HOW-TO GUIDE:

INCREASE PROFITABILITY

By Reducing Non-Value Added Work in Engineering



MICHELLE BOUCHER | VICE PRESIDENT | TECH-CLARITY

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Executive Overview

Engineering Is Key to Competitive Differentiation

Today's market is so competitive; it is hard to stand out. To be successful companies must empower their engineering teams to differentiate products on innovation, quality, performance, and cost. While balancing all that criteria can be a challenge, it is made even harder as engineers report they waste a third of their time on non-value added work. Even worse, 20% of their time is spent working with outdated information, leading to more wasted effort and rework. One way companies can improve this situation is to provide engineers with real-time access to design data, in the right context. The result should be increased engineering bandwidth so engineers can focus more effort on making products more competitive.

Determining Best Practices

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.

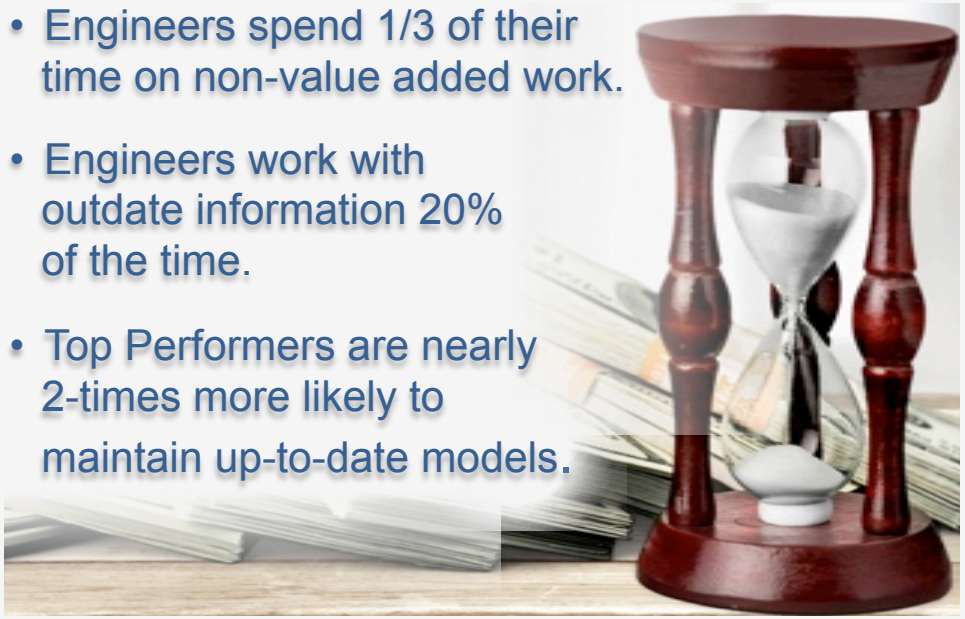
The research shows that companies who are most successful, Top Performers, are nearly 2-times more likely to maintain up-to-date models. PDM/PLM makes these real-time updates possible.

What Can You Learn from This Research?

This report explores best practices for streamlining access to design data in real-time. 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. The report also reveals how manufacturers can plan for a design environment that will prepare them for long-term competitiveness.

Key Insights:

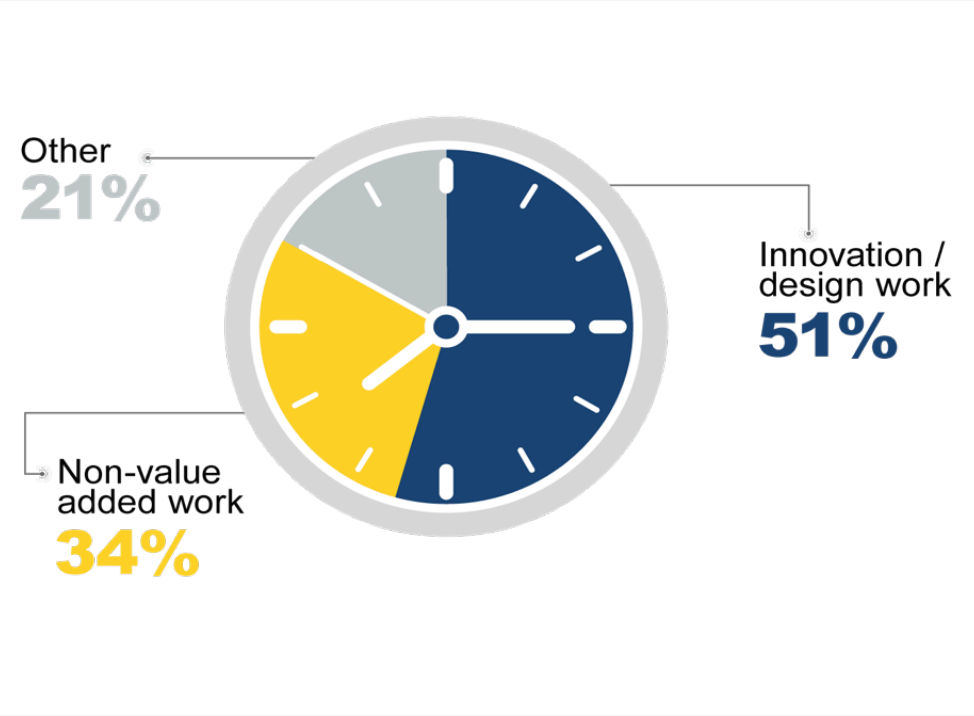
- Engineers spend 1/3 of their time on non-value added work.
- Engineers work with outdate information 20% of the time.
- Top Performers are nearly 2-times more likely to maintain up-to-date models.



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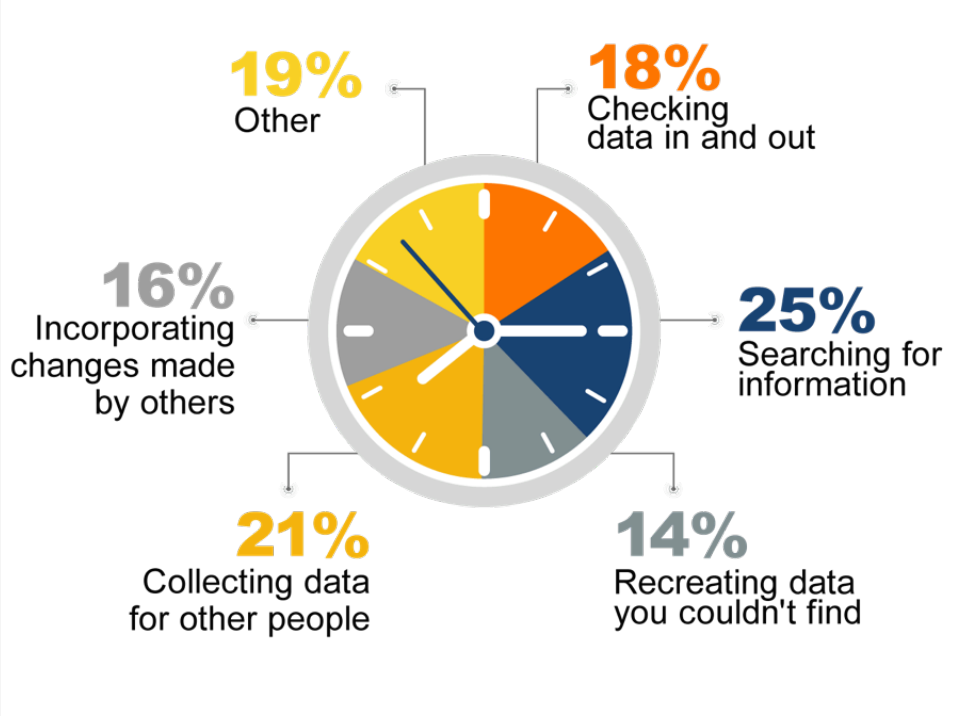
Identify Bottlenecks

Engineering Time
Engineers spend a surprising 1/3 of their time on non-value added work. Undoubtedly, there is much opportunity for improvement.



How Engineers Spend Their Time

Non-Value Added Engineering Time
A more in-depth analysis of that non-value added time reveals that poor data management practices are a significant contributor:



Breakdown of Non-Value Added Time

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Assess Non-Value Added Time

Let's take a deeper dive into the data management practices that contribute to non-value added work:

23% **Searching for information:** Engineers need access to a significant amount of product data to complete their work. This includes product specifications, requirements, material specifications, engineering change requests, bills of materials (BOM), supplier information, other components, and more. With so much to manage, it's not surprising that searching for data can be a bottleneck.

