Tech-Clarity

Design Data Management Maturity Improves Profitability

Analyzing Best Practices for Managing Designs

Table of Contents

Executive Overview

Our previous report, Best Practices in Managing Design Data[1], showed that "*Companies with world-class performance are more likely to have very effective data management capabilities*." Now, we've extended that earlier research with new survey data to take a fresh look at data management challenges and best practices. We also take a deeper dive into product complexity, explore whether companies still suffer from non-value-added time managing data, and quantify the impact of improving design data management.

Complexity has continued to grow, resulting in poor productivity. Almost one-third of companies surveyed report their technical resources spend more than 25% of their time on non-value-added data management tasks!

Survey results indicate that data management is still a big business challenge. Complexity has continued to grow, resulting in poor productivity even for smaller companies. Almost one-third of companies surveyed report their technical resources spend more than 25% of their time on non-value-added data management tasks!

The survey also uncovers that data management is evolving, including significant growth in the use of cloud-based file sharing tools. It appears that the adoption of these tools may be making it easier for companies to share their designs, but making it more difficult to effectively control design data.

The prior report makes suggestions on how to improve data management and resulting productivity, which still hold true. It shows that some companies are more effective at data management and are "*more likely to use structured, collaborative design data management technology, 30% more likely to use PDM or PLM*." It also finds that these companies spend 25% less time on nonproductive data management tasks. This survey furthers the research and finds that companies with the highest product development performance, the Top Performers, have higher data management maturity. They:

- Use more collaborative design data management capabilities
- Leverage their design data management solutions for more functions
- Have tighter integration between their design tools / CAD and data management
- Couple data management tightly with cloud file sharing (if they're using cloud)

Top Performers have higher data management maturity.

We found these companies achieved significant business advantages, including tangibly higher revenue growth, profit margin expansion, and innovation. Further, we found they not only achieve a one-time improvement, but use data management as a foundation to grow on, toward greater PDM / PLM value.

Effective Data Management Improves Productivity, Performance

Tech-Clarity's research shows that good design data management is good business. For example, Best Practices in Managing Design Data finds that "*Companies with world-class performance are more likely to have very effective data management capabilities*," and "*are more able to find the data they need, share it with others, manage their design projects, and provide the correct data to manufacturing*." Another study, The Facts About Managing Product Data[2], reports that "*Top Performers are about twice as likely to beat estimates for design due dates, quality targets, and project / program budgets*." These studies make the business value of improving data management performance clear.

Figure 1: Importance and Benefits of Design Data Management

Companies participating in a survey for this report confirm the benefits of better design data management. For example, one respondent explains that data management is important because it "…*keeps your engineers/designers doing what they are supposed to be doing and not managing data. Also, it allows better communication to the entire company no matter what plant they're in*." Others made similar statements, with the most common themes shown in the word cloud (Figure 1, where most common responses to open ended question appear larger). Perhaps most noticeable is the prominence of improved productivity, a common benefit of improving design data management. Later in this report, we'll quantify how these benefits impact revenue and profitability.

Companies participating in a survey for this report confirm the benefits of better design data management.

Design Data Management Continues to be a Struggle

The survey shows that companies continue to struggle with numerous design data management challenges (Figure 2). These challenges expand across the three primary pillars for design data management; Controlling, Accessing, and Sharing data.

The two most commonly reported challenges relate to controlling data.

The two most commonly reported challenges relate to controlling data. They include conflicting document versions and not having up-to-date, accurate information. The challenge of conflicting versions has increased dramatically since the last survey. Given the prominence of these issues and the increase in revision control problems, it appears that companies are having more trouble controlling design data than before.

