

Tech-Clarity

**Tech-Clarity Perspective:
Reducing Non-Value Added
Work in Engineering**

*Improving Efficiency with
Real-Time Access to Design
Information*



Table of Contents

Executive Overview	3
Empower Engineers to Innovate	4
Identify Bottlenecks and Contributors to Non-Value Added Work .	5
Recognize the Time Required for Check-ins.....	7
Understand the Impact of Outdated Information on Changes.....	7
Consider the Impact of Outdated Information on Collaboration ...	9
Identifying the Top Performers	10
What Sets Top Performers Apart?	11
Use Technology to Support Real-Time Communication	12
Consider the Security Risks of Email	13
Support Real-time CAD Updates	13
Conclusion.....	14
Recommendations	15
About the Author	15
About the Research.....	16



Executive Overview

To be successful in today's market, companies need to keep engineers focused on developing differentiated products that stand out from the competition. Engineers can create this differentiation by developing products that offer higher quality, better performance, and greater innovation at a reasonable price. Unfortunately, engineers report that rather than focusing on this important work, on average, they spend a third of their time on non-value added work. Even worse, 20% of their time is spent working with outdated information, which often leads to wasted effort and rework. Providing engineers with real time access to design data, in the right context, is one way to improve efficiency and streamline engineering decisions.

Engineers spend a third of their time on non-value added work. Even worse, 20% of their time is spent working with outdated information, which often leads to wasted effort and rework.

To determine best practices for accessing design information, Tech-Clarity analyzed survey responses from nearly 250 manufacturers to understand how they manage data, communicate engineering changes, and collaborate with both internal and external members of the development team. The analysis separated respondents into two performance bands based on their ability to hit targets for five product development-related metrics. The "Top Performers" were identified as those who are better than their competitors at quickly and efficiently designing high quality, innovative products that meet cost targets. Then, researchers analyzed what Top Performers are doing differently compared to "Others."

The research shows that compared to competitors, Top Performers are nearly 2-times more likely to maintain up-to-date models. The fact that they get real-time updates is supported by PDM/PLM.

Top Performers are nearly 2-times more likely to maintain up-to-date models.

This report explores best practices for streamlining access to real time design data. It also exposes some challenges manufacturers should be aware of as they strive to maintain a competitive edge in today's complex and cutthroat environment. With this information, manufacturers can plan for a design environment that will prepare them for long-term competitiveness.



Empower Engineers to Innovate

With the global competition faced by today’s manufacturers, it can be very difficult to set products apart from competitors. However, this is critical to win new business and keep existing customers coming back. In a recent Tech-Clarity survey of 248 manufacturers, companies reported the most important criteria for creating a competitive advantage are better quality, performance, innovation, and lower cost.