18% **Collecting data for other people:** Engineers are often asked to bring information to meetings for others. This requires taking time to collect data for activities such as status updates, design reviews, and project meetings.

16% **Checking data in and out:** Some companies use PDM (Product Data Management) or PLM (Product Lifecycle Management) systems to centralize data and make it easier to find. To continue design work or make changes, engineers must first check out and download the relevant CAD files. After making changes, the file must then be uploaded and checked back in so that others may have access to it. This whole check in/ check out process can be tedious and time-consuming, especially if CAD files are large. Data check-ins will be explored further in this report.

14% **Incorporating changes made by others:** With the fast pace of product development, changes can be constant, but they are not always communicated. For example, during a project meeting, an engineer may discover that a coworker changed the BOM. That change has to be reflected in the CAD model as it may impact other parts of the design. In another scenario, perhaps after a change to the PCB layout, the housing no longer fits. Seemingly small changes may have a significant impact on the rest of the design, especially if the design evolved a lot before others became aware of the change. Engineers waste much time when they do not immediately see changes made by others. In some case, they may have to redo hours of work.

12% **Recreating data you couldn't find:** Recreating work can be especially frustrating. No one wants to redo work because the data was either lost or misplaced. This can happen when data is stuck on personal laptops, stored on external drives that other people do not have access to, or no one can remember where it was stored. Additionally, search features on shared drives can't search metadata and may be insufficient to find specific files and information.

These results reveal the many different reasons engineers need better ways to find and reuse data.

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Business Value of Eliminating Non-Value Added Work

Eliminating Manual Data Management Tasks Creates Business Value

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 benefit.



Business Value of Eliminating Manual Data Management Tasks

Interestingly, only 2% of survey respondents said there would be no impact on the business. This means an overwhelming 98% of manufacturers see business value in reducing non-value added work.



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Recognize the Time Required for Check-ins

Check-ins Can Be Time Consuming

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. Product complexity has a significant impact on check-in time as seen in the table below.

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

Average Check-in Time Based on Complexity

The Impact of 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 take more time. Also, higher complexity usually means changes must be shared with a larger development team. Consequently, 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.



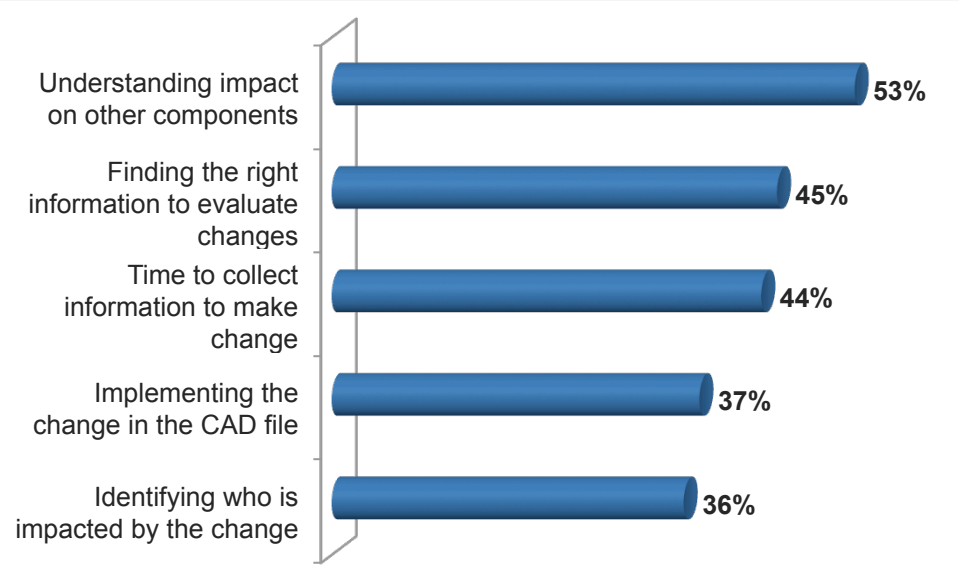
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Outdated Information Impacts Engineering Changes

The Challenges of Engineering Changes

Engineering changes magnify the problems with outdated models. If data cannot be relied upon to be up-to-date, additional time is needed to search for the latest version. Worse, changes made using outdated data must be redone on current versions, wasting time and effort.