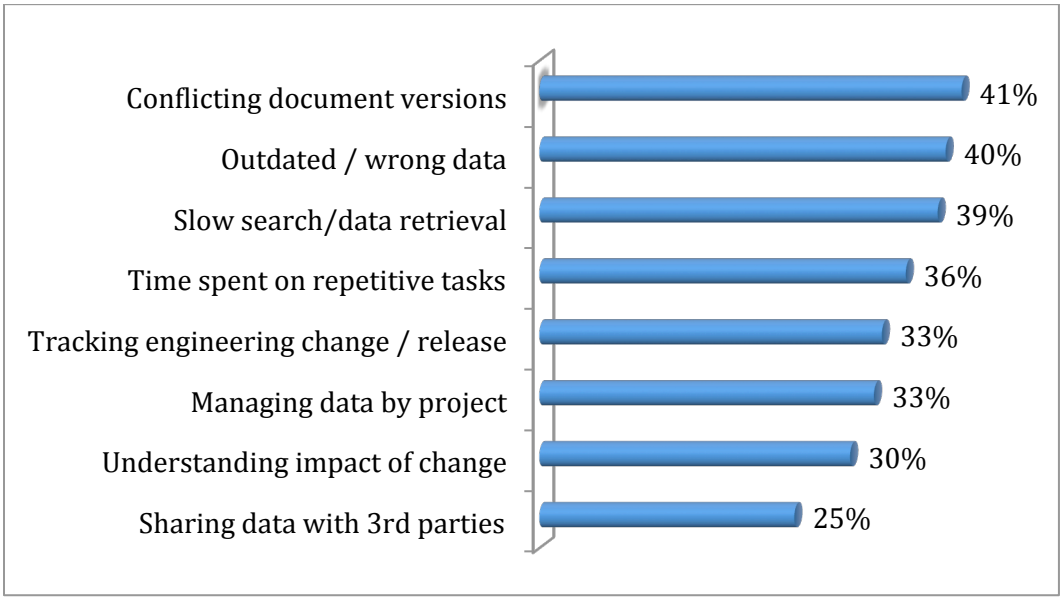

Figure 2: Design Data Management Challenges

Companies also have trouble accessing data. Companies report search-related challenges at about the same frequency as the control issues above. Past research and our experience both show that these issues contribute significantly to lost productivity, as does the next most common challenge, spending time on repetitive data management tasks.

Companies report search-related challenges at about the same frequency as control issues.

Reviewing the 3rd pillar of data management, sharing data, highlights some positive news. Two challenges, viewing multiple document types and sharing designs externally, were reported by fewer companies during this survey effort. We believe this is due to increased availability of cloud-based file sharing sites. It's interesting to note, however, that control issues became more prevalent while sharing issues decreased. This leads us to us to the potential conclusion that cloud file sharing has improved the ability to share data with others but added fuel to the fire by creating more data that is either unmanaged or managed in an ad-hoc way.

Cloud file sharing has improved the ability to share data with others but created more data that is either unmanaged or managed in an ad-hoc way.

Data Management Challenges Continue to Impact Productivity

Challenges are frustrating, but more importantly lead to significant business impacts. In our previous study, we found that one-quarter of companies spent 20% (one day a week) on non-value added data management activities. Ideally, we would like to report that things have gotten better, but that's not the case (Figure 3). Analyzing responses to this survey show that companies, on average, spend over 15% of their time on non-value added tasks related to data management! In fact, almost one-third of companies spend more than 25% of their time on NVA activities!

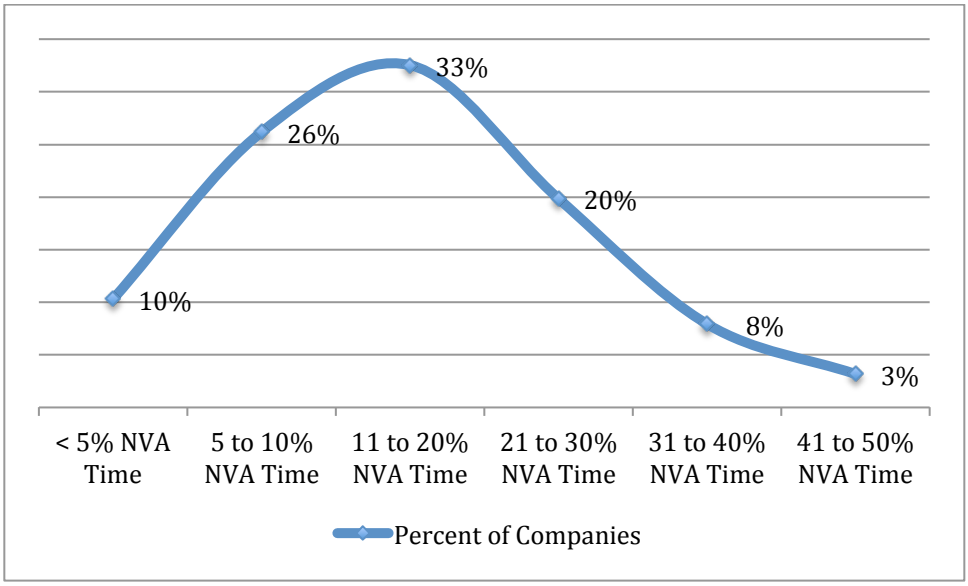

Figure 3: Non-Valued Added Time Managing Design Data

Companies, on average, spend over 15% of their time on non-value added tasks related to data management!

