Tech-Clarity Perspective:

Best Practices for Managing Design Data

How Effective Data Management Fundamentals Enable World-Class Product Development

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Executive Overview

Effectively managing design data is critical to remain agile in today's complex product development environment. Tech-Clarity research shows that effective data management helps companies design innovative, high-quality products quickly and efficiently. This report analyzes how best practices relate to business performance based on over 2,000 responses to a web-based data management survey.

Companies with world-class performance are more likely to have very effective data management capabilities.

The survey allowed participants to report their company performance related to quality, innovation, product development speed, and efficiency. Respondents of all company sizes from various manufacturing industries across the globe shared their experiences. Survey analysis correlated companies with the highest aggregate performance in their important product development metrics with their data management approaches. 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 <u>find</u> the data they need, <u>share</u> it with others, manage their design <u>projects</u>, and provide the <u>correct data</u> to manufacturing
- Spend 25% less time on nonproductive data management tasks

The results indicate that effective data management is an important enabler for designing and developing profitable products. Better data management also helps companies streamline data management efforts. This is critical given that one-quarter of the companies surveyed indicate their technical personnel spend the equivalent of one day per week (20%) on non-value-added data management activities.

World-class manufacturers are more likely to use structured, collaborative design data management technology.

Leading companies take a different approach. Survey analysis indicates that world-class manufacturers are more likely to use structured, collaborative design data management technology. World-class companies are 30% more likely to use PDM or PLM solutions and are more likely to use other collaborative data management tools like Microsoft SharePoint to manage their design data. Managing design data and enabling collaboration – the basic fundamentals behind any PDM or PLM solution – provide important business value. As one participant from the industrial hygiene industry says, "*Quite simply when you have good data management it protects the bottom line and project time*." This report helps manufacturers learn from the approaches of top-performing companies to help them streamline design data management and improve business performance.

Importance of Effective Data Management

The importance of effective data management is probably no surprise to those that face the daily challenges of today's complex product development environment. Tech-Clarity's The Five Dimensions of Product Complexity describes five areas where product development has grown more complex in recent years, including mechanical complexity, mechatronics, global markets, global design and manufacturing, and lifecycle profitability. The report concludes that "*manufacturers must address these challenges or suffer from poor quality products, delayed time to market, and high lifecycle costs.*"

> *"To be caught in the quagmire of lost or irretrievable information, design documentation, or company historical data can paralyze a company."*
> *Hydro-Electric Equipment Company*

Data management is critical to product development success. As one hydro-electric equipment company explains "*Without a clear and precise method of managing design data and other documentation, a company can become stagnated by not being able to find, control, or retrieve important data. To be caught in the quagmire of lost or irretrievable information, design documentation, or company historical data can paralyze a company.*"

With this in mind, how can better data management improve business? Survey respondents were asked to identify up to three areas of improvement that would have a significant impact on their business (Figure 1). The top improvement opportunities identified relate to the basic fundamentals of design data management, including control and retrieval of information. These are consistent with findings in Tech-Clarity's The Business Value of Product Data Management which indicate the reasons manufacturers turn to PDM solutions, including:

- Controlling and securing product-related data
- Improving the ability to quickly find and reuse information
- Sharing product knowledge with other departments

> *"The advantages of streamlined design data management are clear: less time is wasted and fewer misunderstandings occur."*
> *Specialty Packaging Company*

Survey respondents indicate a wide variety of opportunities for improvement. In addition to better data management, respondents indicate they would benefit from extending data management to automate product-related processes, specifically design release and engineering change. They also indicate that better ability to share data, including