The top challenges of executing engineering changes highlight these points. The graph below shows manufacturers report difficulty understanding the impact of a change on both the design and the team. Plus, finding and collecting the information is not easy.



Top 5 Challenges of Executing Changes

Engineers Need Up-to-Date Information

After implementing a change, it can take a couple of days or more to get changed information to the entire team. Given the speed at which engineers must work, two days is too long and means there is significant risk engineers will work with outdated data. Emphasizing this pain, an overwhelming 76% report they would like the data to be updated much more quickly. Companies can accomplish this by granting engineers immediate access to changes with real-time updates. This will streamline access to CAD data to avoid rework and wasted time.

- 41% of respondents report it takes a couple of days or more to get changed information to the entire team.
- 76% need faster access:
  - 61% would like access to the latest CAD file in real time
  - Another 15% need changes within a few hours

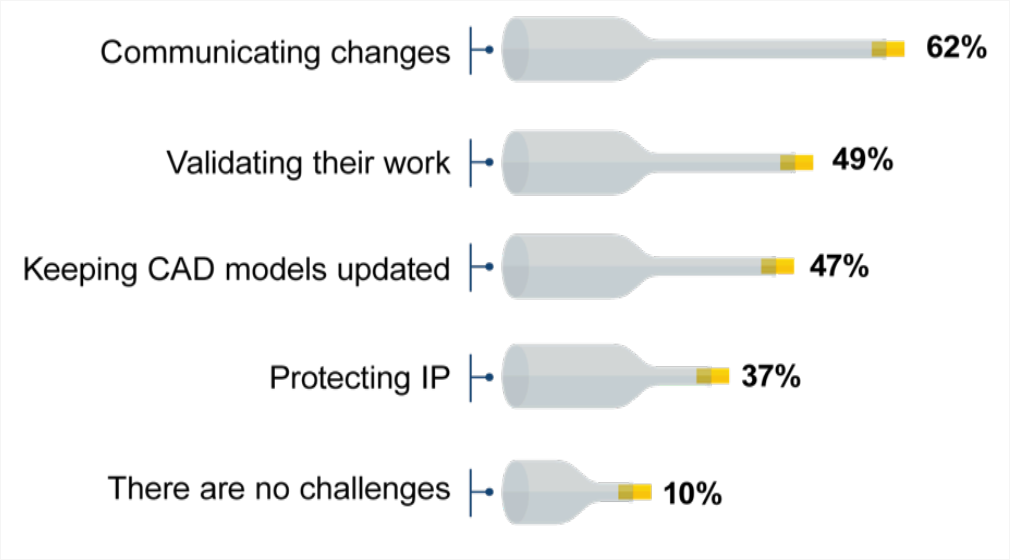
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The Impact of Outdated Information on Collaboration

Third Party Collaboration Bottlenecks

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.

