement. Here again, Top Performers lead the way. An overwhelming 93% of Top Performers report manufacturing has visibility to the design before release to manufacturing, compared to only 69% of Others. Further, 50% of Top Performers give manufacturing visibility during concept design or earlier, while only 38% of Others do. Connecting earlier will help avoid downstream problems and manufacturability issues that cause delays.



74% agree that **earlier manufacturing input** would help.

5. Connect Engineers and Simulation Analysts throughout the Design Process



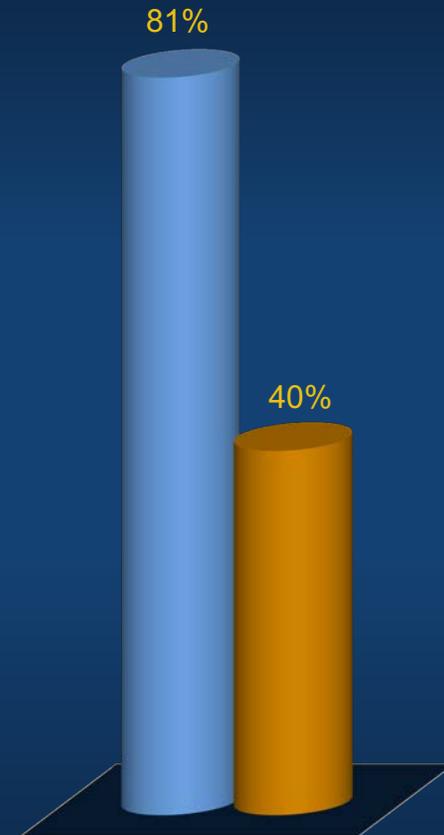
Simulation Is a Valuable Engineering Tool

Design cycles are so compressed that problems found late during the design process can cause significant delays. Simulation can help to identify potential issues earlier, avoiding late-stage delays. Also, simulation can help engineers make better decisions about critical criteria impacting cost, quality, and performance. Tech-Clarity's *How to Survive and Win New Markets by Getting Even More Value from Simulation* found that at 74% of Top Performing companies, design engineers conduct simulations. However, not all design engineers can run a simulation, and even those who do, may need support from an analyst. In that study, 83% of Top Performers agreed that they would get even more value from simulation if design engineers and analysts could collaborate more easily.

Involved Analysts Earlier during Design

By improving collaboration between design engineers and simulation analysts, simulation can be leveraged more easily throughout the design process, resulting in a superior design. Therefore, it is understandable why an overwhelming 73% say that earlier analyst input into the design would help. Further, Top Performers are twice as likely as Others to rate their collaboration between design engineers and simulation analysts as "very" or "extremely" effective.

PROCESSES THAT ARE EXTREMELY OR VERY EFFECTIVE



Collaboration between design engineers and simulation analysts

■ Top Performers ■ Others

An overwhelming **73%** say that **earlier analyst input** into the design would help.