visualization, would have a positive impact on their business. From the results, it is clear that companies see the benefits available from improving data management fundamentals. As a specialty packaging manufacturer explains, "*When multiple people are working on the same project, the advantages of streamlined design data management are clear: less time is wasted and fewer misunderstandings occur.*"
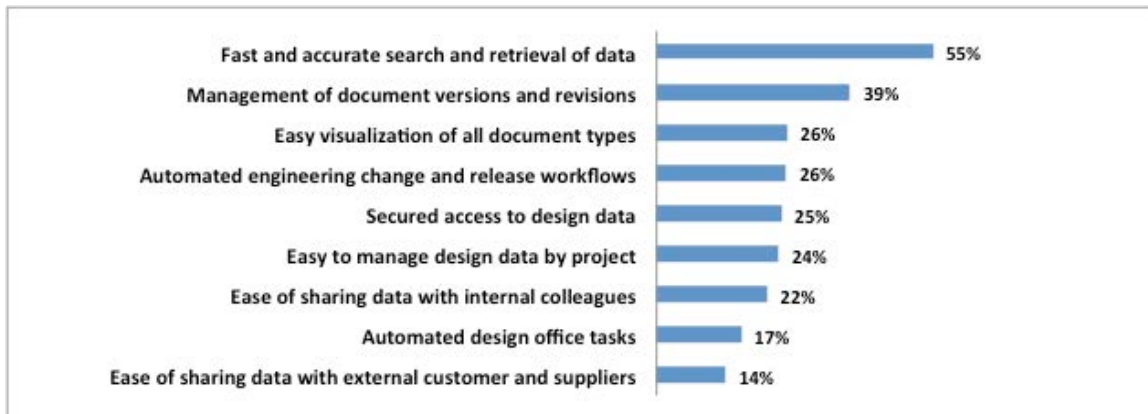
Area	Percentage
Fast and accurate search and retrieval of data	55%
Management of document versions and revisions	39%
Easy visualization of all document types	26%
Automated engineering change and release workflows	26%
Secured access to design data	25%
Easy to manage design data by project	24%
Ease of sharing data with internal colleagues	22%
Automated design office tasks	17%
Ease of sharing data with external customer and suppliers	14%

Figure 1: Areas for Improvement with Biggest Impact on Business Performance

Data Management Challenges Impact Time and Quality

Why do companies see so much value from improving data management? The reason lies behind the data management challenges they face. Respondents indicate a number of problems, with most companies reporting a combination of these issues (Figure 2). These are real challenges with significant business impacts including inefficiency and issues that can lead to mistakes. "*Getting the right information to the right person in the right format is critical,*" offered an industrial equipment participant. "*Without this you will struggle getting parts made correctly and getting them on time.*"

> *"Lost data has caused days of time spent re-creating the data."*
> *Automotive Company.*

The most prominent theme companies expressed is wasting time. Forty percent (40%) of respondents indicate searching for data is a problem. But that is not the only negative impact on design time, two out of the top three issues reported relate to everyday tasks that are too time consuming. One could argue the other issues related to tracking engineering changes and release processes also contribute to wasted time and delayed time to market. "*It is difficult to find the data you are looking for in a timely fashion,*" one representative expressed, "*There are multiple servers, locations and sites to look for the data and there are multiple log-ins needed.*" Another issue is lost or misplaced data, which makes reuse impossible and further wastes precious design time. "*Lost data has*

caused days of time spent re-creating the data," recalls one automotive company. "*Lost or difficult to find information affects production and profitability*," explains a consumer products company.
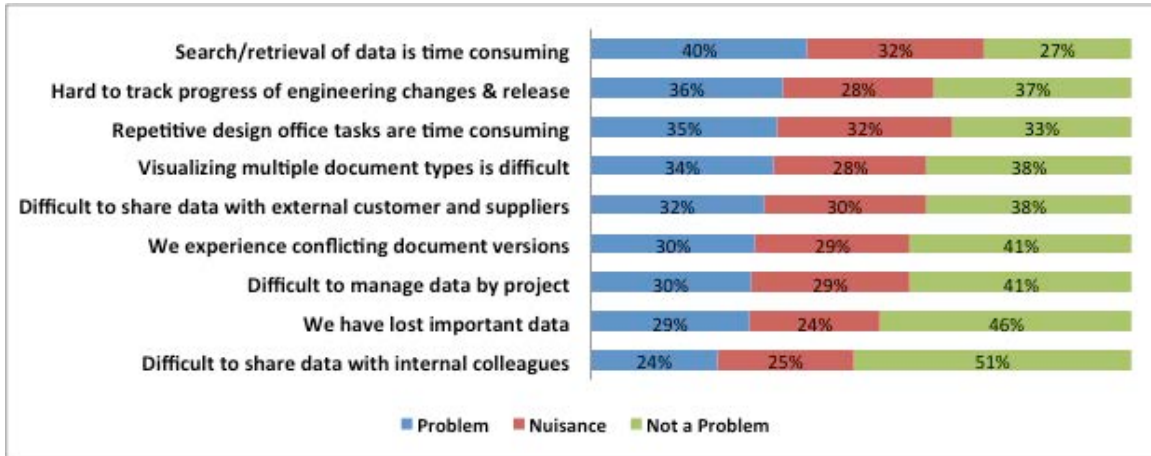