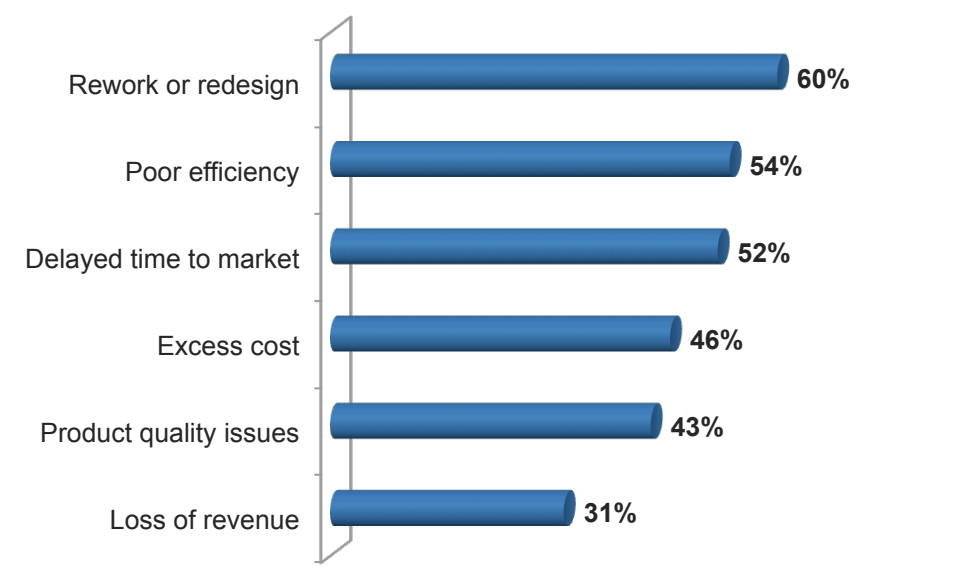


Top 5 Challenges Involving Third Parties

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

The Cost of Collaboration Bottlenecks

Companies need better means for communicating, especially when third parties are involved. Unfortunately, third parties tend to be slow to share updates. Seventy percent (70%) say third parties wait a couple of days or more to send updated information, forcing engineers to work with outdated information. With delays in communication from both internal engineers and third parties, it is inevitable that engineers regularly work with outdated information and in fact, they report that 20% of the time they are working with outdated information. This means every week, an entire day's worth of work is done with outdated information. The business impact is felt in many areas as seen in the graph below.



Top Impacts of Outdated Information

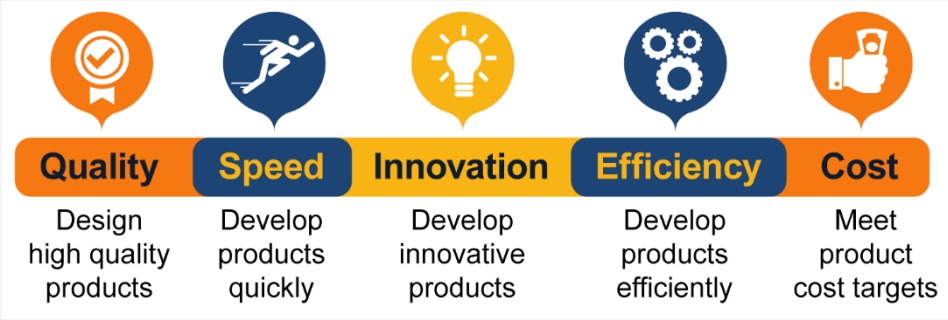
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Identifying the Top Performers

Pillars of Profitability

Tech-Clarity analyzed five metrics to identify manufacturers that use their engineering resources most effectively. Participants evaluated their company's performance compared to their competitors on their ability to:



The top 20% best-performing companies were defined as "Top Performers."

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 (see graph on the right).

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



Effectiveness of Capabilities



"World-class performers are more likely to have very effective data management capabilities. [They] 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."

Best Practices for Managing Design Data – Tech-Clarity

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Technology As a Collaboration Solution

Support Real-Time Communication

The following table shows the 3 most common methods for sharing changes to CAD models with team members:

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

Internal Communication

Top Performers are more likely than peers to communicate changes as real-time updates to CAD models. They also are more likely to use PLM or PDM. While they rely on it less than CAD and PLM, they also use email. However, when sharing CAD models with third parties, the collaboration methods are much different, as seen in the table below:

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

External Communication

Collaborating with Third Parties

When collaborating with third parties, everyone is more likely to use email than any other method. However, 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.



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Consider the Security Risks of Email



Email Is Easy, but Puts Intellectual Property (IP) at Risk

While PLM and PDM are powerful tools, there are some limitations the latest generation of PLM tools seek to solve. Of those using PLM or PDM, use email to communicate changes internally and externally. The simplicity and speed of email make it an attractive option.

In some cases, it is a helpful notification tool. However, when 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 that engineers need an easier means to share data. The latest generation of PLM tools seeks to provide this better mechanism for sharing data.

Of those using PLM or PDM:

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

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The Benefits of Real-Time Data Updates

Support Real-Time CAD Updates

Real-time updates are an important differentiator for Top Performers. They are nearly 2-times more likely to maintain up-to-date models than their peers. Because of this, Top Performers are less likely to waste time fixing models due to outdated information. Real-time updates can be achieved with an integrated design and development environment, which was explored in past Tech-Clarity research.

59% Percent of Top Performers updating models in real time or hourly

31% Percent of Others updating models in real time or hourly



"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."

