Tech-Clarity

Issue in Focus:

Consolidating Design Software

Extending Value Beyond 3D CAD Consolidation

Table of Contents

Introducing the Issue

Tech-Clarity research indicates that consolidating on a single CAD system helps enable design and component reuse and promotes better collaboration among engineers. Most companies initially pursue a single CAD solution for the obvious IT cost savings, however Tech-Clarity Insight: Consolidating CAD – Benefits of a Unified CAD Strategy explains that standardizing on a single CAD platform also provides more strategic benefits. These benefits include higher productivity, greater corporate agility, and faster response to market dynamics. Although most companies can't fully consolidate systems due to customer demands, supply chain dynamics, and the realities of complex business, standardization is a valuable goal.

Consolidating on a single CAD system helps enable design and component reuse and promotes better collaboration among engineers.

The Consolidating CAD report focuses primarily on the value of a common 3D mechanical design solution. Several interviews touched on the benefits of leveraging a common PLM environment, but for the most part the focus is on 3D based mechanical engineering. The benefits reported are the result of consolidating detailed design resources on a single 3D CAD system. Now, the introduction of design suites covering a broader spectrum of the design process opens up new opportunities. The benefits of consolidating design software beyond just 3D mechanical design offers even greater value.

The benefits of consolidating design software beyond just 3D mechanical design offers even greater value.

For example, consider having a common CAD data set that allows an industrial design specialist creating a 2D sketch, an engineer modeling a product in full parametric 3D, an engineer building a concept in 2D (that will ultimately be designed in 3D), and others using direct modeling techniques further downstream to use the appropriate tool for the job. This report extends the previous findings, exploring how an integrated design suite that supports flexible approaches on a common data model adds even more value than consolidating 3D mechanical CAD.

Consolidate Upstream from Detailed Design

As the prior report explains, consolidating mechanical design tools offers significant benefits. But there is more to designing a product than detailed design. Many products begin taking shape as a conceptual sketch or 2D design. Frequently, these are created in a standalone tool or in traditional pencil and paper form. The advent of digital sketching transforms this process to produce a digital output. This allows designers to share,

modify, and reuse concepts more readily. It effectively transforms a disconnected deliverable into a corporate asset.

Integrating digital assets downstream prevents design gaps between what is designed and what is produced.

Digitizing the concept also helps ensure that designers' intentions are carried forward so the next person doesn't have to interpret and recreate the idea. Integrating digital assets downstream prevents design gaps (Figure 1) between what is designed and what is produced, ensuring that intended/ innovation and quality aren't lost along the way.

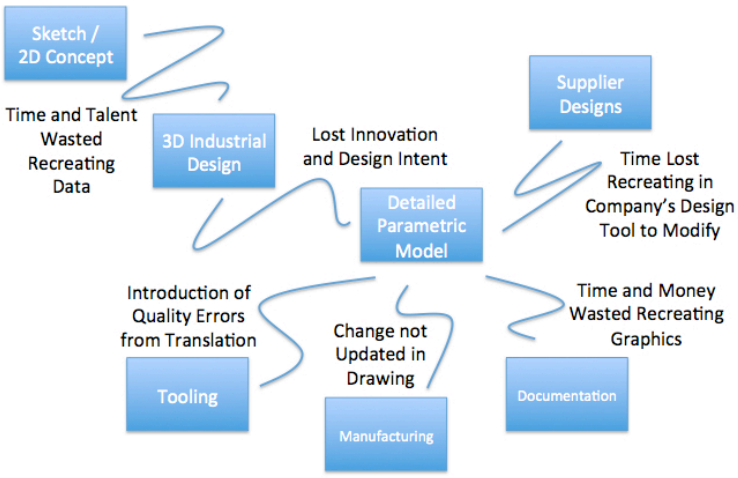

Figure 1: Tech-Clarity Design Disconnect Framework

A digitized sketch can also provide a starting point for a 3D industrial design. Industrial design is a freeform and creative activity that can't afford the constraints a fully featured, parametric design solution may impose. While these solutions transmit design intent and ensure what is designed gets produced, the rigor and training requirements are sometimes more than the industrial design process can support. But the processes shouldn't be disconnected, either. Designing on a common data model provides an opportunity to ensure that conceptual design intent is clearly communicated downstream into detailed design, increasing efficiency because information can be reused instead of recreated.

Companies spend days recreating data without thinking about the productivity loss. It is a huge, hidden productivity sink.