It appears that data management has gotten further out of control as complexity increased and companies have continued to push the boundaries of innovation. At the same time, design data management has become more critical to combat the impacts of complexity. This is a conundrum, because data management provides significant benefits, but companies can't let it become a burden to company innovators. As Charlie Kitts, Product Engineering CAD/PLM Administrator for Ridge Tool Company explains, "*We knew that we needed data management and understood it's important to share data, but we didn't want to be data entry people*." Fortunately, some companies seem to have figured out how to balance these needs effectively. This report focuses on what they do differently as a lesson for others to follow.

Data management has gotten further out of control as complexity increased and companies have continued to push the boundaries of innovation.

Complexity on the Rise

Before looking at best practices, it's important to understand why they are so important to today's manufacturers. Complexity, a major source of data management challenges, is on the rise. Without best practices in design data management, those that are already struggling with poor processes and systems will suffer from even greater productivity challenges. Companies of all sizes struggle with design data management. Perhaps surprisingly, Best Practices in Managing Design Data shows that product complexity is a larger driver of data management issues than company size.

Three-quarters of companies say that complexity has increased due to more software and electronics in their designs, aka "smarter" products. But it's not limited to that.

Tech-Clarity's Five Dimensions of Product Complexity (Figure 4) shares that complexity is a compound issue, including factors related directly to products and to the product development environment (Figure 5). This study takes a deeper dive look at product complexity and whether it's grown over the last few years. The answer is a resounding "yes," with complexity growth reported across multiple dimensions. Three-quarters of companies say that complexity has increased due to more software and electronics in their designs, aka "**smarter**" products. But it's not limited to that, as almost two-thirds say **mechanical** complexity increased and 42% say **materials** complexity has increased, possibly due to the increased prevalence of nanomaterials and composites.

But complexity comes from many sources. Over one-half say product complexity has increased due to the need to manage multiple product **configurations**. This may be to offer more market choice or to provide variants to meet globalization demands, another

significant challenge. Finally, over one-half of companies report that **manufacturing** complexity has increased, and 20% say it has increased *significantly*. This will likely be a growing issue as 3D printing / additive manufacturing and the use of composites continue to move into the mainstream.

Figure 4: Five Dimensions of Product Complexity (updated)

Clearly products, and the business of developing and delivering profitable products, have increased in complexity. Based on our understanding of the connection between complexity and data management problems, we believe that design data management issues will continue to rise with complexity, particularly for areas that require integration of people and designs from multiple disciplines.

Design data management issues will continue to rise with complexity, particularly for areas that require integration of people and designs from multiple disciplines.

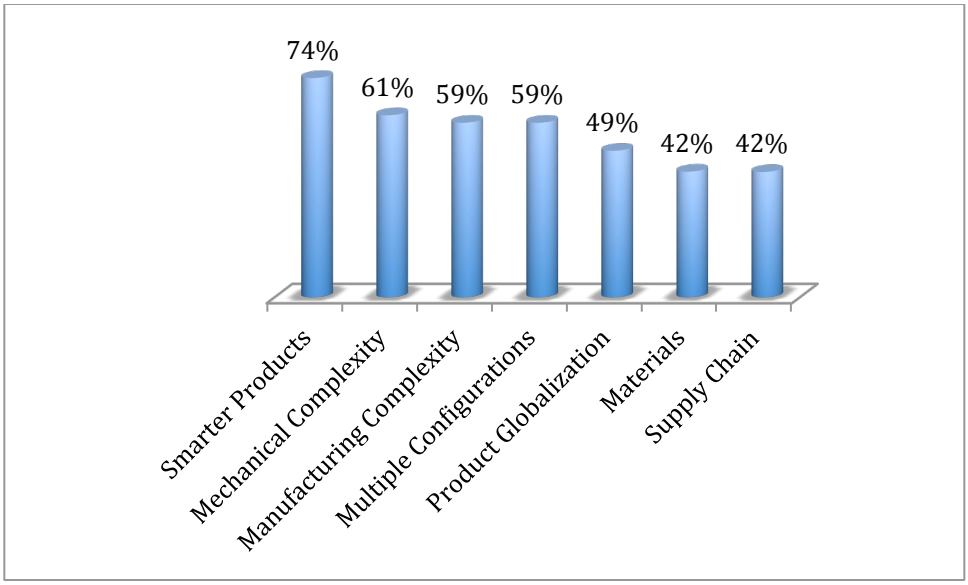

Figure 5: Percentage of Companies Indicating Increased Complexity Last 5 Years

Identifying Data Management Practices of the Top Performers

What do the leading companies do differently in their design data management approaches? Tech-Clarity uses a process called "Performance Banding" to determine which organizational approaches, processes, and technologies leading companies use. The first step in the process is to identify the "Top Performers." To do this, researchers reviewed a series of metrics from each respondent. For this survey, researchers focused on self-reported performance relative to competitors on the business-related metrics that drive product profitability:

- Ability to design high **quality** products
- Ability to develop new products **quickly**
- Ability to develop **innovative** products
- Ability to develop products **efficiently**

Researchers isolated respondents that reported the highest aggregate score, and labeled this top 24% of respondents Top Performers. With those higher-performing companies identified, researchers analyzed what they do differently than the "Others" in order to see what data management practices correlate with better business performance. For example, Top Performers are over two times as likely to view design data management to be of "Strategic" importance to design and engineering performance (Figure 6). Of course there's more to the story than this, but it's important to know that leading companies recognize the strategic value of design data management. We'll examine other

similarities between the Top Performers as well, and use those to make recommendations for poorer performing companies.

Top Performers are over two times as likely to view design data management to be of "Strategic" importance to design and engineering performance.

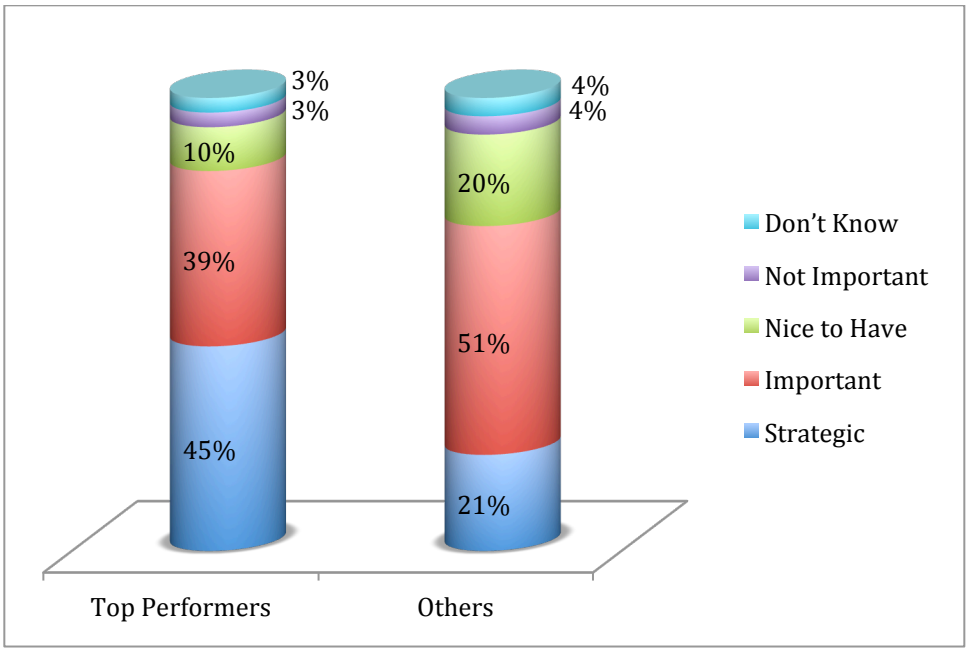

Figure 6: Data Management Importance by Performance Class

Top Performers have Greater Data Management Usage Maturity

Data from the Best Practices in Managing Design Data already shows that Top Performers are more likely to use collaborative, structured solutions including Product Data Management (PDM) and Product Lifecycle Management (PLM). This has been confirmed by other Tech-Clarity research as well. Beyond that, what do Top Performers do differently?

Top Performers display much greater design data management maturity.

Top Performers display much greater design data management maturity. The first indication is that Top Performers use more of the capabilities that data management has to offer. Specifically, Top Performers are 30% more like to have high data management *usage* maturity (Figure 7). We defined usage maturity for this study as using data management for five or more functions, meaning they use data management for more processes.