Integrating Product Design and Development Environments – Tech-Clarity

Benefits of an Integrated Design and Development Environment

Integrated design and development environments allow engineers to design concurrently, in context, in real-time. As a result, manufacturers overcome the data management challenges that contribute to non-value added work, helping them:

- Improve productivity
- Shorten development time
- Reduce the cost of product development

Engineers don't have to worry about check-ins and check-outs as design data is available in real-time. They can see the impact of their changes in real-time as do other members of the development team, both internally and externally. They are not wasting time searching for data or recreating work. Instead, they can focus their efforts on innovation and other design criteria to make products more competitive.

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Recommendations



Recommendations and Next Steps

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

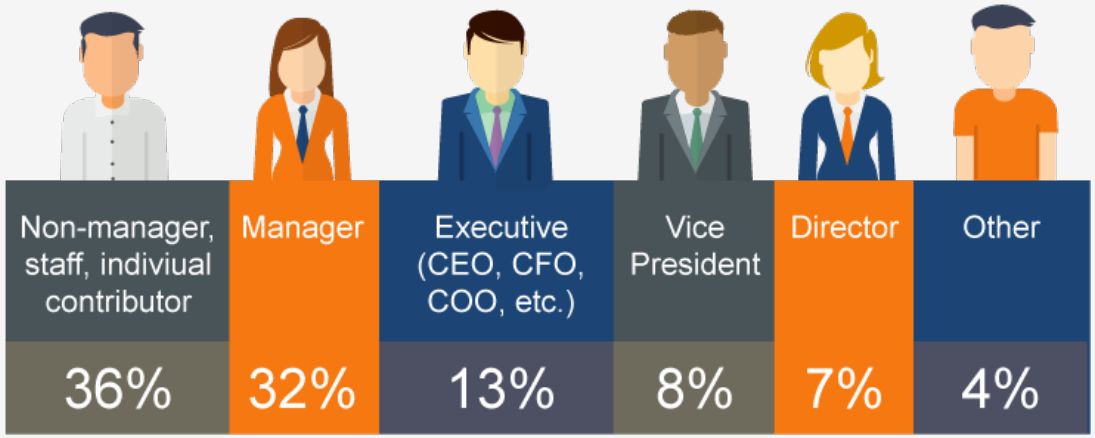
- Understand how engineers spend their time and improve processes to minimize time wasted on non-value added work
- Consider solutions such as PLM or PDM to centralize design information and support change management and collaboration
- Evaluate options to design in the context of the assembly to improve 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

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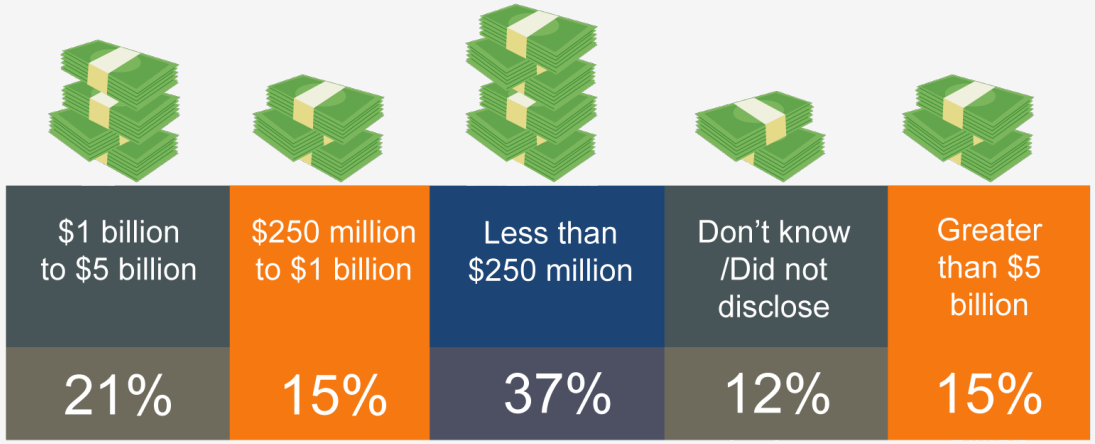
About the Research

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.

