

Four Ways Unmanaged CAD/CAM Hurts Job Shop Performance and Profitability

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CAD/CAM Data Management is often Underappreciated

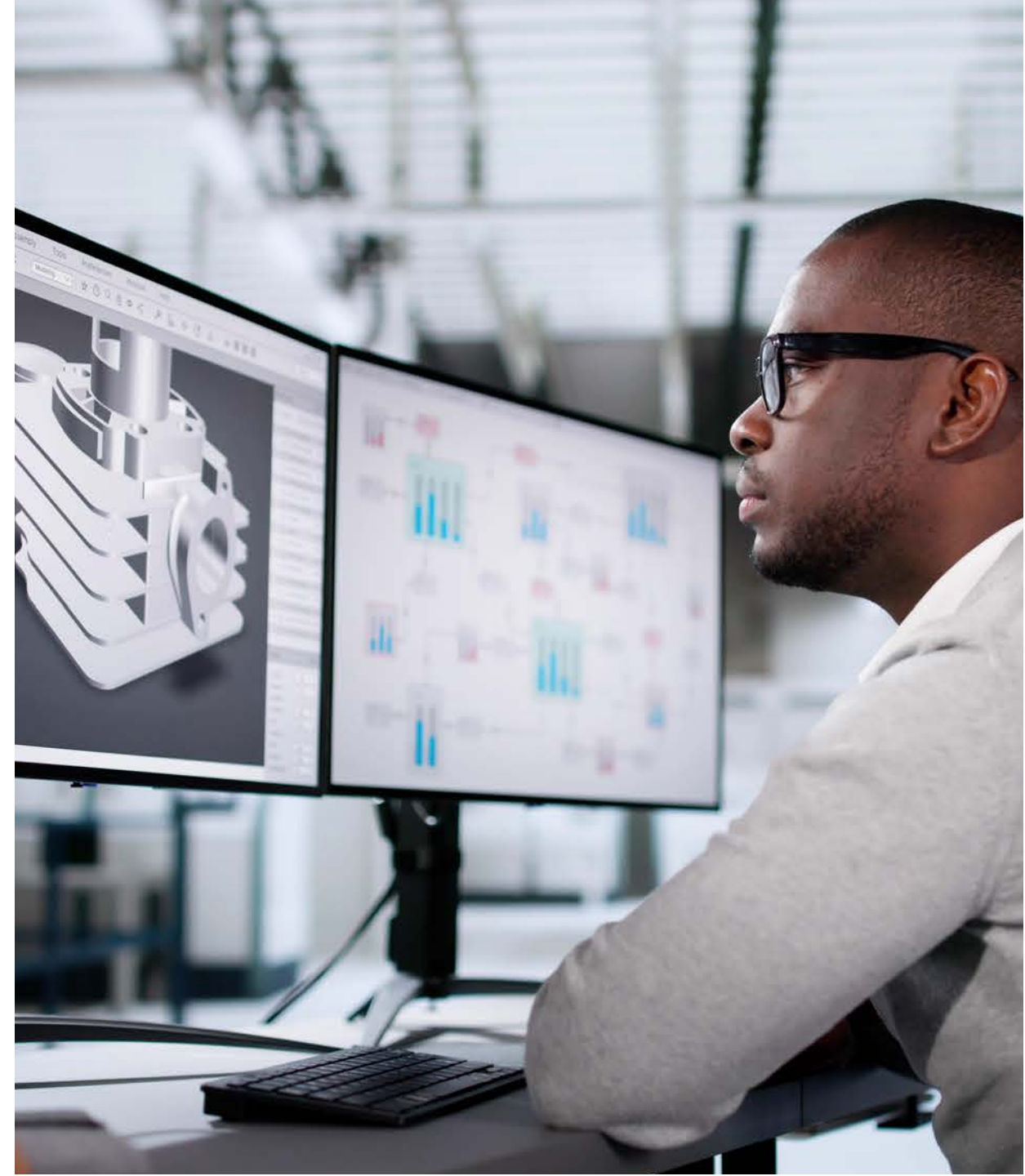
Agility is Crucial for Job Shops

Job shops play a critical role in the manufacturing supply chain by producing low-volume, high-variety, or custom parts. These shops need to be fast, responsive, and efficient. Agility is essential whether the shop is prototyping or delivering production runs. However, speed can't come at the expense of the quality, cost, and customer relationships that drive profitability and repeat business. Job shops, whether internal departments or independent businesses, need to strive for operational excellence in all ways to be trusted partners.

CAD/CAM Data Management is Essential

Accessible, trusted data is a proven contributor to operational excellence, and job shops create a significant amount of manufacturing data to produce their customers' designs. Keeping this data in sync is critical, but job shop leaders typically don't want to slow down or add overhead to implement enablers like formal design and manufacturing data management. Our data, though, indicates that inadequate data management wastes time and impacts results.

How can job shops adopt the basic data management capabilities they need to avoid the downfalls of unmanaged CAD and related manufacturing data? We explore four ways job shops can leverage the cloud to gain control and protect their customers' IP without adding counterproductive cost and overhead.





Manufacturing is Data Intensive

Customer Design Data Needs Control

Job shops receive a lot of engineering and PMI data from their customers. Customers typically send, at a minimum, the design intent for their orders. They may send this in a formal manufacturing package or more informal methods like compressed files, shared drives, and emails. This information, which may include job specs, quality standards, 3D CAD models, drawings, GD&T, and material specifications, must be securely stored and controlled so the right people can access it. Further, the shop has to manage design changes to ensure that they produce to the right final specs.

Manufacturing Runs on Data