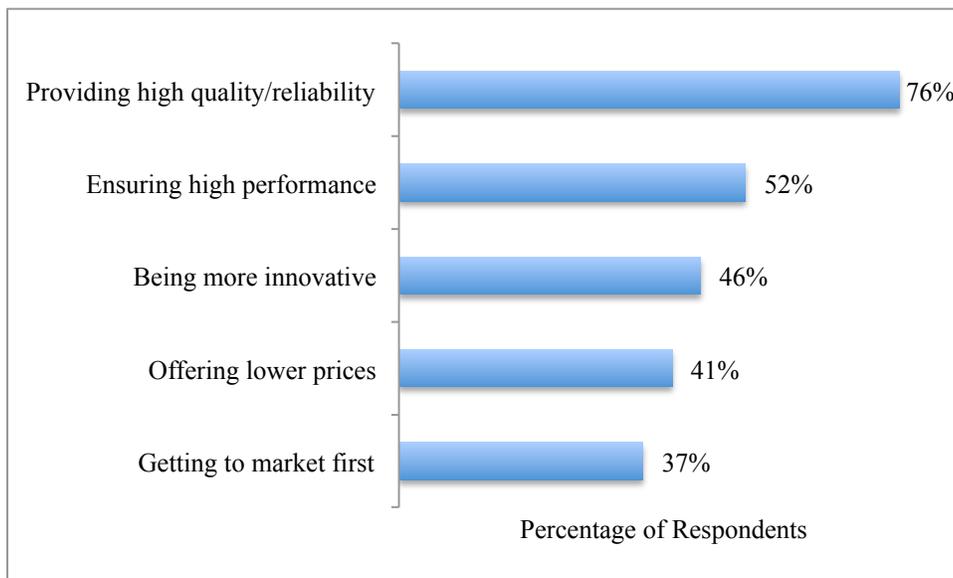


Figure 1: Top 5 Most Important Competitive Differentiators

Historically, getting to market first has been considered key to beating the competition by capturing market share before others can respond. While still important, companies are finding that time alone is not enough. They also need it to be the right product and when it comes to product differentiation, this is even more important than time. Manufacturers report that for products to stand out, they need products to meet customer expectations for reliability and performance. Innovative features give customers a reason to buy a product, yet customers do not want to pay a lot for it. Engineering decisions have a direct impact on quality, performance, and cost. In addition, new development work, fresh approaches to solve problems, and creative features from engineering bring that needed innovation. Expecting all of this to come from engineering, while still maintaining tight deadlines, means considering new approaches to development so that engineering has the bandwidth to accomplish everything the company needs to stay competitive.

Identify Bottlenecks and Contributors to Non-Value Added Work

Looking at how engineers spend their time is a natural place to start when exploring ways to improve the development process. Manufacturers report their engineers spend 1/3 of their time (on average) on non-value added work.

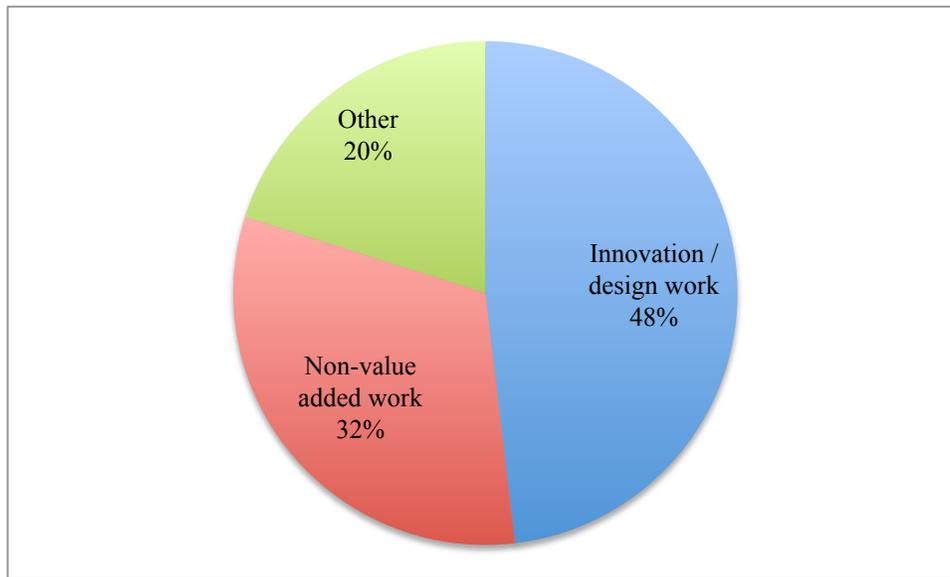


Figure 2: How Engineering Time Is Spent

With that much time consumed by activities that do not add value, clearly there is a lot of opportunity for improvement. Closer examination of how that non-value time is spent reveals that data management practices are a big contributor. Figure 3 shows the breakdown of what contributes to that non-value added time. The largest contributor to non-value added time is related to trying to find information. This includes engineers searching for data to complete their own work as well as collecting it for other people for activities such as status updates and meetings. Another large chunk comes from just giving up and recreating information because it cannot be found. Clearly, better ways to find and reuse data are needed.

The largest contributor to non-value added time is related to trying to find information.