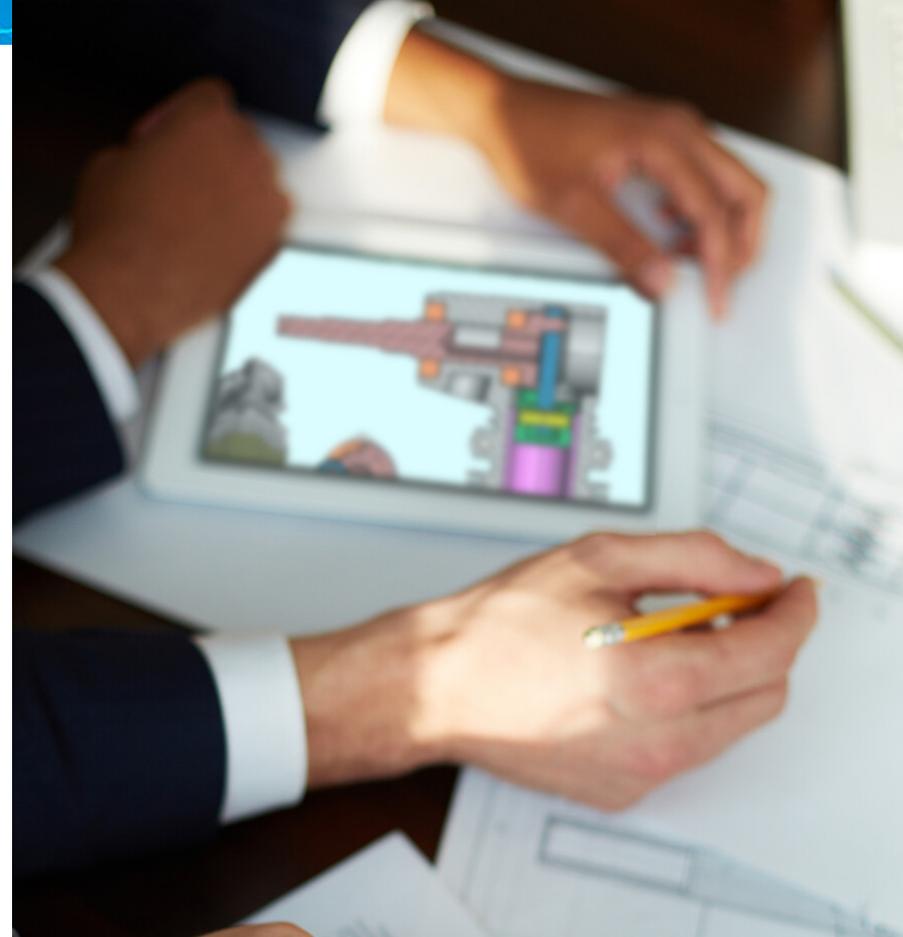
6. Support Market Validation with Improved Customer Collaboration

Solicit Customer Feedback Early

Aligning products to customer needs and then validating designs meet those needs is critical to realizing revenue opportunities. However, this isn't easy to do, and only 10% of companies report that their collaboration processes to support market validation are effective. By soliciting more customer feedback, companies can increase the product success rate by validating they meet customer needs early on.

Top Performers Are More Likely to Engage Customers

Top Performers are more likely than Others to focus on customers. Top Performers are 77% more likely than Others to indicate understanding market needs is a top goal for design success. Also, Top Performers are 33% more likely to collaborate with customers. While connecting with customers and providing them with secure access to design data can be challenging, this is an area when new technologies to support collaboration, such as cloud technology, can be especially useful.



Top Performers are **33%** more likely to **collaborate with customers.**



Recommendations



The good news is that **modern technologies**, such as the cloud and innovation platforms, can help to significantly **overcome barriers and improve design collaboration across the enterprise.**

Conclusions

Collaboration has never been easy, and companies have long struggled to solve collaboration challenges. However, as products and development ecosystems continue to get more complex, collaboration needs have increased.

Unfortunately, poor collaboration comes at a high price. It results in delays, errors, and increased costs, all of which have an impact on profitability. The good news is that modern technologies, such as the cloud and innovation platforms, can help to significantly overcome barriers and improve design collaboration across the enterprise.

Recommendations and Next Steps

Based on industry experience and research for this report, Tech-Clarity offers the following recommendations:

- Understand the true cost of poor collaboration on both engineers and the entire company.
- Invest in collaboration improvements to increase engineering efficiency.

- Recognize the significance of collaboration requirements on engineers from the number of people involved, different departments, and processes impacted.
- Do not overlook the importance of engineering collaboration with non-CAD users.
- Ensure excellent collaboration between engineering and manufacturing to overcome knowledge gaps and support seamless hand-offs.
- Support effective collaboration between design engineers and simulation analysts to empower engineers to catch problems and design more competitive products.
- Incorporate customer collaboration into product development processes to support ongoing market validation and reduce the risk around market uncertainty.
- Consider modern technologies, such as cloud and an innovation platform, to support and enable better collaboration processes.

About the Research

Data Gathering

Tech-Clarity gathered and analyzed responses to a web-based survey from over 155 manufacturers. Survey responses were collected by direct e-mail, social media, and online postings by Tech-Clarity.