Beyond design data received from customers, job shops create an even greater amount of data to order materials, create tooling, produce the items, and inspect them for quality. This data may include NC code, STL files, shop drawings, tool paths, cut sheets, fixture designs, inspection plans, and additional information needed to produce parts right the first time. This information is typically more varied and larger than the customer's original data. This is in addition to downstream production data that may be managed in systems like ERP, MES, or QMS if they are in place.

Unmanaged CAD/CAM Data Hurts Performance

Linking Design and Manufacturing Data

Design and production data are intrinsically related, and the data created by the shop should be managed in the context of the customer's CAD design. Unfortunately, job shops don't always manage this data and data relationships well because they don't want to be slowed down by cumbersome enterprise data management solutions. Some may not even have IT departments or the resources to implement formal data management solutions like PDM or PLM. This leads to disconnected data that is difficult to find and nearly impossible to manage as changes are received.

Manufacturing companies spend **19%** of their time, about **a day a week**, on non-value-added design data management.³

Unmanaged CAD/CAM Costs the Shop


Despite the challenges adopting data management, unmanaged CAD/CAM data causes frustration and reduces productivity. Our research on non-value-added time shares that technical resources only spend about one-half of their time on technical work on a typical project. They spend 19% of their time, about one day a week, on non-value-added (NVA) data management tasks such as finding information, working with the wrong data, recreating data, translating formats, and other common time wasters.¹

Unmanaged CAD/CAM hurts a job shop's performance and profitability in four ways:

1. Wasting time
2. Causing mistakes
3. Creating estimating / quoting challenges
4. Delivering a poor customer experience

These issues significantly impact job shop performance, quality, and profitability. They can also impact customer satisfaction and put customer IP at risk, damaging the shop's reputation.



A wide-angle photograph of a large industrial manufacturing facility. The floor is polished and reflective, with yellow safety lines. On the right side, there is a row of large, white industrial machines, possibly CNC mills or lathes. On the left, there are workbenches and other equipment. The ceiling is high with a complex network of steel beams and large skylights that let in natural light. A red overhead crane is visible in the distance.