Figure 2: Severity of Design Data Management Challenges

Another common theme relates to preventing costly errors. Managing engineering change and release to manufacturing are critical to ensuring that what is designed actually gets produced. "*Data management is crucial for all areas of a business, and vital for engineers and designers who rely very heavily on the engineering data to solve problems*," explains an industrial equipment manufacturer, "*Lack of or incorrect data could be catastrophic in the worst case scenario and in the best case it still takes away from productivity and causes delays.*" Poor data can result in significant quality and cost impacts. One company described the potential business impact, saying "*A huge amounts of profit can be lost in releasing out of date design models which cause late tooling changes and loss of time. This is a big competitive issue.*" Another company reports that obsolete data has been sent out to suppliers to be manufactured, resulting in "*a huge waste of time and money.*"

"Lack of or incorrect data could be catastrophic in the worst case scenario and in the best case it still takes away from productivity and causes delays."
Industrial Equipment Manufacturer

Complexity, more than Size, Creates Issues

The negative impacts of poor data management are significant. Management in some smaller companies might believe they are immune to these issues, assuming that data management challenges are correlated to company size. The data, however, doesn't support this belief. The survey shows similar frequencies of challenges from companies

of all sizes. Even some of the smallest companies face significant challenges. While larger companies do have marginally larger challenges, smaller organizations report similar difficulties. Prior research confirms that smaller companies have many of the same challenges as larger organizations, but they have fewer resources to solve the problems.

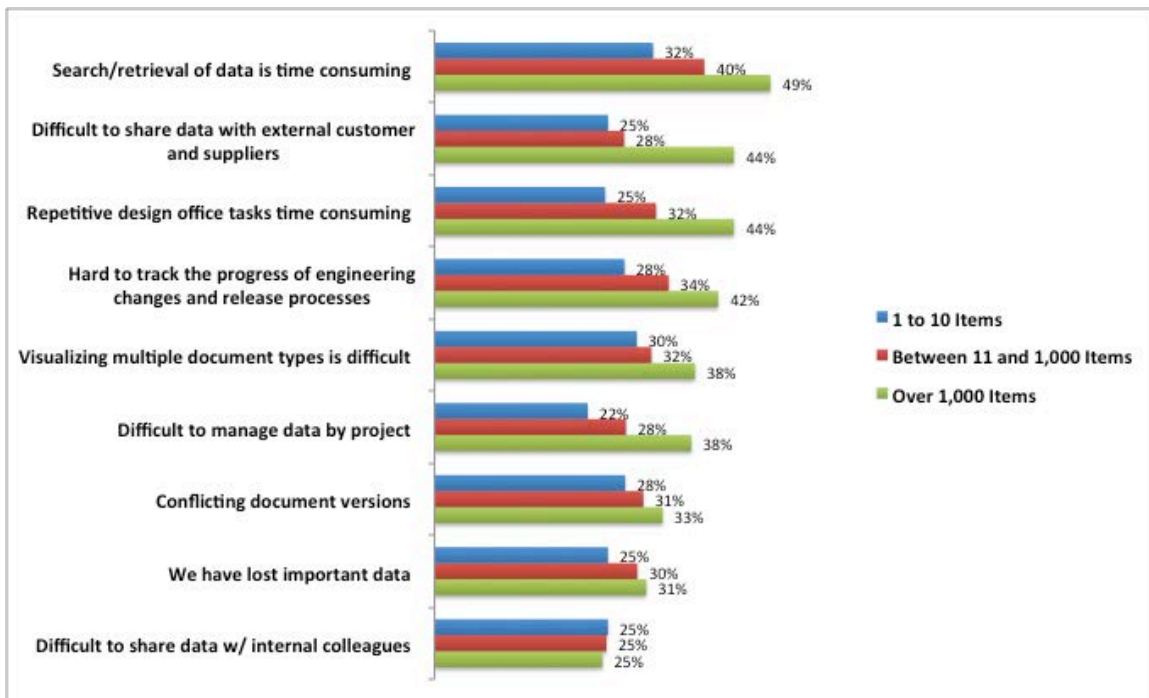*Product complexity is a larger driver of data management issues than company size.*