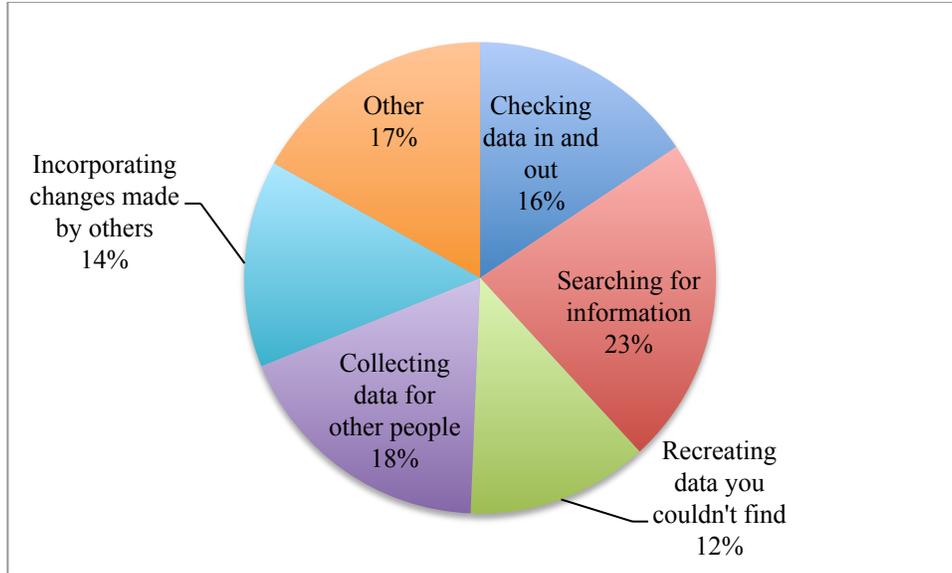


Figure 3: Breakdown of Non-Value Added Time

Manufacturers agree that if all the manual tasks associated with managing data, including searching for it, checking it in and out, and sharing it, their company would enjoy some nice benefits. Figure 4 shows the top five impacts of eliminating manual data management tasks.

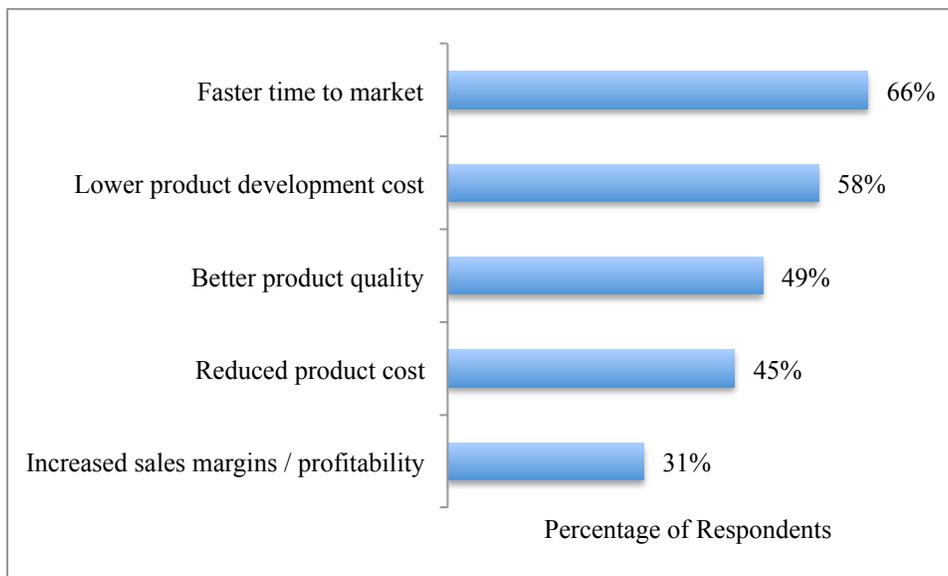
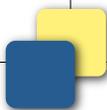


Figure 4: Business Value of Eliminating Manual Data Management Tasks



Manufacturers report that the time saved by eliminating non-value added work could instead be used to focus on things that make their products more competitive. This includes getting to market faster, lowering the cost, and improving product quality. Interestingly, only 2% of survey respondents said there would be no impact on the business. This means that 98% of manufacturers see business value in reducing non-value added work.