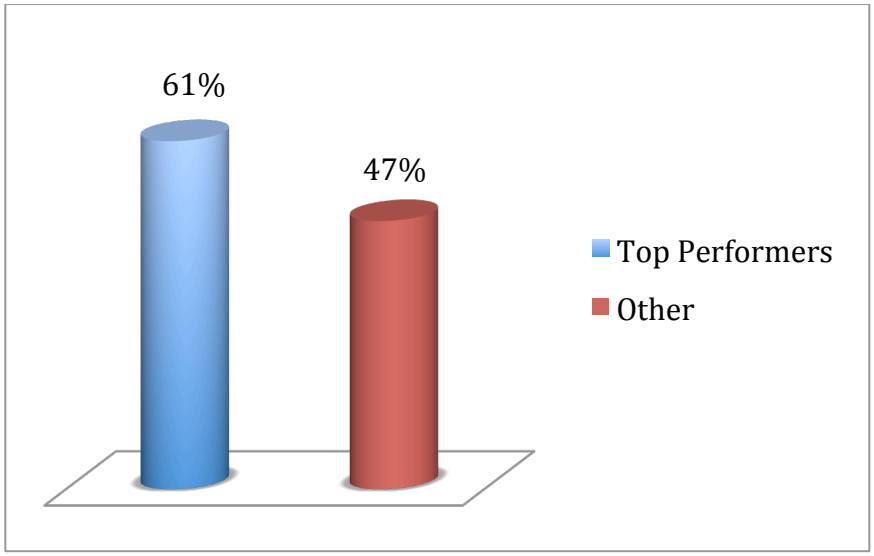

Figure 7: High Data Management Usage Maturity by Performance Class

Leading companies recognize the value of leveraging their data management solution for more. "*The push is on. We want to do more with data management so we can turn products around faster, make fewer mistakes, know the complete impact of changes, and take it global*," explains Ridge Tool Company's Kitts.

Top Performers have Greater Collaboration Maturity

Beyond the *number* of data management functions used by Top Performers, the survey shows differences in the *kind* of functions these leaders support with data management. The first thing to notice is the difference between the most *common* practices (Figure 8) and the most *differentiating* ones (Figure 9). Functions like vaulting, access control, and storing CAD files are relatively common among both performance classes. They are likely very valuable functions, but they aren't what set the Top Performers apart.

Functions like vaulting, access control, and storing CAD files are relatively common among both performance classes. They are likely very valuable functions, but they aren't what set the Top Performers apart.

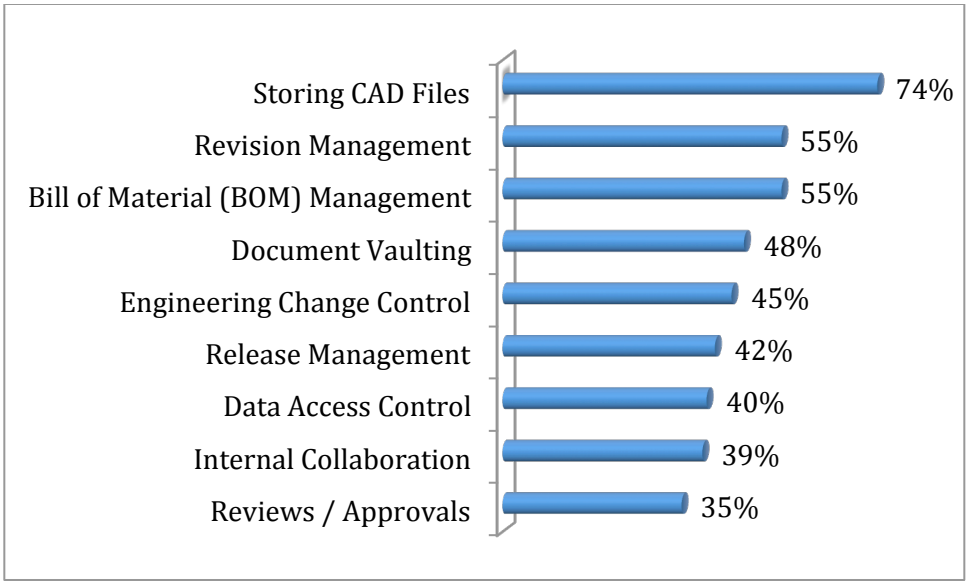

Figure 8: Most Common Uses of Data Management Solutions

Another view of the functions supported by data management solutions provides additional insight by highlighting the areas that Top Performers do most *differently* than Others (Figure 9). We primarily see different approaches related to the aspects of controlling and sharing design data. Note that the tasks in this figure are sorted by the most differentiating usage, not by the most common usage.