Figure 3: Data Management Challenges by BOM Size (Representing Product Complexity)

So what drives data management challenges? The short answer is product complexity. BOM (bill of material) size was used in the study as a way to gauge complexity of respondents' products. Survey analysis (Figure 3) shows a clear correlation between reported challenges and a greater number of items in BOMs. This leads to the conclusion that product complexity is a larger driver of data management issues than company size.

Wasting Time on Nonproductive Data Management

Poor data management results in inefficiency and wasted time. Part of the lost time is due to rework, reduced ability to reuse existing designs, and generally reinventing the wheel. But part of the inefficiency is related to wasting unnecessary time on data management

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tasks themselves. Inefficient data management puts a burden on the precious innovation resources of a company. This leads to a perception that design data management is good for the business but is a burden on individual engineers, or as something that it is done to designers and engineers and not for them. This should not be the case, as effective data management can reduce non-value added time searching for designs in addition to helping enable the rest of the organization.

> *"Inefficient data management puts a burden*
> *on the precious innovation resources of a company."*

Unfortunately, the survey respondents indicate that, on average, 15% of their technical staff's time is wasted on non-product data management tasks (Figure 4). About one-quarter of companies (26%) report wasting more than 20% of their technical time on nonproductive data management tasks. That is more than one full day of work per week! Later we will see that this doesn't have to be the case.
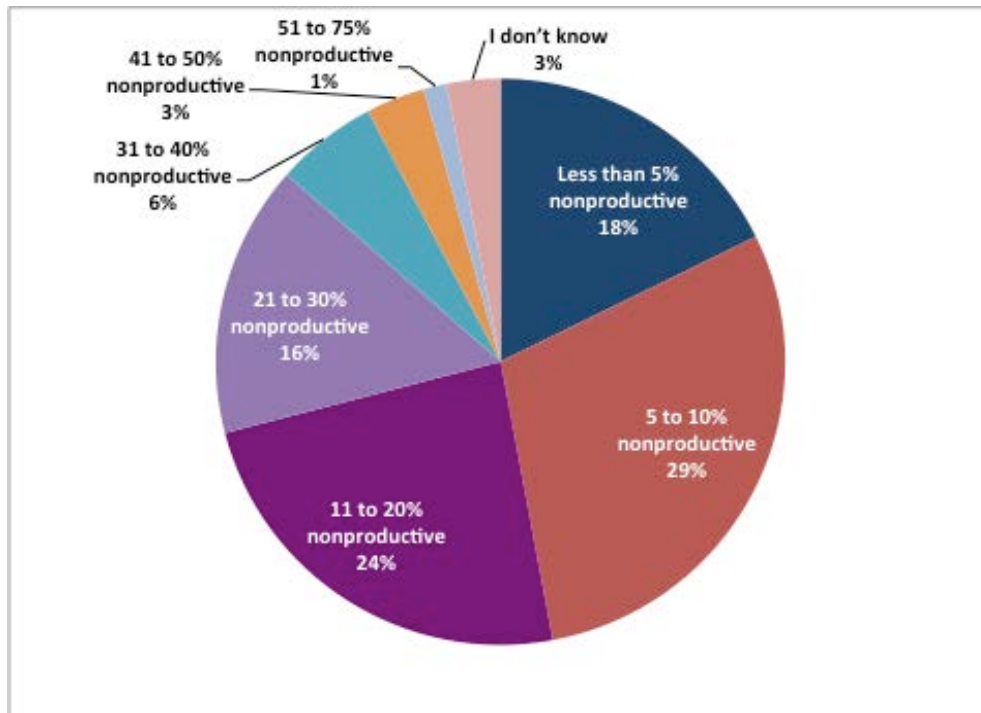

