

Tech-Clarity

**Issue in Focus:
Integrating Product Design
and Development
Environments**

***Battling Complexity,
Improving Productivity, and
Compressing Time***

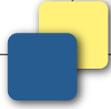


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Introducing the Issue

The status quo for product development is no longer acceptable. Manufacturers have to continuously improve their ability to design, develop, and introduce products around the world or lose relevance to stiff global competition. Today, leading manufacturers compete on speed and innovation. At the same time, they can't afford escalating complexity to impact their productivity or quality.

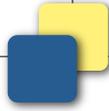
Product designers and developers are rising to the challenge. Manufacturers have made significant progress in battling complexity and improving time to market over the last decade. They have adopted platform and modular design techniques. They have learned to connect engineers from around the world to streamline product development. Engineering and enterprise software have played a critical role in these improvements. CAD and CAE have allowed engineers to design products they could only dream about in the past. PLM and digital manufacturing have enabled them to coordinate global design and manufacturing networks to improve productivity, increase speed, and reduce errors. But that is not enough for the future.

The product development benchmark for the next decade will be the ability to simultaneously introduce localized products around the globe with increased personalization.

The bar is now raised and requires companies to strive toward a new plateau of performance. The product development benchmark for the next decade will be the ability to simultaneously introduce localized products around the globe with increased personalization. To accomplish this, manufacturers will need to compress the time it takes to design global product variants without compromising quality or cost. As if this isn't enough, they have to do this at the same time they adapt to the complexity of developing smarter, mechatronic products.

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Manufacturers are once again looking to their enabling technologies to take them to the next level. Most current engineering software implementations, however, will not support the real-time, concurrent, design-in-context environment required. The current best in class technology offers seamless integration between authoring, analysis, and enterprise tools and allows engineers and product developers to work together in a real-time environment. This paper explores the possibilities available from the latest generation of integrated design and development environments.



Take Advantage of Integrated Design Suites

The latest generation of design tools offers more integrated processes and software. Integrating design tools make engineers lives easier. It allows them to focus on innovation instead of transferring files, translating data, and healing models. Tech-Clarity's [Consolidating Design Software](#) report discusses the benefits of an integrated suite of design tools include cost savings, higher productivity, greater corporate agility, and faster response to market dynamics.

Integration allows engineers to create richer, virtual views of products and systems to better understand their behavior and the experience they deliver to customers.

Beyond simple efficiency improvement, integration allows engineers to create richer, virtual views of products and systems to better understand their behavior and the experience they deliver to customers. For example, integrating CAD with CAE, manufacturing simulation, and other tools allows engineers to model products holistically to get early validation of product and production processes. As the [Consolidating Design Software](#) report concludes, “*The introduction of design suites that cover a broader spectrum of the design process opens up new opportunities. The benefits of consolidating design software beyond just 3D mechanical design offer even greater value.*”

Design suite architectures are evolving to span users and provide concurrent access to models across the enterprise.

Some systems have evolved while others have been reinvented. Engineering software is extending to the enterprise. PLM was developed as an enterprise-class tool. Now, design suite architectures are evolving to span users and provide concurrent access to models across the enterprise. One example of this is moving from traditional, file-based storage to database-oriented techniques.

Tap the Value of Integrated Design and Lifecycle Management

Beyond the integration of design suites, embedding product data and lifecycle management into design solutions helps improve efficiency on an enterprise scale. PLM alone provides value by better managing products, processes, and projects to enhance productivity and improve time to market. Integrating PLM into the design environment keeps engineers immersed in their design tools instead of stepping out to other solutions. It also allows them to quickly search and load data as needed instead of waiting to check data in and out from a separate system.

Integrating CAD and CAE with PLM requires more than just embedding PLM menus inside tools and launching a new interface. The latest generation of integrated solutions provides data and lifecycle management capabilities directly in the CAD environment. This provides seamless design, data, and process management that help reduce non-value added time. This time can be significant. According to Tech-Clarity's [Best Practices for Managing Design Data](#) top performers spend 25% less time on nonproductive data management tasks. That gives engineers more time to innovate or allows managers to significantly reduce design cycle times.

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Expect Digital Mockups in Real Time

Time to market is a critical lever of competition. A proven way to compress product development time is allowing multiple designers to work on different portions of a design concurrently. This helps reduce design times but makes product development more complex. As one designer changes a portion of the product, those changes cause a ripple effect that impacts others. If these changes aren't identified until well after the fact, they can cause significant design and engineering rework. This, in turn, can impact other designs and start the domino effect of change all over.

Engineers can no longer afford to work in a vacuum while they wait for files to be checked in.