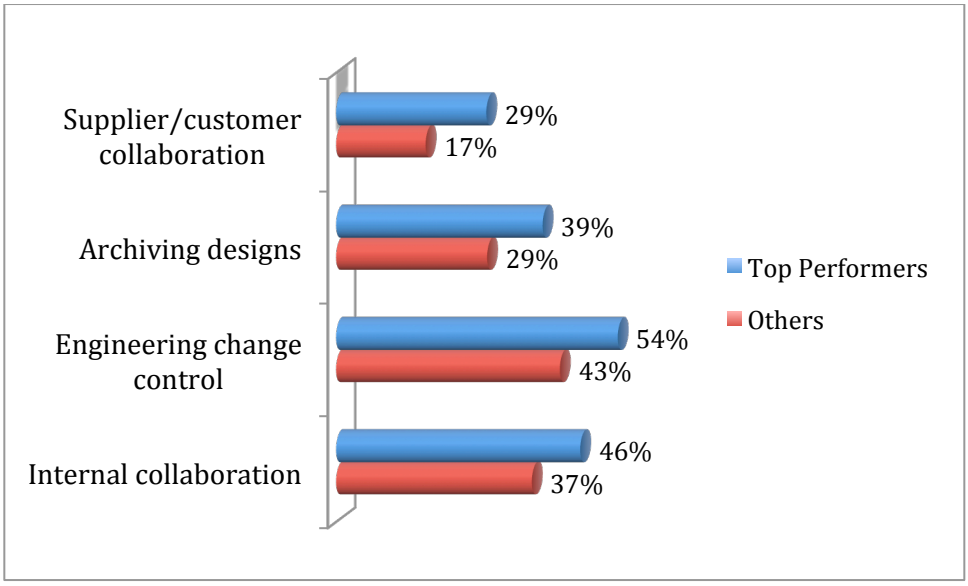

Figure 9: Most Differentiating Uses of Data Management by Performance Class

We also see a clear theme among leading companies supporting collaboration with data management. Top Performers are more likely to use data management tools to collaborate - both externally and internally. As John Winter, Manager Mechanical Engineering for Bird Technologies shares, "*Our design process is very integrated and cross-functional*." Top Performers are also more likely to run change control with data management, a highly collaborative process that requires strong design data management.

Top Performers are more likely to use data management tools to collaborate - both externally and internally.

Emergence of Cloud Highlights another Dimension of Maturity

Another goal of our survey was to gain insight into some emerging trends such as the use of cloud-based technologies for data management. The emergence of cloud computing has impacted data management in several ways. For example, the majority of companies - both Top Performers and Others - are running their data management solution on site. But about one-quarter of Top Performers running PDM / PLM say they are running in a SaaS model of some kind.

The use of cloud file sharing tools is an undeniable trend, with positives and negatives.

But even if they aren't using the cloud for a formal data management solution, companies may be using cloud file sharing tools such as Box, Dropbox, Google Drive, SkyDrive, and others. The use of cloud file sharing tools is an undeniable trend, with positives and negatives. About one-half of Top Performers use cloud file sharing, likely in conjunction with other solutions. In fact, Top Performers are much more likely to look to cloud file sharing to prevent losing files. As Bird Technologies' Winter shares, "*We moved all mechanical data to the cloud in Google Drive (G Suite). Now we have a 3rd party backing it up. Google's doing a better job protecting / backing up than we are – it was indisputable*."

The most interesting finding related to the cloud is that Top Performers are using cloud file sharing tools differently than others. For example, Top Performers that use cloud tools are more likely to implement them with formal processes, while Others have ad-hoc processes. This is somewhat similar to what we see with companies using shared drives, where Top Performers that don't have formal data management tools tend to have increased process maturity, despite not having tool maturity.

Top Performers that use cloud file storage are twice as likely to let their design tool manage revisions, prevent overwriting, and avoid other data management issues.

But we're also seeing companies rely on their CAD tool to help manage data management complexity. Again, from John Winter of Bird Technologies, "*Our users have read/write access anywhere in the world working from their hard dive and syncing back and forth with the cloud, it can't get any faster than that. And our CAD tool now creates a lock file, preventing users from having write access to the same file at the same time. It also helps prevent duplicate documents numbers, and we can lock down released documents*." Top Performers that use cloud file storage are twice as likely to let their design tool manage revisions, prevent overwriting, and avoid other data management issues.