Figure 4: Percent of Time Spent on Non-Productive Data Management Tasks

> *About one-quarter of companies (26%) report wasting more than 20%*
> *of their technical time on nonproductive data management tasks.*
> *That is more than one full day of work per week!*

There is clear opportunity to increase efficiency and give time back to designers to increase innovation and throughput. According to one correspondent effective data management allows him to "*spend more time creating and refining products instead of wasting time managing data*." People across the business have to be able to access data efficiently to do their jobs, and if it is too difficult they are more likely to guess and cause quality issues, or reinvent the wheel and reduce efficiency even further. But enabling others to leverage design work should not hamper the productivity of individual designers. Ideally, companies should achieve benefits on both sides such as this industrial equipment manufacturer serving the food industry, "*Data management is important to us because it affects our business economically and makes it easier on the end users to perform their jobs well*." Clearly a win-win.

Identifying the Top Business Performers

Which companies are doing better at designing their products? And more importantly, what are they doing differently so others can learn from them to improve their own performance? To find out, we analyzed four design and product development metrics to identify world-class performers. The survey requested that each participant evaluate their company's performance (Figure 5), on their ability to:

- Design high quality products
- Develop new products quickly
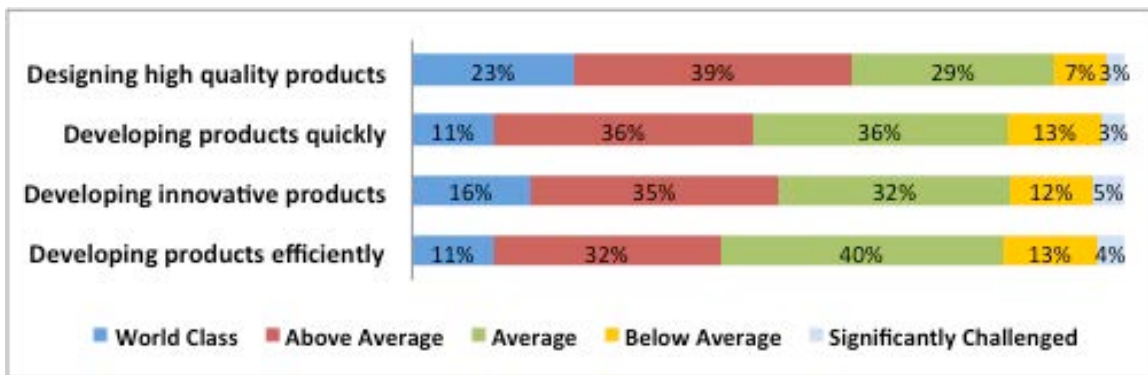- Develop innovative products
- Develop products efficiently

Figure 5: Self-Assessment of Product Development Performance

These metrics were chosen because they have a significant impact on product success and profitability. The evaluations were aggregated across the multiple metrics and respondents were classified into one of five performance bands. The top 20% of the aggregated scores were defined to be "world-class performers." Although these self

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evaluations may be inflated, as the fact that the vast majority report themselves as either average or above average, selecting the top 20% across multiple design and development disciplines is very useful for our purposes. The organization, processes, and software enablers in place at the manufacturers in this world-class performance band were analyzed to determine which approaches were more common to these leaders in order to make recommendations to others.

