

3D CAD – The Key to Successful Product Development

Digital Model Definition Drives Growth, Profitability and Value

Twenty years ago, 3D computer-aided design (CAD) burst onto the manufacturing scene delivering unprecedented innovation, productivity, and profitability. Today, as the world of product development becomes ever more complex, the 3D digital model has now emerged as the essential key to driving manufacturing success.

Engineers everywhere are using 3D computer-aided design/engineering/manufacturing (CAD/CAE/CAM) tools to deliver many of the world's most innovative products. As the dominant 'language' of product development, the digital product model is increasingly viewed as an invaluable component of a company's intellectual property portfolio.

This trend is especially true in today's fast-paced world of mergers, acquisitions, outsourcing, and distributed manufacturing, where the need for a single product model—one that can be understood and worked on by everyone in the product development value chain—is essential.

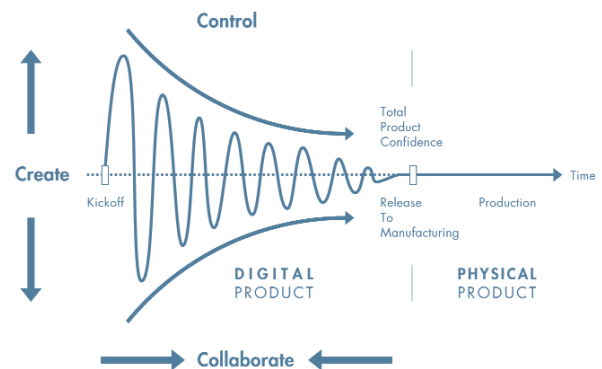
The fact is, without a single, digital 'master model' representing their product, companies are now experiencing miscommunication, costly data translation, manufacturing errors, and schedule delays—pitfalls that can jeopardize a company's very existence.

Digital Model: The Tie That Binds

Modern 3D CAD offers manufacturers the opportunity to ensure that all pertinent design and manufacturing information is contained in a single product model. This approach to design—often referred to as model-centric design—allows for information such as design requirements, geometric definition, and manufacturing and assembly process characteristics to be captured in the 3D digital product model. This content can then be easily extracted into engineering deliverables such as inspection information, assembly instructions, and manufacturing tool paths.

The digital model definition—that is, the 3D product model created by designers and engineers—is a vital asset around which many product development stakeholders base their work:

- Partners and suppliers use the digital model data to ensure that the complementary parts they're designing or manufacturing will satisfy the requirements of the overall design.



Digital product model creation is critical to optimizing the product development process.

- Customers can easily review lightweight (i.e., small byte size), accurate representations of the models to ensure their requirements are being met.
- Internal Simulation and Analysis Groups use the master model to determine whether the product will meet performance, compliance, and safety requirements.
- Sourcing uses the digital data to secure the proper materials for manufacturing the product.
- Engineering and Manufacturing teams work together to troubleshoot design—from the early concepts through to final design—ensuring cost-effective production on a timely basis.
- Manufacturing uses the model to define production and assembly process plans to ultimately build the final product.
- Sales and Marketing use the model to test customer acceptance and drive demand for the ultimate product through promotional activities.

With 70% of a product's costs locked in before the product reaches manufacturing (Aberdeen Group), it is absolutely vital to a company's success that everyone in the value chain listed above work from the same high-quality digital product definition. In this way, changes can be made quickly, easily, and cost effectively, resulting in the right product delivered on time.

When product development professionals have a single, powerful 3D CAD solution to create a complete digital model, companies enjoy far-reaching and profound benefits, at top and bottom lines, both of which drive business and boost value.

Controlling Changes: Key to Digital Product Confidence

Why do companies have difficulty creating a single, robust, complete digital model? The biggest obstacle is that they're unable to accommodate design changes while seamlessly flowing the proper digital information among all requisite functional disciplines. Yet, in order for stakeholders to have confidence in that digital model, it is essential that design changes be appropriately propagated throughout all deliverables, regardless of where a change is initiated. This cross-functional data propagation is a process called 'associativity'.

Thus, to establish true digital model definition, associativity is a mandate, and must span the entire product development gamut, including conceptual designs, detailed designs, analysis models, routed systems, tooling, manufacturing tool paths, process plans, and detailed drawings.

Need for Accurate, Fully Defined Geometry

Since digital models form the basis for capital-intensive endeavors such as sourcing, machining, tooling development, and volume production, they must be geometrically complete and accurate. Inaccuracies or improperly defined geometry can wreak havoc on the process, and have a devastating impact on a company's bottom line.