Leading companies have invested in digital mockup (DMU) environments to provide full visibility into their designs to visualize the impact of changes and identify issues. Unfortunately, this approach causes delays between the time a design changes and when others recognize the impact. Engineers can no longer afford to work in a vacuum while they wait for files to be checked in. Instead, the latest generation of design and development software reflects changes in real-time to quickly understand the impact of change.

Enable Engineers to Design in Context

Integrating the design environment with PLM helps engineers understand the impact of change on their designs and manage the complexity of concurrent design. PLM already helps manage logical relationships such as the relationships between a CAD model and its associated requirements and specifications. The latest generation of integrated solutions should also manage physical relationships such as where parts are located, what parts they are in proximity to, and which parts they interface with. This allows engineers to determine the context of parts in which to design. But setting up this context can be

cumbersome. The engineer can't check everything out, and copying related designs means they won't update as others make changes to their parts.

Designers should be able to quickly prepare a tailored design session without having to know how the CAD product structure is organized.

The latest generation integrated design and development environment should allow engineers to quickly select parts based on product structure relationships or physical locations to set up a design context. This could be by making a graphical selection using a 3D bounding box to load related parts into the design space or navigating visually through product structure instead of trees of parts and assemblies. They should also be able to apply filters and selection criteria to see only what is relevant to the task at hand. Designers should be able to quickly prepare a tailored design session without having to know how the CAD product structure is organized.

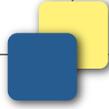
Design contexts should be dynamic, reflecting updates real-time without having to wait for a periodic generation of visualizations and a digital mockup.

Engineers should be able to work in this context to make updates with full contextual fidelity and see the impact of their changes in real time, and be assured that others will see their updates to take them into account in their own work. In the latest generation of systems, they should not have to wait to check out a whole assembly to modify assembly relationships and metadata. Design contexts should be dynamic, reflecting updates real-time without having to wait for a periodic generation of visualizations and a digital mockup. This allows engineers to identify updates to the design data already loaded in their design session and be able to refresh the information in real time.

Proactively Manage Variant Configurations

Another aspect of improving time to market is launching multiple product variants concurrently. Forward-thinking manufacturers simultaneously launch product variants that meet specific market, geographic, or customer needs – without compromising quality. In the past, manufacturers adapted products to different markets over time, but today's fast-paced markets drive companies to launch products concurrently on a global scale. In addition, tailoring products to market and individual needs typically drives higher margins. Introducing these variants, however, adds complexity and creates a proliferation of designs that have to be created, tested, and managed.

The latest generation design and development environment helps manage the growing complexity companies face managing numerous configurations and product variants.



The latest generation design and development environment helps manage the growing complexity companies face managing numerous configurations and product variants. Traditional approaches require independently generating different configurations in order to validate designs. The traditional approach causes designers to find issues too late – after design decisions have already been made. An integrated design environment allows configurations and valid combinations of products to be defined in PLM and associated with design elements in CAD. This allows engineers to understand the impact of their decisions on multiple variants as they design.

Current tools make it hard to make informed decisions on these multi-variant models because they force engineers to see all configurations at once or generate and review each configuration independently.

Creating a single, configured 3D platform that includes all potential variations allows engineers to model the entire product with all options, sometimes known as “150% BOM.” This helps validate multiple variants. Current tools, however, make it hard to make informed decisions on these multi-variant models because they force engineers to see all configurations at once or generate and review each configuration independently. Instead, the latest generation of integrated solutions should access configurations in PLM and allow engineers to turn features on and off to review various configurations in real-time as design options are explored. This effectively allows the “Design in Context” concept to be extended to all configurations so designers can see the impact of changes on all configurations early.

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Improving variant design also helps support platform and modular design processes. Manufacturers can improve efficiency, expand reuse, and shorten time to market by leveraging these techniques. As Best Practices for Developing Industrial Equipment found, top performing companies (those that have grown revenue and margins much faster than others) have adopted more advanced engineering approaches including modular and platform design. This is also true in many other industries. Commonality greatly improves design cycle times and quality, but adds complication because changes to the platform impact many related designs. The ability to design in the context of multiple variants or a specific configuration greatly reduces the complexity of platform and modular design efforts.

Advance Collaboration to Team-based Design

Beyond individual productivity, an integrated design and data management suite can improve team performance. To start, simply consolidating CAD platforms offers significant value. Tech-Clarity's [Consolidating CAD](#) research shows, "*A unified CAD strategy also helps to encourage better product development and design collaboration.*" It also enables strategic benefits like corporate agility.

The latest generation design and development platform needs to enable real-time design collaboration with quick response times connecting globally dispersed design teams.