Best Data Management Practices of World Class Companies

When the performance bands were evaluated, the analysis uncovered a high correlation between effective data management and world-class product development performance. On first blush this may seem trivial, but it is in fact a very profound finding. It provides a strong indication that effective design data management supports higher levels of business performance. "*Without proper data management we will be always behind the competition,*" explained one participant. How was this determined? The survey asked participants to evaluate their ability to:

- Find the data they need
- Share data with others
- Complete tasks efficiently
- Manage design projects
- Provide the correct data to manufacturing

The analysis uncovered a high correlation between effective data management and world-class product development performance.

Survey results indicate that world-class companies are much more likely to be highly effective across all of the operational data management capabilities reviewed. Specifically, world-class companies are:

- 2.7 times as likely to be "very effective" at finding the data they need (50% compared to 19%).
- 2.7 times as likely to be "very effective" at sharing data with others (49% compared to 18%)
- Over 3 times as likely to be "very effective" at completing data management tasks efficiently (51% compared to 16%)
- Over 3 times as likely to be "very effective" at managing their design projects (49% compared to 14%)
- Over 2.5 times as likely to be "very effective" at providing the correct data to manufacturing (60% compared to 22%)

The results clearly show that companies performing at world-class product development levels have developed much better design data management capabilities. "*Design data management leads to better productivity, product quality, service, and change management*," an aerospace company participant explains, "*It also leads to significant reduction in cycle times and overall production and support costs*." Perhaps counter-intuitively, these world-class companies are not spending more time on data management to achieve their higher levels of performance. In fact, the poorer performing companies spend, on average, 34% more time on nonproductive data management tasks than world-class companies. This indicates that the leaders' investment in better data management not only improves performance but also pays dividends in terms of efficiency.

> *Poorer performing companies spend, on average, 34% more time on nonproductive data management tasks than world-class companies.*

Enabling World Class Data Management (and results)

One reason that companies suffer from poor data management performance is the systems they use. "*The wasted data management time and lack of communication of our current system is the greatest challenge we face*," explains one industrial equipment respondent. Although network or shared drives are the most common systems used to manage design data, they appear to lead to little differentiation in company performance. In fact, world-class companies report less reliance on unstructured tools for design data management such as using local computers and shared files (Figure 6).

> *Top performing companies are more likely to use structured, collaborative data management solutions like PDM, PLM, or Microsoft SharePoint.*

On the other hand, the top performing companies are more likely to use structured, collaborative data management solutions like PDM, PLM, or Microsoft SharePoint. Specifically, world-class companies are 30% more likely to use PDM or PLM to manage design data. The findings lead to a clear conclusion that structured data management approaches like PDM/PLM help enable better product design and development performance. Although the overall percentage of companies using Microsoft SharePoint is small (about 5% overall), world-class companies are almost two times as likely to use SharePoint to support their design processes. The SharePoint findings, coupled with the fact that world-class companies are less likely to use generic document management systems, leads to another interesting conclusion. World-class manufacturers tend to use more collaborative solutions such as SharePoint, PDM, or PLM.
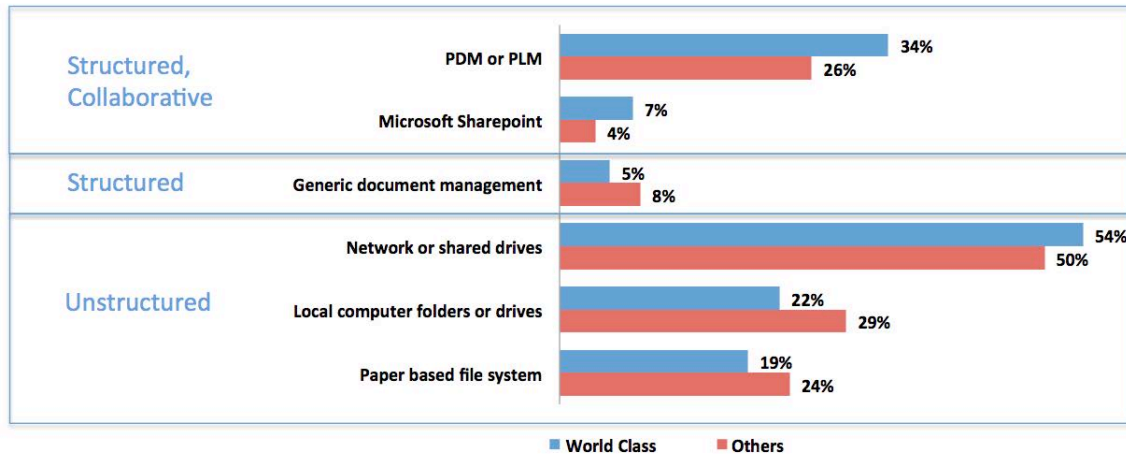
Figure 6: Primary Systems to Manage Design Data by Product Development Performance