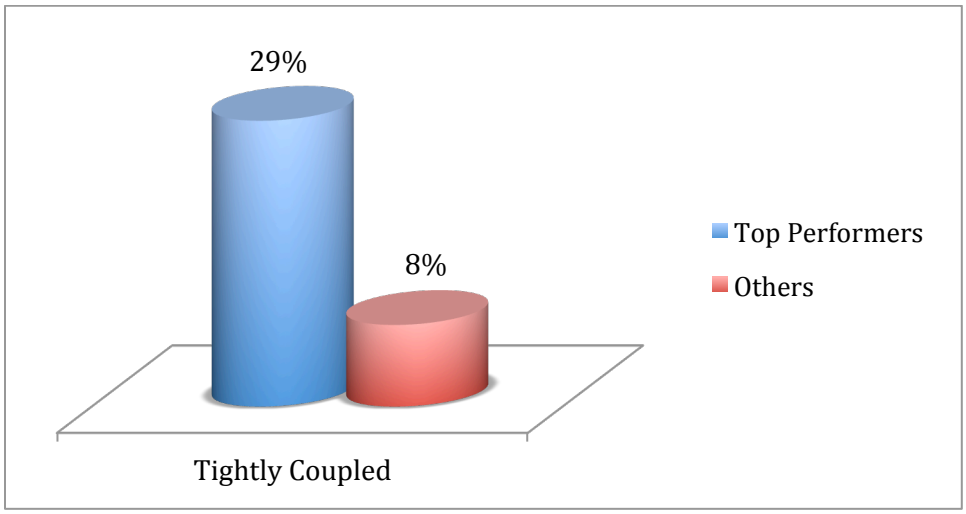

Figure 10: Integration Between Cloud File Storage and Data Management Tools

Top Performers are also much more likely to couple their data management solution tightly with cloud file sharing, taking advantage of the control available from formal data management tools (Figure 10). This is another way that Top Performers demonstrate higher maturity even when using less formal, structured data management tools. Design data management maturity helps even for companies that don't have access to a formal PDM system!

Top Performers are also much more likely to couple their data management solution tightly with cloud file sharing.

Quantifying Design Data Management Impact on Profitability

We've seen that Top Performers – those that are better able to design high quality, innovative products quickly and efficiently – have higher data management maturity. But what's most important is the business impact data management provides. Better data management maturity helps fight the non-valued added work that slows designers down. "*Our productivity is going to go up because we're removing the crimp in the hose*," shared John Winter of Bird Technologies.

Beyond anecdotal evidence, researchers looked for hard numbers to quantify the impact data management maturity has on business performance. Survey respondents shared their improvements in a number of critical metrics impacted by data management maturity, and those with higher data management maturity showed better results.

Those with higher data management usage maturity gained performance advantages in important financial metrics.

Researchers analyzed data management maturity in two dimensions. The first was increased design data management usage maturity. The analysis found that those with higher data management usage maturity gained performance advantages in important financial metrics (Figure 11). It's important to note that these improvements are the *additional* efficiency, cost reduction, margin increase, and revenue growth these companies achieve. Clearly improving the number of functions supported by design data management solutions provides very valuable business advantages that tangibly impact the top and bottom lines.

Business Metric	Performance Advantage
Design Efficiency	2%
Product Cost	1%
Profit Margin	9%
Revenue Growth	4%

Figure 11: Benefits of Higher Design Data Management Usage Maturity

The second indication of maturity reviewed was the advantage achieved by companies that have better integration between their CAD tools and their design data management solution (Figure 12). This can be a valuable step in improving maturity, even for those that don't have a formal solution. "*A data management tool that isn't built into your CAD environment isn't as helpful*," explains Charlie Kitts of Ridge Tool Company. "*When we started using an embedded client it became very useful, it's very important*." John Winter of Bird Technologies shares a similar perspective, "*Lightweight data management inside*

our CAD tool made managing designs really convenient." Clearly, the business benefits are compelling.

Business Metric	Performance Advantage
Design Efficiency	3%
Product Cost	4%
Profit Margin	3%
Revenue Growth	7%

Figure 12: Benefits of Tighter CAD-Data Management Integration

Design Data Management is a Foundation to Grow On

Better design data management maturity drives tangible improvements to productivity and top- and bottom-line business performance. As shown earlier, Top Performers have greater usage maturity of design data management (using it to do more). The previous section quantifies those advantages in business terms.

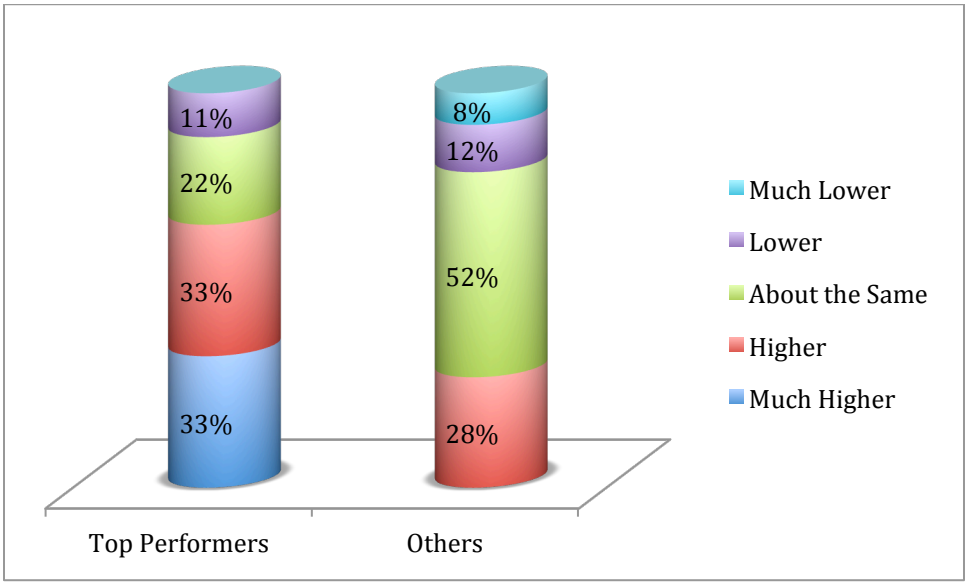

Figure 13: Relative ROI of Subsequent Data Management Initiatives by Performance Class

