

The Importance of Capturing IP in Product Development

Why the Value of Intellectual Property Skyrockets When It's Embedded – Electronically – into the Product Model's Digital File

Anyone who has ever designed a product using CAD software will tell you that the value of a 3D model is typically more – much more – than the sum of its parts.

The model's geometry, along with its likely materials, strength requirements, maintenance needs, and other relevant characteristics are frequently reflected in the image presented on-screen, thanks to the knowledge and forethought of the design engineer. For instance, if the product-to-be is intended for use in a hostile environment, the engineer has likely added extra bracing, or has specified a super-tough surface material. Likewise, if the product is targeted toward users who can perform a basic level of self-service, the engineer has probably made the design compatible with some simplified maintenance and assembly procedures.

Often, the design engineer is asked by Manufacturing to reduce the product's weight for any number of reasons. Or, Engineering may want to build-in a design correction made on a similar product as the result of an engineering change order (ECO).

In each case, the reasoning behind the designer's decision is a critical part of the product's intellectual property, or IP – and should be captured in a way that it can be easily shared with others who will be working with the product. These operatives range from a new designer working on the next-generation product, to the manufacturing engineer who would like to substitute a different surface material.

Traditionally, in order to capture IP, design engineers kept handwritten notes or impromptu notebooks to record their reasons for design decisions. However, today's designers, design teams and product development enterprises may not have the luxury of close personal communication and interaction.

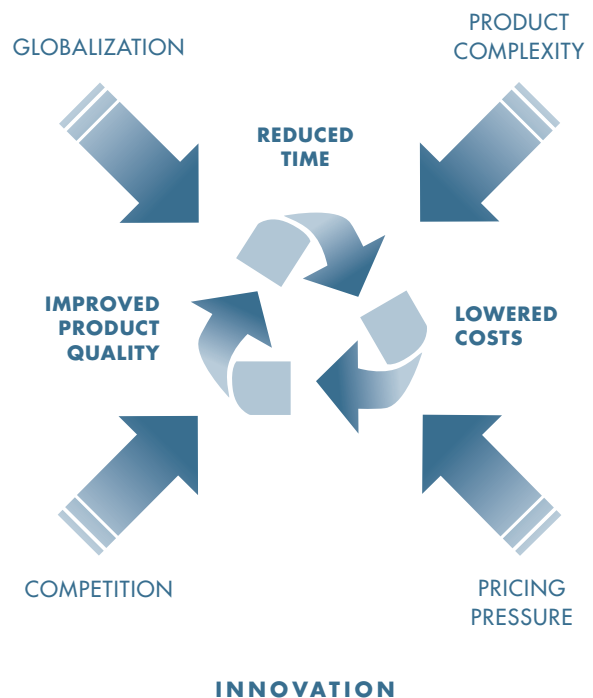
In today's world of global product development, design teams are very often geographically dispersed; teams often change in mid-design; and products are now being designed and tested by engineers in three different countries, then sent to a fourth country for manufacturing.

As a result, for many product design applications, it's now vital that all of the design IP associated with the CAD model be captured automatically and preserved digitally as an integral part of the product development process.

Changing Business Models, Changing Products

In the 21st century, businesses are changing, products are changing, and the processes that drive product development are also changing. According to John MacKrell, senior consultant for industry analyst CIMdata, the success of products is no longer confined to the traditional "time, cost, and quality" equation. Today, success also must take into account the following factors:

Business Drivers to Innovation



(Courtesy of CIMdata)

- **Globalization** – Today's products are being designed, built, marketed and maintained in many parts of the world.
- **Product Complexity** – Increased parts counts, plus the growing popularity of build-to-order and mass-customization paradigms, are all adding more complexity to designs.