With disconnected point solutions, companies often recreate the wheel from the sketch or 2D design when moving to a 3D model. Then, they sometimes recreate it again from an

industrial designer's 3D model to a fully featured 3D, parametric model. This costs precious time and resources recreating data or translating it and having to fix, or "heal" models. It destroys efficiency and innovation and introduces the potential for misinterpretation and errors that impact product quality. In some instances, it can also lead to data corruption. Companies spend days recreating data without thinking about the productivity loss. It is a huge, hidden productivity sink. Companies could be spending this time on a few more conceptual design alternatives by leveraging an integrated design solution that ensures integration and data transportability without the need to translate or recreate product models.

Consolidate Downstream from Detailed Design

Product engineers are not the only ones who use design tools in the manufacturing enterprise. Different departments may use CAD to design manufacturing layouts, tooling, or other manufacturing assets. These people probably don't need the power of a fully featured, parametric, 3D CAD tool. They are not likely to use the system enough to justify the level of training and investment required to outfit them with a fully featured design application. In fact, they may be using 2D or using a simpler 3D CAD system. This often leads to disconnects in the way data moves downstream from detailed designs. These additional gaps in the design process further complicate the issues encountered when moving conceptual designs into detailed design.

Designers can avoid recreating data by using simpler tools that interoperate on a common data model.

Using different systems when designing a manufacturing aide like a jig, fixture, or container can lead to recreating product geometry. This creates discontinuity from the product design and can introduce errors and quality problems. Alternatively, they might choose to use a physical prototype for this, wasting time and effort. Designers can avoid recreating data by using simpler tools that interoperate on a common data model.

Using detailed designs in manufacturing eliminates the vast amount of time wasted recreating, translating, and healing data for downstream use.

Like reusing conceptual designs in detailed design, using detailed designs in manufacturing eliminates the vast amount of time wasted recreating, translating, and healing data for downstream use. But, manufacturing engineers need simpler tools. The same is true for other downstream departments. For example, service and installation personnel could use simpler tools to create drawings for customer site installations or to determine how a product would fit with existing equipment. Interoperability is the key.

Live with Supply Chain Realities (Multi-CAD)

Beyond upstream and downstream challenges, it's important to understand collaboration and peer-level integration issues. The realities of customer mandates and supply chain dynamics dictate that companies need to be able to operate in a multi-CAD environment. Although some companies can force their supply chain to standardize on a common platform – including specific versions of CAD tools and PLM solutions – most companies do not have this luxury. One could argue about the validity of that approach, but for most companies that is not a realistic opportunity. Instead, they must live with different CAD tools, different versions, and different design approaches.

In a multi-CAD environment, designs come in different forms. They may need to be translated from different native CAD solutions or may come in "neutral" file formats. These neutral formats include standards such as IGES or STEP, which provide "dumb" models that convey geometry but incorporate no design intent. These models could come from 3rd party design centers, other divisions of the company, suppliers, or customers, and introduce foreign data to the design environment.

Capabilities such as direct modeling make it easier to adopt geometry from other systems and treat it as if it was native data.

Fortunately, the design suites of today are more capable to work on CAD models from other systems. Capabilities such as direct modeling make it easier to adopt geometry from other systems and treat it as if it was native data. These systems offer feature recognition to recognize a round or a hole as a feature and understand how they should behave. They may also recognize symmetry, for example recognizing that ten identical holes should probably remain ten identical holes. This adds intelligence back to the "dumb" geometry, which would be nearly impossible with a parametric system.

Interoperability and integration are essential to work with models of different types and from different sources.

Of course direct modeling is only a part of the solution. Foreign data is better addressed with a design suite that includes direct modeling, but may also need to be combined into assemblies with parametric parts. Interoperability and integration are essential to work with models of different types and from different sources. The tool should also understand the bigger picture, maintaining the relationship with the foreign data, so relationships are not lost.

Leverage the Past (Legacy Designs)

An integrated design suite helps upstream and downstream in the product lifecycle, but what about the company lifecycle? Companies evolve over time. Most companies have designs from a legacy CAD system (or more than one). This might be the due to the natural replacement of tools or result from a merger or acquisition. For many, these designs are not converted to the newest system even though the products are still in use and may still be active in the market. Some executives might be surprised to find out how little of their current product portfolio has designs in their current CAD system. It is probably a lot less than they assume.

Some executives might be surprised to find out how little of their current product portfolio has designs in their current CAD system.

Legacy data is important when redesigning old products or supporting products in the field. In some industries, legacy designs may be valuable for a very long time. How do companies address this issue? Some companies keep copies of the old software around to work on old designs. These systems become hard to maintain as new operating systems and infrastructure are implemented. Some may even require maintaining old hardware. Most of the new design work, though, is recreated or translated and corrected in the new system. Bringing the old data into a direct modeling tool may make more sense. An interoperable, integrated design suite provides this capability without significant lost time and productivity.