96% of manufacturers face significant business costs from missed deadlines, higher costs, lower innovation, and poor quality due to poor data management.²

How to Improve Data Management

Four Ways to Improve

Now that we've discussed how poor data management negatively impacts job shops let's talk about how to fix it. Few job shop leaders would disagree that they should have effective control over their data, be able to reuse existing work, and capture learnings to continuously improve and avoid repeating mistakes. These factors are important to running an efficient, profitable shop. However, they can't always achieve the control they need over their CAD/CAM data because of the potential overhead of data management solutions.

In this eBook, we'll discuss four ways to increase profitability, performance, and customer satisfaction with minimal disruption and investment by taking a lightweight data management approach that manages CAD and related data like NC programs and CAM project files so they can:

- Stop wasting time by effectively managing CAD/CAM and related manufacturing data
- Eliminate mistakes by improving collaboration and control
- Estimate accurately by using facts from prior projects
- Enrich customer experiences by building trust and confidence

These changes extend outside of the shop to help job shop leaders achieve performance to meet budgets and drive profitability. We'll also discuss a fifth way that better data management sets up future benefits from artificial intelligence (AI) and PLM.

Fix Data Management without the Disruption

It's important to recognize that implementing these changes requires change and investment. Later in the eBook, we'll discuss how to achieve these improvements by taking a lightweight approach to CAD/CAM data management by leveraging PDM and how the cloud has made effective data management more accessible than ever.

1 – Stop Wasting Time

Unmanaged Data Wastes Time

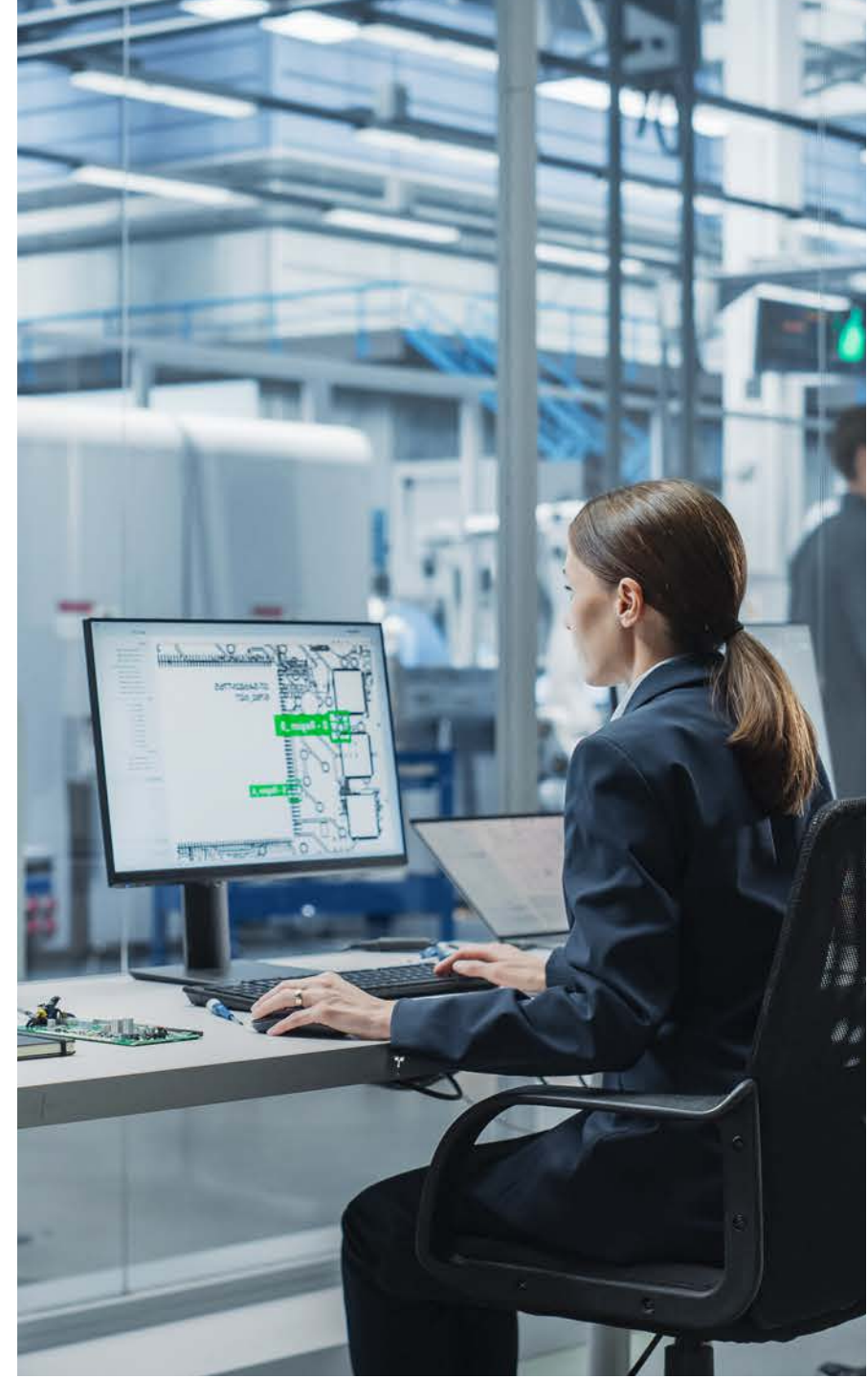
Let's step back to understand the problem. We've already shared that technical resources waste significant time due to unmanaged data. There are a number of ways this occurs. One of the most common is time lost searching for the appropriate data in different folders, on different computers, or on shared drives. Another significant inefficiency is taking the time to ask others for data or responding to data requests from others. Further, even if an engineer, CNC programmer, or operator finds what they are looking for, they are unsure if the data is correct or the latest revision. They still need to ask others for confirmation. Even worse is when CAD or manufacturing data gets lost, and people must recreate it from scratch or go back to the customer for it. All of these non-value-added activities waste precious time and resources.