Recognize the Time Required for Check-ins

With so much potential opportunity for minimizing manual data management tasks, it is interesting to look at one of the aspects of traditional data management, checking data in and out. Thirty-one percent (31%) of survey respondents report they wait more than 10 minutes as data is checked-in. This check-in time is further impacted by product complexity:

Product Complexity	Average Check-In Time
Simple (< 50 components, 5 or less configurations)	4 Minutes
Medium (51 to 500 components, 6-50 configurations)	18 Minutes
High (> 501 components, 51 or more configurations)	49 Minutes

Figure 5: Average Check-in Time Based on Complexity

In a traditional data management solution, check-ins have been an important part of keeping models up-to-date. However, as products increase with complexity, check-ins will take more time. Also, higher complexity likely means a larger development team that needs to be aware of changes. This means the importance of keeping models up-to-date also grows with complexity. Engineers need methods to ensure models are kept up-to-date, without disrupting their workflow with long delays due to check-ins.

31% of survey respondents report they wait more than 10 minutes as data is checked-in.

Understand the Impact of Outdated Information on Changes

The problems when models are not kept up to date become more apparent when there are engineering changes. If data cannot be relied upon to be up-to-date, additional time is needed to search for the latest version. Worse, using outdated data to implement changes

means wasted work that must be redone to reflect current versions. These points are emphasized when looking at the top challenges of executing engineering changes.

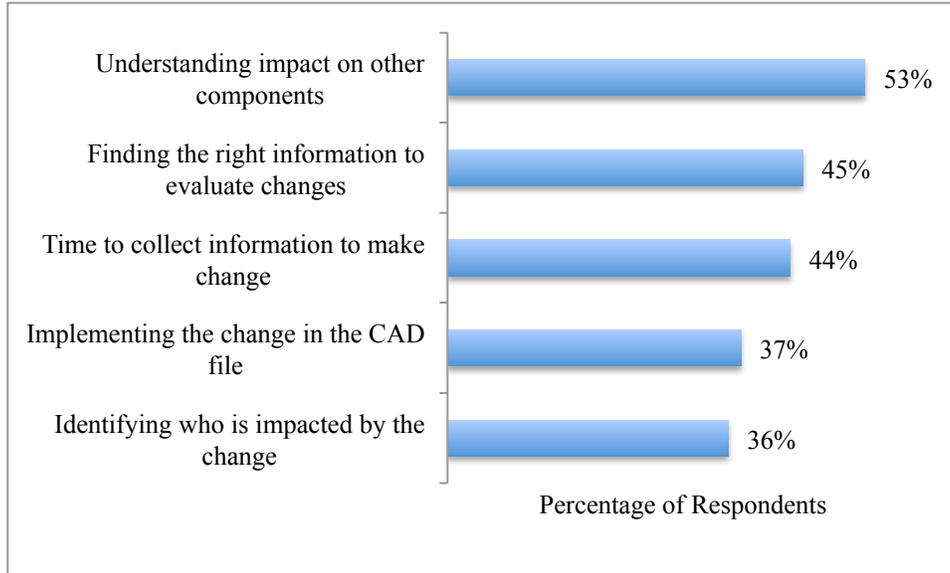


Figure 6: Top 5 Challenges of Executing Changes

Manufacturers report difficulty understanding the impact of a change, including which components are impacted. Then, finding and collecting the information is not easy. Afterward, when implementing a change, there are delays getting updated design information to everyone. Forty-one percent (41%) of survey respondents report that when implementing a change, it takes a couple of days or more for the changed information to get to the entire team. Given the speed at which engineers must work, two days means there is risk people are working with outdated information. The pain of working with outdated information is emphasized by the overwhelming number who report they would like the data to be updated much more quickly:

- 61% say they would like everyone to get access to the latest CAD file in real time
- Another 15% need changes within a few hours

This means 76% find a couple of days longer than they would like. Immediate access to changes with real time updates avoids rework and wasted time. Based on this, there are opportunities for improvement to streamline access to CAD data to support changes.