Industries

The respondents represent a broad cross-section of industries. 33% were from Industrial Equipment, 18% Engineering Services, 16% Automotive, 12% Life Sciences, 12% Consumer Products, 11% Aerospace & Defense, 10% High-Tech, and others.*

Company Size

The respondents represent a mix of company sizes, including 55% from less than \$50 million, 28% between \$50 million and less than \$1 billion, and 19% greater than a billion. their

Company sizes were reported in US dollar equivalent.

Geographies

Responding companies report doing business in North America (71%), Asia (27%), Western Europe (26%), Eastern Europe (10%), Latin America (10%), Australia (7%), Africa (5%), and Middle East (3%).*

Title

The respondents were comprised of 13% Executive, 7% Directors or VP Level, 21% Manager level, and 59% individual contributors.

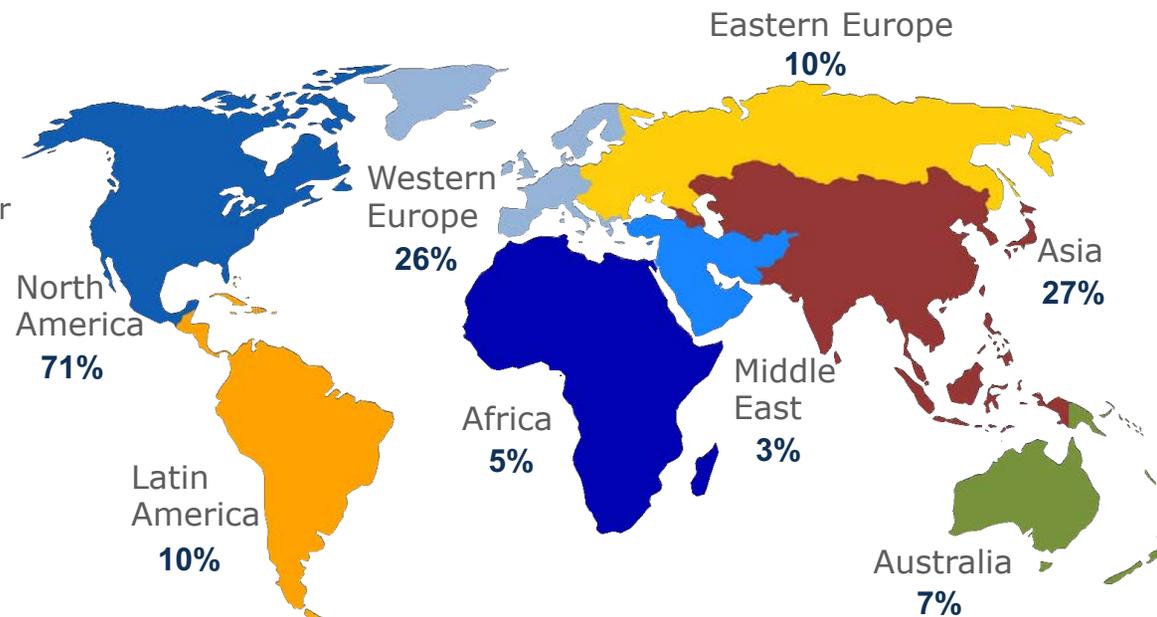
Organizational Function

Of the respondents, 55% were in Product Design/Engineering roles, 19% Manufacturing Engineers, 6% Product / Project / Program Management, and the remainder were

from a variety of other roles including Industrial Design, Analysts, IT, and more.

* Note that the values may total greater than 100% because companies reported doing business in multiple industries and geographies.

The respondents represented a mix of industries, company sizes, and geographies.



Acknowledgments



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About the Author

Michelle Boucher is the Vice President of Research for Engineering Software for research firm Tech-Clarity. Michelle has spent over 20 years in various roles in engineering, marketing, management, and as an analyst.

Michelle graduated magna cum laude with an MBA from Babson College and earned a BS in Mechanical Engineering, with distinction, from Worcester Polytechnic Institute. She is an experienced researcher and author having benchmarked over 7000 product development professionals and published over 90 reports on product development best practices.

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