Top Performers use more structured, collaborative data management solutions.³ As a result, they spend **25% less time** on nonproductive data management tasks.⁴

Control, Access, and Share Data

Tech-Clarity's research shows that engineering and manufacturing teams must put three key capabilities in place to reduce wasted, non-value-added work. These basic capabilities include effectively controlling, accessing, and sharing information (see details on page "Control, Access, and Share with PDM").

PDM is a critical enabler to centralize and manage CAD/CAM and other related manufacturing data. It's proven to enable job shops to control, access, and share information effectively. PDM centralizes data to limit the time wasted on non-value-added tasks. It ensures that data stays current and updated, so there is no need to question or recreate work. It also allows other technical resources to have easier access to needed CAD/CAM or other data in a self-service model so they don't have to interrupt others who have their own jobs to do. Lastly, without PDM, CAM and other manufacturing data are not managed, and it is likely recreated every time a job comes in, instead of reusing NC data when the CAD is the same revision or using the manufacturing as a starting point if only minor details have changed.





2 – Eliminate Mistakes

Mistakes Cost Time and Money

Inefficiency is not the only way that job shops suffer from ineffective data management. Operational excellence relies on a trusted digital thread of data, starting with the customer's CAD designs and continuing through inspection. Poor CAD/CAM data and poor collaboration around it can lead to costly mistakes. For example, if the shop starts manufacturing planning using the wrong CAD revision to develop CAM toolpaths or uses the wrong CAM data to manufacture, they must rework and/or deal with scrap. At a minimum, they have to rework manufacturing plans. But they can miss first-time quality goals if it's not caught before manufacturing. Of course, the worst scenario is when quality issues due to incorrect CAD/CAM data lead to part quality problems that leave the shop and get rejected by the customer. This situation compromises the job shop's reputation and hurts customer relationships.