41% of survey respondents report that when implementing a change, it takes a couple of days or more for the changed information to get to the entire team.



Consider the Impact of Outdated Information on Collaboration

Problems with communication and outdated information get even worse when working with third parties. Communicating changes, validating their work, and keeping CAD models updated are the most common problems when working with third parties.

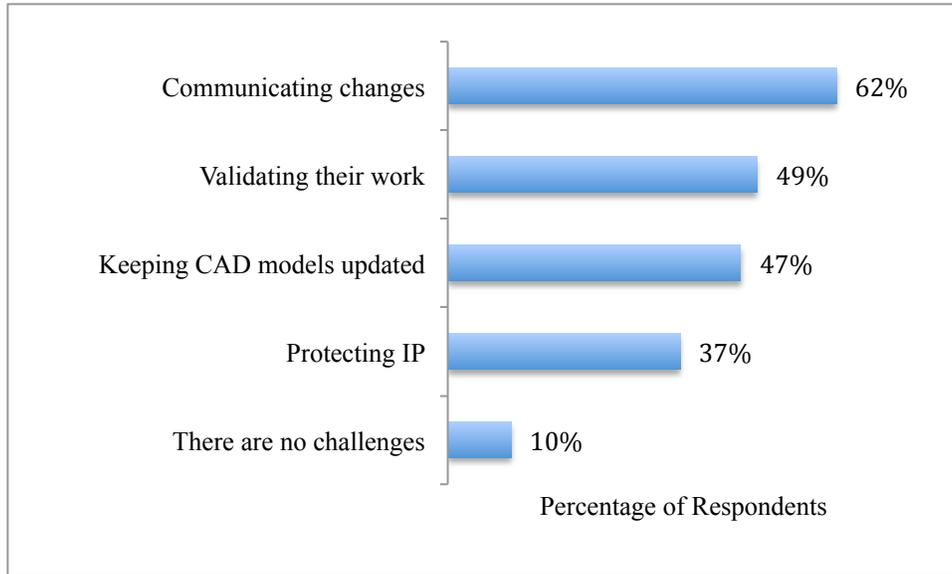


Figure 7: Top 5 Challenges Involving Third Parties

Clearly, companies need better means for communicating, especially when third parties are involved. Unfortunately, third parties tend to be slow when providing updates on changes. Seventy percent (70%) say third parties wait a couple of days or more to send updated information. This leaves several days for engineers to work with outdated information. With delays in communication from both internal engineers and third parties, it is not too surprising that engineers report, on average, 20% of the time they are working with outdated information. This means every week, a day's worth of work is done with outdated information. There is lots of opportunity to improve this. The business impact is significant (Figure 8).

70% say third parties wait a couple of days or more to send updated information.