As discovered in previous Tech-Clarity research, the fundamentals of design data management include sharing information in addition to controlling it. The data shows that world-class companies are sharing more data (Figure 7). For example, leading manufactures are 1.5 times as likely to be sharing data with suppliers using their data management system. Of course sharing information is only valuable when the information is available and accurate, so it not surprising that world-class companies are also 19% more likely to be controlling access to files (protecting IP) with their data management systems, and 20% more likely to control versions / revisions this way.

Leading manufacturers are 1.5 times as likely to be sharing data with suppliers using their data management system.

Beyond the basics of data management, some extended capabilities were also more commonly found in world-class companies. For example, they are more likely to automate product-related business processes. In fact, world-class companies are about one-third more likely to use data management systems for managing design release and engineering change in addition to managing data. These capabilities, to some, might delineate the boundary between PDM and PLM systems. Regardless of definitions, the fundamentals provide value on their own and set up a foundation on which even broader capabilities can be implemented to gain greater business value.
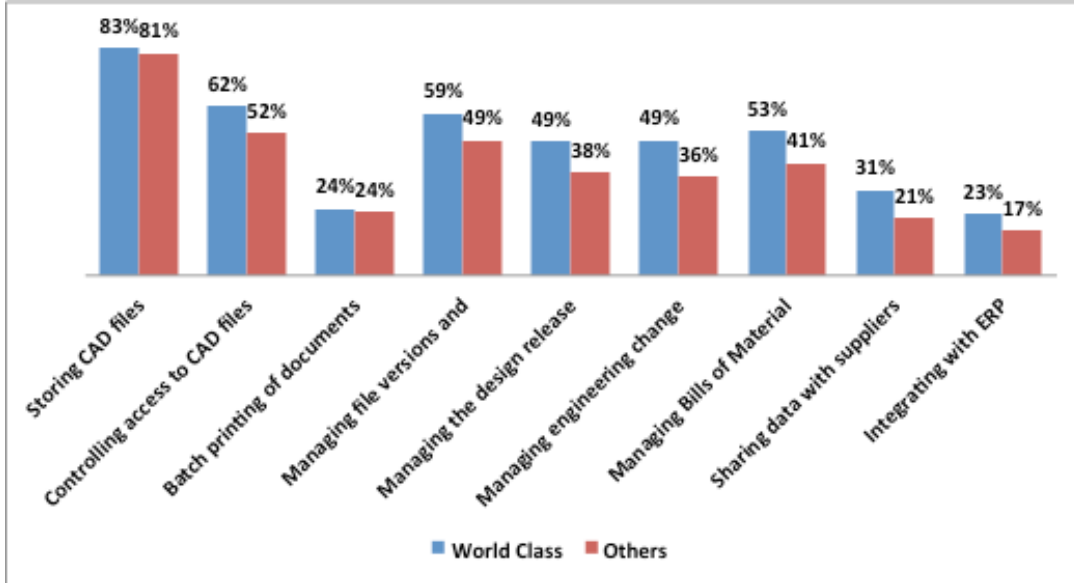
Figure 7: Use of Design Data Management System by Product Development Performance

World-class companies are about one-third more likely
to use data management systems for managing design release
and engineering change in addition to managing data.