- **Pricing Pressure**—Pricing can no longer be a “hit-or-miss” proposition, because the window of opportunity may close before the price can be corrected. Accurate pricing means that companies must know their costs up front, so they can positively impact margins as much as possible before product prices are set.
- **Competition**—Product differentiation must also be more precise, and differentiation must emanate from product development processes—along with tightened supply chains—as well as through the products themselves.

Against these pressures, it is more critical than ever that product development companies do their utmost to sharpen their competitive edge. Companies must, according to CIMdata’s MacKrell, foster innovation as the principle means of competitive differentiation. Without a sustainable program for driving innovation, companies will be threatened by faster-moving competitors.

“With the pace of innovation heating up, any enterprise that fails to replace ten percent of its revenue stream annually is likely to be out of business within five years.”

—The Economist Magazine

The Quest for Innovation – And the Role of Knowledge

“An organization’s ability to enable innovation provides a competitive advantage,” says MacKrell. “And an organization’s intellectual assets drive innovation.”

MacKrell points out that innovation is central to improving many key areas of the business, including profitability, shareholder value, and market capitalization for product development companies. And a key to sustaining innovation lies in harnessing the intellectual assets—that is, the knowledge—of the company’s engineering professionals.

To do that, product development companies should follow these basic principles:

Institutionalize IP Capture

Companies should build comprehensive IP capture into the product design process, rather than leaving it up to engineers to document their work after-the-fact – a practice that can be erratic, inaccurate, and less than complete. For short-term projects, engineers often don’t have the time to write up documentation—they’re too busy with the next project. For long-term projects such as shipbuilding, the design staff may change dramatically before the typical 10-to-12-year project is finished, so a great deal of knowledge can be lost if it’s not documented as part of the design process itself.

Make Your PDM or PLM Repository “Library-quality”

A sophisticated product data management (PDM) or product lifecycle management (PLM) system doesn’t automatically ensure library-quality knowledge-storage: information quality is only as good as the documentation stored with the design files. In a research library, information is typically vetted for accuracy and completeness. Product development companies need to do the same with the documentation in their PDM/PLM repositories. For instance, design engineers should include third-party attributions in their documentation wherever possible; or, if an engineer uses a formula found in a reference book, that resource should be cited in the documentation. This level of record-keeping requires both a concerted effort and clear direction from senior management.

Document Design Failures as Well as Successes

Information completeness requires that every aspect—both positive and negative—of the design project be documented because today, more than ever, documentation is critical to cross-team involvement. For time-critical or expensive product development projects, for instance, it’s important to involve Quality Assurance teams early in the process, before Manufacturing and Testing. Doing this requires that documentation be complete and reliable.

Take Advantage of Technology Tools

As digital information becomes more ubiquitous, best-practice IP capture grows more feasible for product development companies of all sizes. PLM and PDM systems are an example of this ubiquity: once digital information is entered into a part file, it stays there for the life of the file. Automated workflows are another example because they create clear trails of reviews and approvals, alerts, and other elements of product development that can later be referenced for insight into product design decisions and actions.

For engineers, a valuable tool for electronically capturing IP is engineering calculation software, such as PTC’s Mathcad®. Thousands of companies worldwide are now using engineering calculation software because these tools make it easy to capture information during—not after—the design phase, and to perform calculations that can later be referenced for verification. Engineering calculation software also helps companies establish norms and practices that aid in institutionalizing IP capture. Some examples include:

- **Documenting Names and Constant Values**—Engineering calculation software makes calculations easy to understand; for instance, constants used in calculations, such as material properties or modulus of elasticity, can be highlighted for easy reference. In addition, calculation software can be used for notes, names of procedures, and even the reasoning behind the operations.
- **Using Computational Graphics**—A wide range of graphics options make it easy for engineers to visualize the results of many types of calculations. The more sophisticated the calculation software, the more types of graphics it can support. For instance, Mathcad covers all popular engineering plot types, plus 3D plots with zoom, angle adjustments, and other functions.