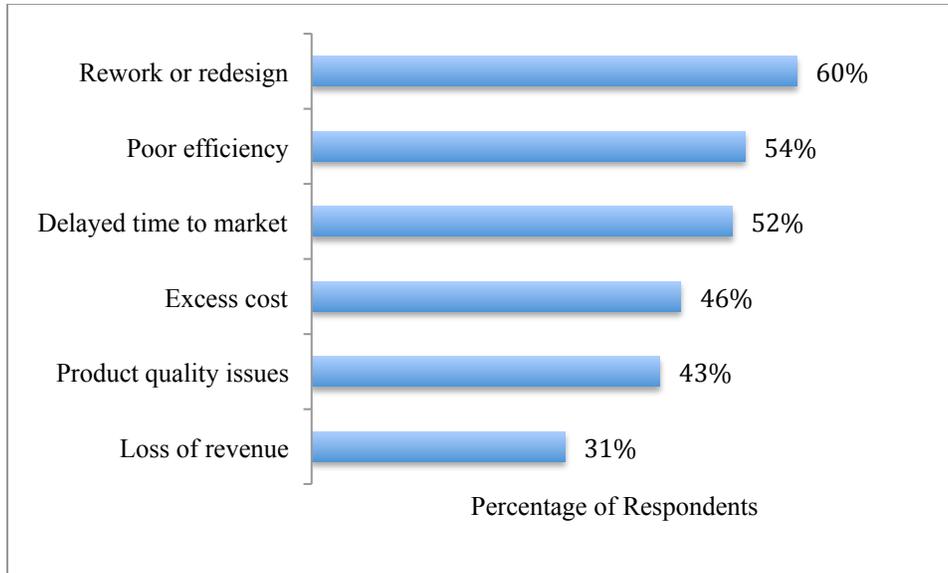


Figure 8: Top Impacts of Outdated Information

Working with outdated information wastes time. First, the time spent on working with outdated information adds limited value, and then more time is needed to redo the work with the correct versions of CAD files. This leads to poor efficiency and creates delays. If the problems are not found soon enough, market launch dates are put at risk. The time required to fix problems also drives up cost. In addition, overlooked problems hurt product quality. The most troubling impact is losing time that could have been spent improving the product. With less time to work on the things that will differentiate the product, revenue opportunities are reduced. This hurts a company's ability to develop differentiated products that will win business.

Engineers report, on average, 20% of the time they are working with outdated information.

Identifying the Top Performers

To understand some of the best approaches for streamlining access to design information, Tech-Clarity first determined which companies are better at meeting their product development goals. Then, Tech-Clarity researchers analyzed what they do differently so others can learn from them to improve their own performance. Researchers analyzed five metrics to identify manufacturers that use their engineering resources most effectively. The survey requested that each participant evaluate their company's performance compared to their competitors on their:

- Ability to design high quality products

- Ability to develop products quickly
- Ability to develop innovative products
- Ability to develop products efficiently
- Ability to meet product cost targets

These metrics measure a company’s ability to be profitable.

Researchers correlated performance in other metrics from the survey in order to validate and quantify the benefits of the Top Performers. Top Performers are 8% closer on deadlines compared to competitors. This means they do a better job managing their project schedules and avoiding unexpected problems.

Top Performers are 8% closer on deadlines compared to competitors.

What Sets Top Performers Apart?

Top Performers are more effective at managing their design data and processes. When asked to rate their processes on a scale of 1 to 5, with 5 being the most effective, on average Top Performers rate their processes as very to highly effective while Others rate their processes as only average.

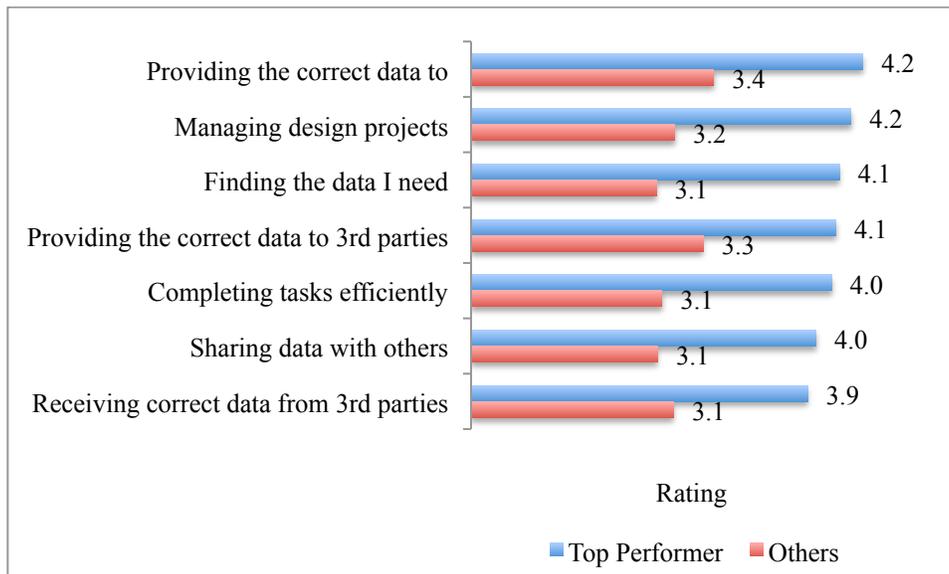
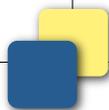


Figure 9: Effectiveness of Capabilities

With Top Performers rating their processes as more effective, understanding what they do differently can help other organizations become more successful. Survey research from Tech-Clarity’s report Best Practices for Managing Design Data, found, “*The data*



shows that companies with world-class performance are more likely to have very effective data management capabilities. World-class manufacturers are more able to find the data they need, share it with others, manage their design projects, and provide the correct data to manufacturing... The results indicate that effective data management is an important enabler for designing and developing profitable products.”