Improve Collaboration

For effective collaboration within a shop and between a job shop and their customers, it must be easy for everyone involved to collaborate easily and effectively. All related data should be available and easily accessible in one place, not lost in emails or in unmanaged shared folders. Everybody should be able to securely access what they need, securely, in a format they can understand and use for their work. People should only see what they need based on security and release status, and changes must be tracked to make it easy to see the latest information. Effectively collaborating on a single source of information also improves reviews and DfM (design for manufacturability) processes so the shop can proactively identify and report potential issues to provide early feedback regarding manufacturability and cost. Improved 3D collaboration with customers' engineering teams sets the conditions for companies to "shift left" to improve the value of the shop to the customer.

3 – Estimate with Confidence

Poor Information Leads to Poor Estimates

Poor data management issues are not limited to the shop, they can also impact the front office. For example, effective estimates and quotes, whether for internal or external purposes, have enormous consequences. First, it's important to develop quotes quickly. Slow quote response time can result in lost business opportunities. But speed alone is not sufficient. Inaccurate or low-confidence estimates hurt the business in other ways. Either the quote is too low and the shop loses money, or the shop inflates quotes to compensate for low confidence in the estimates and the shop misses business opportunities.

Guide Quotes with Facts

Quick access to past projects with all the associated data can help job shops quote accurately and maintain margins without reinventing the wheel each time a quote is needed. If data management extends beyond technical data, estimators can leverage past quotes and actual outcomes to see the results of similar jobs. In addition, shops can access related manufacturing data in context with the 3D CAD model and associated manufacturing data. If the shop can easily retrieve data such as the equipment/machines used, quality defects, actual cost of production, tooling cost, and manufacturing time, they can develop quotes with confidence. Connecting CAD/CAM data with manufacturing information allows estimators to guide estimates and quotes with facts to rapidly develop accurate quotes that lead to more business, create higher customer confidence, and protect budgets or margins.





4 – Create a Compelling Customer Experience

Lack of Control Reflects Poorly on the Job Shop

As we've discussed, poor CAD/CAM data management can lead to internal problems, including outdated revisions and miscommunication that result in costly rework, quality leaks, and production delays. It may also prevent them from meaningfully participating in continuous improvement exercises with customers. These issues indirectly impact the job shop's customers, whether they are part of the same company or independent entities.

Beyond that, poor CAD/CAM data management practices put customers' engineering data at risk of being accidentally shared. Inefficient CAD/CAM data management does more than just waste resources. It also signals a lack of discipline and organizational excellence to customers that can potentially jeopardize future business opportunities.

These issues can tarnish the shop's reputation, erode customer trust, and raise doubts about the firm's competence.

Build Customer Trust and Confidence

The ability for a job shop to manage CAD, CAM, and other manufacturing data, along with industrial-grade data security, proves it can comply with the requirements that its customers expect. Effective data management makes it easy for the shop to feel they have a reliable partner and are confident their IP is safe. It can also help them demonstrate compliance with industry standards to improve their marketability and qualify for more projects. Finally, improving customer experience by increasing data management maturity leads to more repeat business and new customers through referrals.