Conclusion

Effective design data management fundamentals enable better product development performance. The data shows, however, that companies face significant challenges in managing their critical design data due to product complexity. The challenges can lead to quality problems and inefficiency, and prevent companies from taking advantage of strategic opportunities such as design reuse. Addressing these challenges with effective design data management practices and technology leads to significant business advantages, including improved efficiency, quality, and time to market. "*If we don't control our data properly we put revenue at risk*," explains an electronics manufacturer. "*Also, reuse of parts saves us hundreds of thousands of dollars each year*."

"If we don't control our data properly we put revenue at risk.
Also, reuse of parts saves us hundreds of thousands of dollars each year."
Electronics Manufacturer

World-class companies are more effective in the area of design data management, yet also spend less time on non-productive data management tasks. Other companies can learn from them to improve data management without adding additional cost. "*Data*

management is very important," explains one participant from an industrial equipment manufacturer. "*It has allowed our business growth to outpace the need to add more engineering staff. We are doing much more with less effort*."

"Data management is very important. It has allowed our business growth to outpace the need to add more engineering staff. We are doing much more with less effort."
Industrial Equipment Manufacturer

World-class companies also take a more collaborative approach to design data management. For example, they are more likely to use their data management systems to share data internally. "*Like most manufacturing / engineering companies the design data is used in all areas of the company*," explains a consumer electronics manufacturer. "*This means that maximum efficiency is attained by keeping this data accurate and easily accessible by all that need to see and use it*."

To enable this more collaborative, efficient data management, world-class companies are more likely to use structured, collaborative data management solutions such as PDM, PLM or SharePoint. "*Design data management is key, because in todays fast-paced market people expect a better design in less time*," explains an industrial equipment manufacturer. "*From my experience the time and/or money lost by incorrect or conflicting designs can be greatly reduced by refining the design process to include a robust data management system*." The fundamentals of design data management, supported by an effective data management solution, provide significant business value and provide a foundation that can be expanded on for future benefits.

Recommendations

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

- Ensure that your business has the basic fundamentals of data management in place
- Improve design data management effectiveness to improve business performance in product design and development
- Identify innefficiencies in data management tasks and reduce non-productive time, freeing up time for innovation and greater design throughput
- Explore the use of structured, collaborative tools including PDM, PLM, and SharePoint to improve data management and product development performance
- Leverage design data management solutions beyond data to automate processes and enhance collaboration

About the Author

Jim Brown is the President of Tech-Clarity, an independent research and consulting firm that specializes in analyzing the true business value of software technology and services. Jim has over 20 years of experience in software for the manufacturing industries, with 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, manufacturing, and others. Jim is passionate about improving product innovation, product development, and engineering performance through the use of software technology and social computing techniques.

Jim is an experienced researcher, author, and public speaker and enjoys the opportunity to speak at conferences or anywhere that he can engage with people that are passionate about improving business performance through software technology.

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About the Research

Tech-Clarity gathered and analyzed over 2,400 responses to a web-based survey on managing design data. Responses were gathered by direct e-mail, social media outreach, and online postings by Tech-Clarity, Siemens PLM, Cadalyst, and 3DST. The responses were filtered to identify manufacturers to get the perspective of people that manage design data as a part of their business, resulting in 2,325 responses.

The respondents comprised design engineers (40%), design managers (10%), and engineering managers (9%), draftsmen (8%), and CAD managers (8%) with additional representation from across the enterprise.

The respondents represented a mix of company sizes, including large companies with over 500 employees (38%), medium-sized companies with between 101-and 500 employees (29%), and smaller companies with less than 100 employees (33%).

The responding companies represent diverse manufacturing industries, including Industrial Equipment (37%), Automotive (28%), Consumer Products (18%), Electronics & High Tech (17%), Aerospace and Defense (16%), Medical Devices (10%), and others.

The respondents reported doing business globally. The majority of companies design and manufacture products in the North America (56%), about one-half design and manufacture in China (51%), Asia/Pacific Rim (19%), Western Europe (18%), Latin America (13%), Eastern Europe (9%), and India (8%) among others.