Use Technology to Support Real-Time Communication

Technology plays a key role in communication. Figure 10 shows the three most common methods for sharing changes to CAD models with internal team members.

Communication Method	Top Performers	Others
CAD models update in real time	66%	44%
Managed in PLM/PDM	66%	54%
Email	47%	40%

Figure 10: Internal Communication Methods for Sharing Changes to CAD Models

Top Performers are more likely than competitors to communicate changes using PLM or PDM and real-time updates to CAD models. While relied on less than CAD and PLM, email is also used. Figure 11 shows how often these methods are used to share changes to CAD models with third parties such as suppliers or design partners.

Communication Method	Top Performers	Others
CAD models update in real time	35%	17%
Managed in PLM/PDM	48%	26%
Email	74%	69%

Figure 11: External Communication Methods for Sharing Changes to CAD Models

With third parties, everyone is more likely to use email than any other method, but compared to their lesser performing competitors, Top Performers are 85% more likely to use PLM and twice as likely to have the CAD models update automatically. The use of these technologies is likely an evolving trend as available technology makes this easier to do when working with third parties.

Top Performers are 85% more likely to use PLM and twice as likely to have the CAD models update automatically.

An issue to be aware of is that lengthy check-in times can be a deterrent for keeping data in PLM or PDM. Of those using PLM or PDM 18% also use local computer folders or drives. This would suggest that data sometimes sits on a local computer, inaccessible to anyone else who needs it, rather than keeping it up-to-date in PLM. This is an issue the latest generation of PLM tools seek to solve.

Consider the Security Risks of Email

While PLM and PDM are powerful tools supporting the success of the Top Performers, there are also some points to be aware of that the latest generation of PLM tools seek to solve. Of those using PLM or PDM:

- 33% also use email to communicate changes internally
- 45% also use email to communicate changes externally

The simplicity and speed of email make it an attractive option. In some cases, it can be used as a helpful notification tool. However, when it is used as a mechanism for sending data, there can be some risks including lack of security, limited visibility, and poor version control. The common use of email could suggest, in some cases, an easier means to share data is needed. This is another issue the latest generation of PLM tools seek to solve.

Support Real-time CAD Updates

Tech-Clarity researchers found real-time updates are an important differentiator for Top Performers:

- 59% of Top Performers update models in real time or hourly
- Comparatively, only 31% of their competitors update models in real time or hourly

This is striking because it means that Top Performers are nearly 2-times more likely to maintain up-to-date models. Because of this, Top Performers are less likely to waste time fixing models due to outdated information.

The difference made by a real-time solution is further supported in Tech-Clarity's report Integrating Product Design and Development Environments, "*The integrated design and*

development environment is the latest evolution of product innovation and engineering software. It offers the advantages of integrated design tools combined with product data and lifecycle management. These advanced solutions help manufacturers meet the challenges of compressing time, improving productivity, and battling complexity by allowing engineers to design concurrently, in context, in real-time.”

Addressing the delays due to check-ins, the report also states, “*Integrating PLM into the design environment keeps engineers immersed in their design tools instead of stepping out to other solutions. It also allows them to quickly search and load data as needed instead of waiting to check data in and out from a separate system.*” To manage changes, the report points out, “*Engineers should be able to work in this context to make updates with full contextual fidelity and see the impact of their changes in real time, and be assured that others will see their updates to take them into account in their own work.*” Real-time updates are an important contributor to the better business results enjoyed by Top Performers.