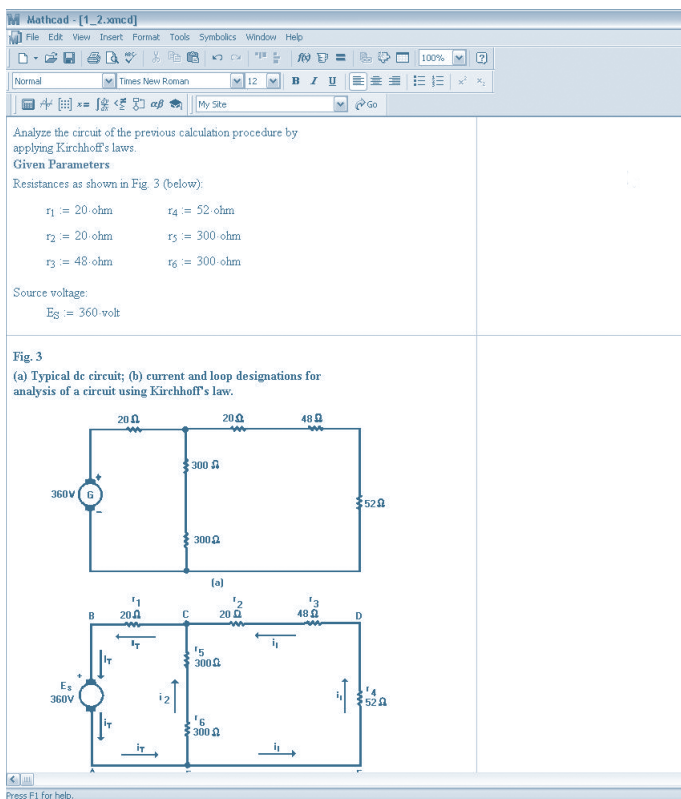
Vendor Perspective: Mathcad for IP Capture

Engineering calculation software is a valuable enabler in helping product development companies capture IP. The ideal solution should be both powerful and intuitive: powerful enough to support highly complex engineering formulas and symbols, yet intuitive enough that the design engineer won't have to stop what they're doing to figure out how to enter and manipulate data.

Mathcad fits both criteria.

Mathcad is easy-to-use, yet advanced enough to perform high-end numerics, differential equation solving, and other tasks. It easily supports live symbolics, vector and matrix handling, and wide-ranging data analysis, plus it offers numerous display and graphics options.

At the same time, Mathcad is very intuitive, because it lets engineers enter equations and text via near-freeform input, simply by typing data anywhere in the worksheet. Unlike other computational applications that use specialized programming languages to perform calculations, Mathcad uses natural math notation, so others can read and understand the content. Engineers can mix units of measurements, and then automatically check and correct them, as necessary. And, Mathcad supports the documentation process by enabling engineers to enter equations, text and graphics on the same worksheet.



Above: Fully documented calculation in a Mathcad worksheet.

Weighing the Benefits of Capturing IP

Like it or not, today's product development environment is far different from what it was 20 years ago. Today, your product design teams and your company's supply chain may stretch around the world. Your competition, as well, may come from anywhere and appear at any time, thanks to the "24/7" nature of modern-day business.

By capturing all of the engineering IP associated with a product design, today's product development companies can take a giant step forward in helping itself survive—and even thrive—against today's challenges.

Comprehensive knowledge-capture also helps companies both to tighten budgets through design reuse, and to shorten time-to-market by enabling a faster product development process. IP capture also helps companies continuously improve product quality and ergonomics, rather than constantly having to "reinvent the wheel" with new product designs. And, IP capture helps transfer invaluable knowledge from highly experienced experts to fledgling engineers, so that critical concepts and subtle techniques are preserved, and not lost to job change or engineer retirement.

Perhaps most important, complete IP capture adds to the company's core value, and as that value grows, it puts the company in an increasingly better position to differentiate itself against competitors, by having better products and better business processes.

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