Prepare for the Future

Don't Get Left Behind

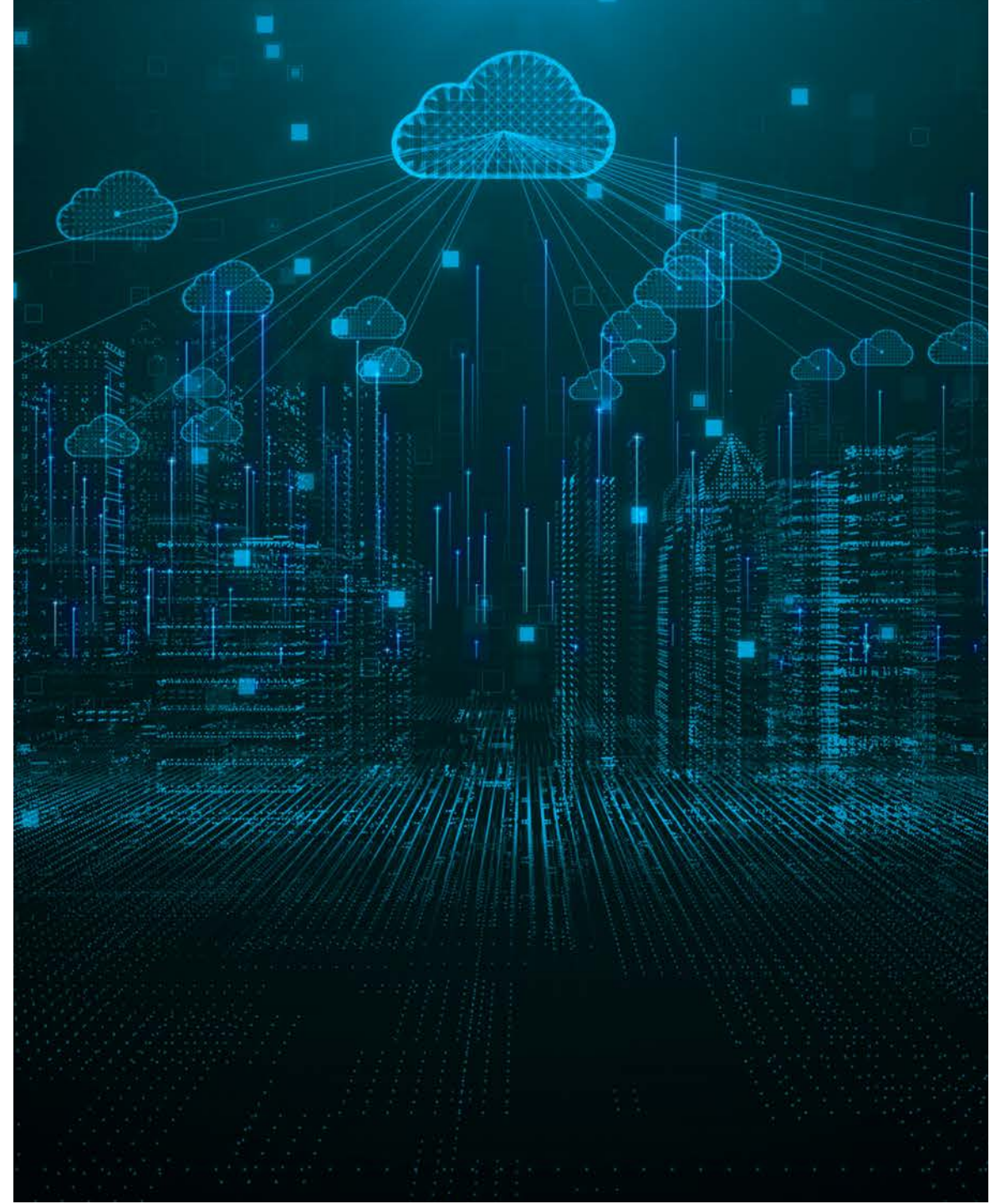
We discussed four ways that managing CAD/CAM data helps the business, and we'll add a fifth about how it creates a foundation for even greater benefits. For example, everyone is talking about how AI has the potential to change work as we know it. As a progressive job shop, you may already be using AI to analyze complex manufacturing data to optimize machining parameters, tool paths, and cutting conditions in CAM software. Effective CAD/CAM data management sets the stage for AI to leverage that data in novel ways. For example, AI could help job shops quickly and accurately estimate and generate quotes based on prior project data.

Beyond internal value, customers may be more inclined to work with tech-savvy partners who can deliver more data and data-driven insights. Customers may value this information to train their own AI or improve their design process. On the other hand, job shops that are not leveraging AI have the potential to be perceived as outdated or less capable.