Understand the Bigger Picture

Having an integrated design suite also helps drive efficiency across the enterprise. For example, consider the important task of developing product documentation. Today's integrated solution suites offer the ability to leverage existing 3D content to provide better product documentation and technical information. Tech-Clarity Insight: The Business of 3D Technical Communications explains that reusing detailed designs for technical communications allows companies to improve the productivity of Engineering, Manufacturing, and Service in addition to technical documentation teams. They can also gain a competitive market advantage by developing highly compelling graphics for Sales and Marketing. This is just one more example of how integrated solutions offer more opportunity to save money, shorten time to market, and improve factors such as quality that drive product profitability.

Integrated solutions offer more opportunity to save money, shorten time to market, and improve factors such as quality that drive product profitability.

Address the Pain (with a Little Help from IT)

Many companies fail to act despite the clear value of consolidation. They simply don't recognize the huge amount of time they waste due to incompatible design data and systems. Recreating CAD data and dealing with translation problems has just become a normal part of the job instead of being seen as the huge productivity sink it has become. Maybe companies have just given up because there were few good options to address the issue? But companies need to recognize the source of quality issues from translated designs, even though they are hard to trace. They need to understand that conceptual or industrial design intent is being lost in detailed design and should not be accepted as inevitable. These are strategic issues that impact top- and bottom-line performance.

IT savings will likely pay for the entire consolidation effort!

Ironically, the place that the issue is often addressed is outside of Engineering and product development. The issue is frequently broached by the CIO to reduce spend on information technology (IT). The benefits to IT-oriented consolidation are perhaps more tactical, but also more tangible and can lead to strategic product development benefits. Consolidating vendors and tools across the enterprise reduces cost (as discussed in the last paper) including licenses, training, help desk, maintenance costs, integration expense, upgrade efforts, and more. The truth is that IT savings will likely pay for the entire consolidation effort!

The Expanded ROI Model

The previous paper offered a template ROI model to help manufacturers analyze the potential benefits of consolidating their 3D CAD solution. This paper expands on that by including upstream and downstream savings available from consolidating on a design suite instead of just a mechanical 3D CAD solution. In addition, the ROI model has been adjusted to use maintenance fees as a basis instead of initial license fees based on feedback from manufacturers that they don't have license cost data or feel it is outdated.

This example can serve a starting point to analyze costs as they apply to a specific company scenario.

As with the previous report, the ROI example is a representative view of the cost savings available from consolidating CAD tools across an organization. The costs in the model are highly dependent on the specifics of each individual s business and their solutions, but this example can serve a starting point to analyze costs as they apply to a specific company scenario.

The model below is based on the following assumptions, which will vary from company to company:

- Annual maintenance cost for the primary mechanical CAD system is $100,000
- The company has 25% as many upstream CAD users as mechanical CAD users
- The company has 50% as many downstream CAD users as mechanical CAD users

Cost Driver	Source of Savings	System *	Cost **	Reduction	Frequency	Annual Savings
License Fees	Assume no license savings	N/A	0%	0%	N/A	-
Maintenance	Discontinuation of redundant system	M	100%	10%	Annual	$10,000.00
	Consolidation, economy of scale	U	25%	10%	Annual	$2,500.00
	Consolidation, economy of scale	D	50%	10%	Annual	$5,000.00
CAD Integration / Translation Tools	No longer needed (direct modeling, common data model)	All	50%	90%	Annual	$45,000.00
Customization, Configuration, Wizards, Templates	Eliminate need for redundant systems	M	10%	50%	Annual	$5,000.00
		U	5%	100%	Annual	$5,000.00
		D	5%	100%	Annual	$5,000.00
Upgrades	Eliminate need for redundant systems	M	100%	50%	Biannual	$25,000.00
		U	25%	100%	Biannual	$12,500.00
		D	25%	100%	Biannual	$12,500.00
3rd Party Applications - Maintenance	Reduce duplication due to incompatibility	M	50%	25%	Annual	$12,500.00
		U	10%	100%	Annual	$10,000.00
		D	15%	100%	Annual	$15,000.00
3rd Party Applications - Upgrades	Reduce duplication due to incompatibility	M	25%	25%	Biannual	$3,125.00
		U	5%	100%	Biannual	$2,500.00
		D	7.50%	100%	Biannual	$3,750.00
User Training - Development	Eliminate need to develop training for redundant systems	M	50%	50%	Biannual	$12,500.00
	Extend training for primary system	U	50%	75%	Biannual	$18,750.00