Conclusion

To be more competitive, companies are looking to differentiate their products with better quality, performance, innovation, and lower cost. The decisions engineers make have a direct impact on these things. Unfortunately, rather than focusing on these features, engineers spend 1/3 of their time on non-value added work. Further hurting their ability to improve products, they are working with outdated information 20% of the time. Top Performers empower their engineers by providing real-time updates to CAD models. This combined with a PLM or PDM solution enables them to be 2-times more likely to maintain up-to-date design information. As a result, Top Performers avoid wasting time redoing designs due to outdated information. Instead, they can focus their energy on developing better products that will stand out from the competition.

The latest generation of PLM solutions, which offer an integrated design and development environment, can help companies improve the future competitiveness of their products.

The latest generation of PLM solutions, which offer an integrated design and development environment, can help companies improve the future competitiveness of their products. These solutions enable teams to work collaboratively and design in-context, while supporting real-time updates.



Recommendations

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

- Understand how engineers spend their time and improve processes to minimize time wasted on non-value added work
- Consider solutions such as PLM or PDM to centralize design information and support change management and collaboration
- Evaluate options to design in the context of the assembly to improve collaboration and understand the impact of changes
- Consider real-time updates to keep CAD data up-to-date while minimizing or eliminating check-in times
- Establish means for secure, real-time collaboration with third parties to minimize delays in getting updated CAD data from them

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. She has broad experience with topics such as product design, simulation, systems engineering, mechatronics, embedded systems, PCB design, improving product performance, process improvement, and mass customization. She graduated magna cum laude with an MBA from Babson College and earned a BS in Mechanical Engineering, with distinction, from Worcester Polytechnic Institute.

Michelle began her career holding various roles as a mechanical engineer at Pratt & Whitney and KONA (now Synventive Molding Solutions). She then spent over 10 years at PTC, a leading MCAD and PLM solution provider. While at PTC, she developed a deep understanding of end user needs through roles in technical support, management, and product marketing. She worked in technical marketing at Moldflow Corporation (acquired by Autodesk), the market leader in injection molding simulation. Here she was instrumental in developing product positioning and go-to-market messages. Michelle then joined Aberdeen Group and covered product innovation, product development, and engineering processes, eventually running the Product Innovation and Engineering practice.

Michelle is an experienced researcher and author. She has benchmarked over 7000 product development professionals and published over 90 reports on product development best practices. She focuses on helping companies manage the complexity of

today's products, markets, design environments, and value chains to achieve higher profitability.

About the Research

Tech-Clarity gathered and analyzed 248 responses to a web-based survey on overcoming product design bottlenecks. Survey responses were gathered by direct e-mail, social media, and online postings by Tech-Clarity, Dassault Systèmes, Engineering.com and Connect Press.

Responses included representation from all levels of the organization. Specifically respondents were Executive, "C-level", including titles of CEO, CFO, COO, and others (13%), Vice President level (8%), Director level (7%), Manager level (32%), Non-manager, staff, individual contributor (36%), or Other (4%).

The respondents represented a mix of company sizes, including 37% from smaller companies (less than \$250 million), 15% between \$250 million and \$1 billion, 21% between \$1 billion and \$5 billion, and 15% greater than \$5 billion. 12% chose not to disclose their company size or did not know it. All company sizes were reported in US dollar equivalent.

The responding companies were a good representation of the manufacturing industries, including including 30% Industrial Machinery, 21% Auto, 20% Aerospace & Defense, 15% High Tech and Electronics, 15% Energy and Utilities, 11% Durable Consumer Goods, 9% Consumer Packaged Goods, and others. Note that these numbers add up to greater than 100% because some companies indicated that they are active in more than one industry.

The respondents reported doing business globally, with most companies doing at least 10% of their business in the North America (79%), about one-third doing business in Western Europe (36%), slightly less than one-third doing business in the Asia-Pacific regions (29%), Latin America (15%), Eastern Europe (11%), and Africa (3%).

Respondents included manufacturers as well as service providers and software companies, but responses from those determined not to be directly involved in designing or manufacturing products (including software vendors and consultants) were excluded from the analysis. The report reflects the experiences of those considered to have direct involvement in designing and manufacturing products.