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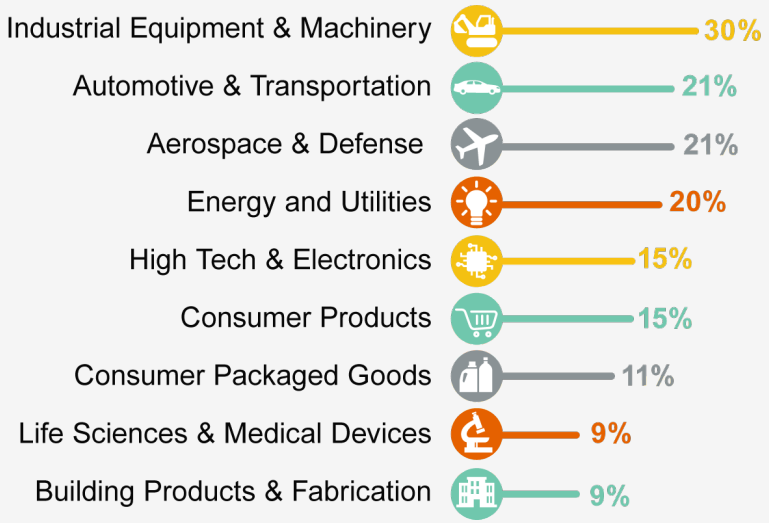


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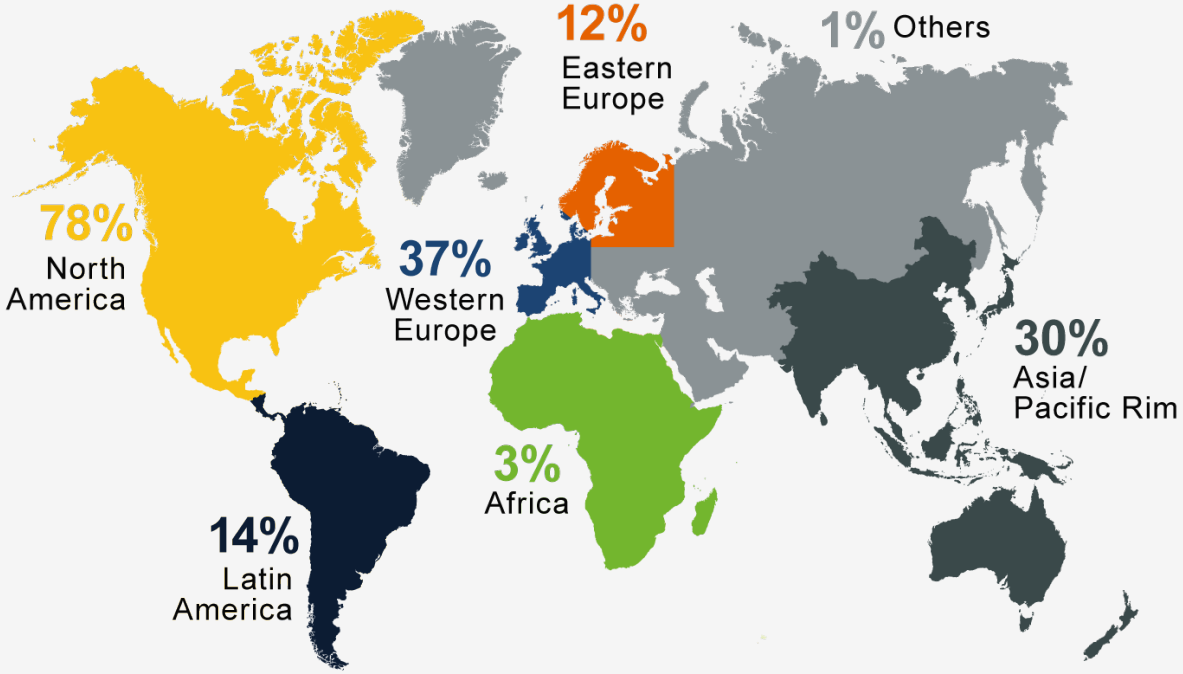


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Industry*



Geography*



* Some companies serve multiple industries and geographies. Only the top nine industries are included in the Industry graph above.

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About the Author

Michelle Boucher is the Vice President of Research for Engineering Software for research firm Tech-Clarity, an independent research and consulting firm that specializes in analyzing the business value of software technology and services. Michelle has spent over 20 years in various roles in engineering, marketing, management, and as an analyst.

Michelle 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 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.

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