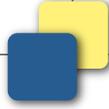
The latest generation design and development platform, however, goes further. Many companies today have designers in different geographies and time zones to optimize design cycle time and cost, or have a distributed design environment in order to involve suppliers and other 3rd party engineers. Regardless of physical location, these designers need to design in the context of the other designs and be sure they are always looking at the most current design. The latest generation design and development platform needs to enable real-time design collaboration with quick response times connecting globally dispersed design teams.

Collaborate in Context at the Team Level

Beyond working in the same environment, the latest generation of design and development software should offer new collaboration techniques that allow more dynamic design collaboration and design review. Instead of making changes independently and consolidating changes later, the software should create a joint design space where engineers can change their design in 3D and others can see what they are doing. This has been mimicked with screen sharing in the past, but can only be "driven" from one side.

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Instead of looking at the same screen, advanced techniques allow designers to share data and set up their own environment around it. In this way, they can set up their own design context and see changes from other engineers reflected real-time on their screen. The tools should also offer 3D comparisons that show what has been added, removed, or changed so engineers can work together in parallel without waiting until the end of the day (or longer) to see changes. Because each party has their own design context instead of a screen share, this approach respects security and access rules so people only see what they are allowed to see.



Support the Business of Product Design and Development

Designing products is only one part of solving the time to market problem. Developing and commercializing products requires the ability to address much more than the product's technical characteristics. PLM has expanded to address a more complete view of products. In addition to capturing this information, advanced solutions should allow designers to visualize business data in its 3D context, providing a visual representation of product development information such as status, weights, or owners to put the business and project information into the context of the product itself. The latest generation of design and development should continue to manage business data in conjunction with designs.

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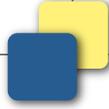
In addition to capturing business data, leading edge manufacturers are finding new ways to get value from their digital product models. They leverage their digital models to optimize products and their customers' experiences early in the development process. The latest generation solutions needs to incorporate aspects like environmental compliance, manufacturability, serviceability, and more into design decisions to enable manufacturers to get the product right up front.

The latest generation of design and development software needs to go beyond supporting product design to improve the business of product development.

Of course, not all product data is directly product related. Manufacturers today are learning to leverage knowledge from inside and outside of their organization to make better decisions. For example, they are turning to analytics to leverage big data from product experience in the field to help provide feedback to engineers. They are leveraging the wisdom of the crowd by incorporating social input. They are soliciting information and ideas from outside of the enterprise and accessing corporate knowledge that isn't directly associated with products to provide insights and information to drive innovation. The latest generation of design and development software needs to go beyond supporting product design to improve the business of product development.

Conclusion

The integrated design and development environment is the latest evolution of product innovation and engineering software. It offers the advantages of integrated design tools combined with product data and lifecycle management. These advanced solutions help manufacturers meet the challenges of compressing time, improving productivity, and battling complexity by allowing engineers to design concurrently, in context, in real-time.



Tomorrow's manufacturers will not be able to compete without updating their design and product development solutions to these capabilities.

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Enhanced integration of engineering software suites allows engineers to stay immersed in designs and their design tools so they can focus on innovation instead of navigating multiple interfaces and moving files. Increased integration also allows engineers to develop more complete product models to visualize products, optimize their designs, validate their manufacturing processes, and simulate the experience they will provide their customers so they can design them right the first time.

Design solutions have improved to allow much stronger capabilities for designing global variants based on a modular 3D platform. This enables a wider variety of variants, reduced part counts, and greater innovation because engineers can consider all possible variants during design. It also increases efficiency and quality because changes can be automatically propagated to all relevant variants.

Team-based collaboration allows concurrency so designers can jointly work on the same elements of a design but view it in their own context that respects access rights.

Collaboration capabilities have advanced to allow designers to work in the context of their designs and see changes from others in real-time. Designers are now able to set up an appropriate context in which to design so they can understand the impact of their changes on related designs and vice versa. Team-based collaboration allows concurrency so designers can jointly work on the same elements of a design but view it in their own context that respects access rights. This allows globally dispersed teams to collaborate on designs in real-time.

Today's best in class solutions go beyond traditional PDM and PLM boundaries to leverage corporate knowledge, market information, and more from big data, unstructured information, and social knowledge.

Finally, the latest generation of tools goes beyond technical and product design to incorporate a much richer view of the business of developing and delivering products. Today's best in class solutions go beyond traditional PDM and PLM boundaries to leverage corporate knowledge, market information, and more from big data, unstructured information, and social knowledge.

Recommendations

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

- Implement today's best practices for PDM and PLM
- Expand PLM beyond technical design to incorporate a richer view of products
- Understand the limitations of the PLM architecture most manufacturers have in place today
- Explore the possibilities available from the latest generation of integrated product design and development environments
- Expand beyond today's PLM to improve the business of product development, incorporating unstructured information, big data, and social knowledge

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.

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