Beyond AI, better managing CAD/CAM data sets the foundation for broader PLM capabilities. Our data shows that PDM / PLM improves operational control leading to reduced cost and higher profitability. However, the most important step is to get started by controlling, accessing, and sharing CAD/CAM data with PDM.

Build a Foundation for Future Value

Effective CAD/CAM data management is a core capability that drives agility and operational excellence internally. It also sets the stage for higher value and positive customer perception. One thing is sure, if AI does become a necessity, companies will want to have their CAD and manufacturing data in order so that AI can learn from it and leverage it. And if customers begin demanding PDM or PLM capabilities, you will have the foundation in place to support them. Mature CAD/CAM data management prepares the shop to answer questions about what they're doing about AI and PLM – internally and externally.

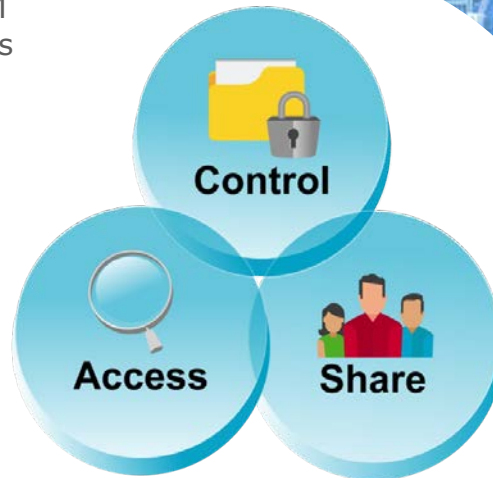


Control, Access, and Share with PDM

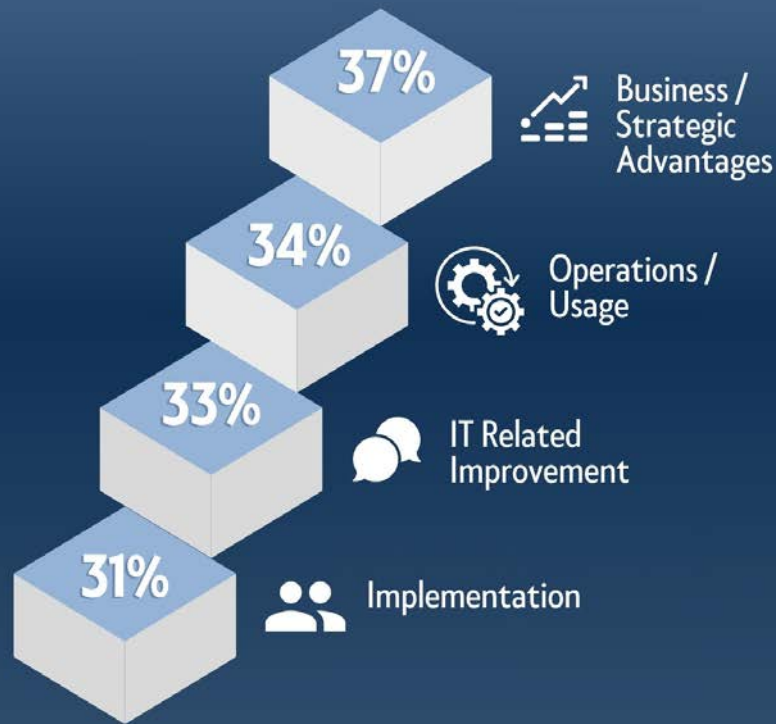
PDM Helps Drive Operational Excellence for Job Shops

Before we wrap up, let's take a deeper look at how PDM supports job shops. Most manufacturers leverage PDM to control, access, and share engineering data. Job shops can leverage these same capabilities to store their customers' CAD data in context with the volumes of data they create to produce parts with quality. For a job shop, PDM offers:

- **Control** supports managing CAD models, CAM files, and other engineering and manufacturing data through version control, standardized naming conventions, and revision histories. It ensures that data is not lost, overwritten, or corrupted, changes are tracked, previous versions can be retrieved, and everyone works from the latest approved information. It also includes managing related data, such as manufacturing and inspection data, in context with designs for easy access and to make sure changes are reflected downstream.
- **Access** allows retrieval of information needed by others and defines who can view or modify data, including CAD/CAM files. By setting permissions and user roles, organizations can provide efficient access to information, allowing engineers and operators to quickly find design and manufacturing data so they can update or reuse it while restricting modifications to authorized personnel and protecting the integrity and confidentiality of their customers' design data.
- **Share** enables distributing CAD/CAM data among team members, departments, or external collaborators. It enables collaboration and ensures all users work with consistent, up-to-date files.



THE CLOUD SIGNIFICANTLY IMPROVES DESIGN DATA MANAGEMENT



Manage CAD/CAM Data without the Big Investment

Put the Basics in Place

Job shops need to control, access, and share their CAD/CAM and related manufacturing data in context in order to drive agility and operational excellence, but it does not have to be burdensome and require deep IT resources. Job shops that are concerned about the overhead of managing CAD/CAM should consider a lightweight data management solution that keeps all data in a centralized location, contextualizes it, protects it, and allows people to securely collaborate on it. Today, job shops can implement basic PDM capabilities by taking a simpler, less burdensome approach. At the same time, they can leverage a solution that can scale with their needs over time.

Leverage the Cloud

Job shops looking for a lightweight PDM data management solution to manage CAD/CAM data should look to the cloud. Cloud solutions are more accessible than ever. They offer a low-cost option and reduce adoption barriers for small job shops. The path doesn't have to be burdensome. An overwhelming 78% of respondents who characterized their PLM implementation as 'Easy' had deployed a cloud-based solution compared to only 15% with onsite implementations.²

Additionally, cloud solutions make it easier to securely collaborate with customers, both internally and externally. In fact, our research shows that the cloud provides value in several different ways:

- System implementation, leading to lower risk and barriers to entry
- System operation / usage, allowing better data control, access, and sharing
- IT factors, such as better performance, security, and scalability
- Business / strategic benefits, including supporting future value from AI

Last but not least, cloud solutions can offer industrial-grade security that ensures peace of mind for the job shop and their customers, leading to a confident and secure customer experience.

Get Started

It's time to create agility, reduce cost, increase quality, and secure customer relationships by better managing CAD/CAM data in the cloud to get the control you need, stop wasting time, reduce errors, improve quotes, create compelling customer experiences, and prepare for the future with a foundation that can be leveraged for further value with AI and PLM.

Acknowledgements



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About the Authors

Jim Brown founded Tech-Clarity in 2002 and has over 30 years of experience in the manufacturing and software industries. Jim is an experienced researcher, author, and speaker and enjoys engaging with people with a passion to improve business performance through digital enterprise strategies and supporting software technology.

Jim is actively researching the impact of digital transformation and technology convergence in the manufacturing industries.

Arvind Krishnan is the Vice President of Research for Product Innovation Practices for the research firm Tech-Clarity. Over the last 25 years, Arvind has worked in various roles in product management, product strategy, engineering, technical marketing, business strategy, and entrepreneurship. As an entrepreneur, Arvind ran his own engineering and management consulting firm in water management, bioenergy, and sustainability.

Arvind is an avid marathon runner and a lifelong learner. Other than engineering and technology, Arvind is interested in economics and finance. When he is not working, he loves to travel and learn about different cultures.

Tech-Clarity is an independent research firm dedicated to making the business value of technology clear. We analyze how companies improve innovation, product development, design, engineering, manufacturing, and service performance through the use of digital transformation, best practices, software technology, industrial automation, and IT services.

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