Cost Driver	Source of Savings	System *	Cost **	Reduction	Frequency	Annual Savings
	Extend training for primary system	D	50%	75%	Biannual	$18,750.00
User Training - Delivery	Eliminate need for training on redundant solution	M	25%	10%	Annual	$2,500.00
Technical Training	Eliminate need for training on redundant system	M	10%	100%	Annual	$10,000.00
	Eliminate need for training on redundant system	U	10%	100%	Annual	$10,000.00
	Eliminate need for training on redundant system	D	10%	100%	Annual	$10,000.00
Internal Help Desk	Support for one system, one vendor	M	25%	25%	Annual	$6,250.00
	Extend support for primary system	U	12.50%	75%	Annual	$9,375.00
	Extend support for primary system	D	12.50%	75%	Annual	$9,375.00
Software Administration	Eliminate admin need for redundant system	M	2%	50%	Annual	$1,000.00
	Eliminate admin need for redundant system	U	2%	100%	Annual	$2,000.00
	Eliminate admin need for redundant system	D	2%	100%	Annual	$2,000.00
Server Hardware and Software and Operating System	Reduce duplication due to incompatibility, increased scalability	All	50%	25%	Annual	$12,500.00
Workstation Hardware and Operating System	None, assume compatibility on workstations	N/A	0%	0%	N/A	-
TOTAL ****						**$300,000**

Figure 2: Design Suite Consolidation Savings as a Percent of Maintenance Fees

* M = Duplicate Mechanical CAD, U = Upstream Conceptual and Industrial CAD, D = Downstream CAD
** Total cost as a percentage of primary mechanical CAD system annual maintenance
*** Total savings rounded up from $299,375

The Consolidating CAD report shows the equivalent of 23.3% of original license cost saved per year, or roughly 115% of maintenance. The value of consolidating across the design suite is closer to 300% (Figure 2). These significantly higher cost savings are the result of reducing expenses across multiple CAD systems, including both vendor costs and internal expense such as upgrades, help desk, training, and more. Clearly the opportunity here is much higher than from simply consolidating 3D mechanical design software, and they do not even include people time and inefficiency!

The opportunity here is much higher than from simply consolidating 3D mechanical design software, and they do not even include people time and inefficiency!

Conclusion

The bottom line is that manufacturers waste a significant amount of time recreating product data across disconnected tools in their design process. Few understand how much inefficiency this causes at the critical times when designers should be focusing on innovation instead of fighting with file formats. Upstream data from conceptual and industrial design is recreated or translated, introducing opportunities for errors and creating a gap between the original design intent and what is handed over to production.

Manufacturers waste a significant amount of time recreating product data across disconnected tools in their design process.

An integrated design suite, on the other hand, helps keep design intent from conceptual design through the rest of the product lifecycle. It reduces the need to recreate geometry, increasing efficiency by removing the hidden productivity sink. The integrated design suite approach uses a common data model allows people to apply the right tool for the right person and the right job. This is also true downstream, where manufacturing engineers and others need to leverage product data but design in much simpler tools. This saves time and improves quality, and keeps manufacturers from creating gaps in intent from industrial design to what is sent to manufacturing.

An integrated design suite that uses a common data model allows people to apply the right tool for the right person and the right job.

A flexible approach also helps companies address the reality of multi-CAD environments. Whether foreign CAD data comes from the supply chain or from legacy designs, direct modeling approaches allow companies to intelligently manipulate the "dumb" data. An integrated suite of tools allows assemblies that include both foreign data and fully parametric models into assemblies.

The project to consolidate on a single design suite may likely be targeted to save money in IT.

In addition to these benefits, an integrated suite allows companies to work in a broader PLM context and enhances corporate flexibility. With all of these potential benefits, however, the project to consolidate on a single design suite may likely be targeted to save money in IT, which might be the simplest reason to get started on an initiative with such strategic benefits.

Recommendations

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

- Research how many different software tools are used across the product development process.
- Research how much time and effort is spent recreating or translating and "healing" designs from one step in the design process to the next
- Consider how much more valuable that time would be if it were spent on more iterations of the conceptual design, spending a bit more time to innovate, or improving time to market
- Reuse digital assets from upstream conceptual and industrial design through detailed design to increase productivity, retain design intent, and prevent errors
- Leverage a suite of design tools that works on a common data model to prevent time lost recreating, translating, and repairing data between steps of the product design process
- Leverage interoperable tools to modify legacy and foreign designs from the supply chain with direct modeling capabilities while maintaining the ability to design with full parametric support
- Explore the corporate benefits or resource balancing and available from a common toolset
- Justify the strategic product development benefits with tactical, hard IT cost savings from consolidating tools and vendors

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.

Jim can be reached at jim.brown@tech-clarity.com. You can follow Jim on Twitter at @jim_techclarity, you can read his blog at www.tech-clarity.com/clarityonplm, or you can find Tech-Clarity on Facebook.