The data shows that design data management provides value, and that the value it provides can be extended. Companies are extending their higher degree of design data management prowess to gain even greater advantages over their competitors. Specifically, two-thirds of Top Performers gain higher ROI from subsequent data management initiatives (Figure 13). This means that they not only get the same

improvements they earned from their initial efforts, they get even more. In fact, about one-half of the Top Performers reporting higher ROI say it is "Much Higher." Even those with design data management in place have the opportunity to improve performance by further improving maturity.

Even those with design data management in place have the opportunity to improve performance by further improving maturity.

Conclusion

Product and product development complexity are on the rise, bringing with it significant reductions in design productivity for companies small and large. The leaders are combatting this complexity with design data management. Top Performers have been shown to use more structured, collaborative solutions including PDM and PLM. This research shows that even if these tools are not within reach, companies can improve their design data management maturity and achieve a productivity and business performance advantage.

Companies can improve their design data management maturity and achieve a productivity and business performance advantage.

Companies can extend their design data management in several ways. The first is to follow more formal data management processes. The second is to use their CAD tool to help manage designs if they are using less formal design data management capabilities like network drivers or cloud file-sharing. "*The combination of cloud file sharing with some sort of data control is a great solution for smaller companies*," concludes Bird Technologies' Winter. "*As soon as our vendor made this available it was a no-brainer and we jumped on it right away*."

Finally, companies can improve performance by increasing their design usage maturity, leveraging their design data management solution to support more tasks. There is always room to improve. The Top Performers are extending their design data management maturity in multiple ways, and are more able to leverage their design data management foundation to gain higher benefits over time.

Recommendations

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

- Understand the complexity is a larger driver of design data management issues than company size
- Recognize the impact of increasing product complexity and improve design data management maturity to mitigate the risk
- Use formal data management tools such as PDM or PLM, if accessible
- If formal systems aren't available and you're using network or cloud file management, at a minimum improve maturity through better processes
- For greater levels of performance, leverage your CAD tool's capabilities to help manage complexity
- Extend the usage maturity of design data management to continually improve and raise the bar on productivity and business performance relative to the competition

About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries. He has a broad background including roles in industry, management consulting, the software industry, and research. His experience spans enterprise applications including PLM, ERP, quality management, service lifecycle management, manufacturing, supply chain management, and more. Jim is passionate about improving product innovation, product development, and engineering performance through the use of software technology.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere he can engage with people with a passion to improve business performance through software technology.

Jim can be reached at jim.brown@tech-clarity.com. You can read additional research, watch Tech-Clarity TV, or join the Clarity on PLM blog at www.tech-clarity.com. You can also follow Jim on Twitter at @jim_techclarity, or find Tech-Clarity on Facebook as TechClarity.inc.

About the Research

Tech-Clarity gathered and analyzed over 300 responses to a web-based survey on designing software-intensive products. Survey responses were gathered by direct e-mail, social media, and/or online postings by Tech-Clarity, and Siemens PLM.

The respondents were comprised of about one-half (49%) who were individual contributors. Another one-third (36%) were manager or director level, and 10% from VP or executive levels. the remaining 5% included others.

The respondents represented a mix of company sizes, including 32% from smaller companies (less than 100 employees), 23% between 101 and 500 employees, 22% between 501 and 5,000 employees, and 23% greater than 5,000 employees.

The responding companies were a good representation of the manufacturing industries, including Industrial Equipment / Machinery (25%), Automotive / Transportation (18%), Aerospace and Defense (13%), Building Products and Fabrication (14%), High-tech and Electronics (14%), Life Sciences / Medical Devices (12%), Consumer Products (10%), Energy / Utilities (10%), and others including Federal Government, Marine, and Consumer Packaged Goods. 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 business in the North America (75%), about one-third doing business in Western Europe (34%), just under one-third doing business in the Asia-Pacific regions (29%), and others from Latin America (14%) and Eastern Europe (10%).

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

References and Links

1) Best Practices in Managing Design Data, Tech-Clarity, 2012, http://tech-clarity.com/bp-design-data/2167

2) The Facts About Managing Product Data, Tech-Clarity, 2015, http://tech-clarity.com/pdm-facts/4276