For example, if production inefficiencies due to flawed digital model definition cause a product to be late to market by six months, there can be a resulting potential negative profit impact of 33%. Similarly, an R&D cost overrun (e.g., increased overtime for production personnel) of 60% can result in a negative profit impact of 3.5%. Further, a product cost overrun of 9% causes a negative profit impact of 9%. (Wheelwright and Clark).

Interoperability, Compatibility are Crucial

Another major obstacle to creating a single digital model occurs in operations using multiple CAD applications, since most CAD systems have trouble integrating data created with a third-party tool, or between OEM and partner. This incompatibility saps engineering productivity and causes rework, data translation, and delay. In fact, research shows that application interoperability problems are rampant, costing upwards of \$1 billion per year in the automotive industry alone (National Institute of Standards), and upwards of \$20 billion in worldwide manufacturing (Daratech Research).

With the right digital model definition solution, engineers have the power to work fluently with CAD data from many sources, and catch problems early in the design process, reducing downstream risk and

related costs. The fact is, if problems in the design are not caught until after production has begun, changes can be up to a thousand times more costly to implement than if the problem had been addressed early, in digital form during the design phase (DARPA, MIT).

The reality is that most CAD/CAM/CAE solutions fall far short of what's required for efficient product development, whether due to poor usability, capability shortcomings, or incompatibilities with other CAD files and/or product development applications. All these problems can compromise a company's ability to drive value from its product development processes.

Value of a Single Digital Model

Conversely, when product development professionals have a single, powerful 3D CAD solution to create a complete digital model, companies enjoy far-reaching and profound benefits, at top and bottom lines, both of which drive business and boost value:

- Reduced time-to-market for new products

By providing accurate, complete definition of product geometry to downstream functions such as analysis and production, companies can shorten design cycles.

- Reduced product cost

Using 3D tools to perform virtual prototyping, engineers can lower—often eliminate—the cost of physical prototyping. As well, by optimizing 'design for performance,' you reduce warranty costs and validate product behavior.

- Faster response to customer requirements

Because an associative digital model automatically updates as changes are being made, designers can execute and assess the impact of changing customer requirements quickly and easily.

- Reduced development costs

By automating essential, yet routine, tasks, designers have more time to test new ideas and try new iterations, increasing quality and driving innovation. With an easy-to-use 3D CAD solution, companies can simply extend the tools to new/casual users, so teams spend less time learning new software, and seasoned engineers spend less time mentoring novices. Teams can thus work leaner and reassign essential personnel to other value-added activities.

The Solution: PTC's Product Development System

For thousands of leading manufacturers across the globe, PTC's Product Development System (PDS) delivers all the essential tools for creating a single, complete digital product definition. An industry proven, truly unique solution, our PDS empowers engineers to quickly build a comprehensive, high-fidelity "master model" easily used by all members of today's extended product development value chain—engineers, customers, suppliers, partners, sales, marketing, and services.

Architected to Support Standard Web Services

Built to take advantage of today's standard Web technology, PTC's Product Development System brings together all stakeholders across the globe as if they're sitting in the same room. With its unparalleled capabilities, the PDS enables the most creative minds to design whatever they can imagine—quickly, easily, without compromise.

By creating a complete digital model definition, there are no information gaps that can cause misinterpretations of design intent. The benefit: All stakeholders in product development work faster and more efficiently. Engineers have what they need to simulate product behavior and accurately predict real-world behavior and performance. Designers can readily pass complete information to downstream parties such as manufacturing who can plan for tooling development and machining. Teams can more effectively respond to changing customer requirements and propagate the effects appropriately. The result: lower product development risk and greater success.

PTC's PDS captures all forms of product-related intellectual property in high-fidelity electronic formats, enabling unambiguous information exchange necessary for users to effectively collaborate and deliver high-quality products.

PTC—Uniquely Qualified

Implementing a single, accurate digital product model initiative requires more than superior technology. It also requires an ability to understand the impact that Product Lifecycle Management solutions may have both on critical business processes and on people within your organization.

PTC's Product Development System delivers a combination of leading technology, process optimization, and proven adoption methods that can ensure a successful digital model definition initiative.

With the experience gained from partnering with more than 35,000 leading companies worldwide in a variety of manufacturing industries, PTC understands how to apply technology appropriately and successfully. We ensure full support for optimized processes that can be successfully implemented and adopted throughout your organization.

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