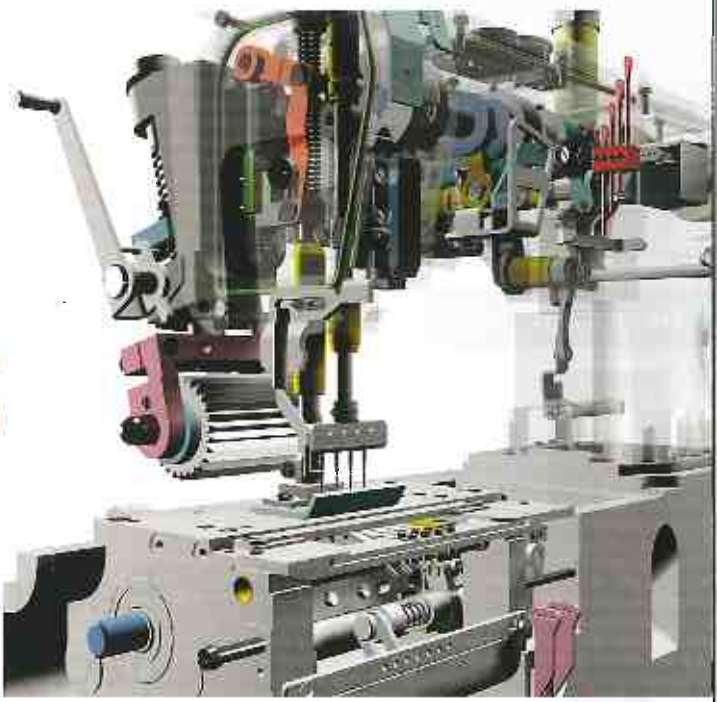
# Digital Prototyping: Design For Success



Global manufacturing SMBs, through digital prototyping, may have an answer for their product development needs. By **Samuel Tang**, regional sales manager, manufacturing industry, SEA, Autodesk

For many years, product manufacturers have been under enormous pressure to improve their operations. Products must meet ever more specific customer requirements, designs must be completed faster, prices must be competitive, and quality must hold up to a lifetime of use.

For example, let's take a look at the automotive industry: Manufacturers now offer a greater range of automobiles than ever before, from quirky subcompacts such as the Smart car to hybrid SUVs and trucks of all sizes; development cycles are being reduced from four years and more to less than 24 months; price competition is hotter than ever; and defect rates, particularly in notoriously buggy US automobiles, have gone down dramatically over the past few years.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Jim Lambert, design manager at (Bosch) Rexroth's Industrial Hydraulics business unit in Welland, Ontario, ranked his company's top three strategic imperatives as, first and foremost, innovation, followed by competitive advantage and faster time to market. Karl Thysell, HTC's chief technology officer, listed faster growth, cost control, and competitive advantage.

## Key To Success

To achieve these performance improvements, manufacturing enterprises, not only in the automotive industry but also in the aerospace, industrial machinery, medical devices, and consumer goods industries, have substantially changed their product development processes.

The key to success is the abolishment of functionally unconnected 'silos' of activities, such as concept development, design, engineering, manufacturing, and sales and marketing. At market-leading enterprises, these activities are now connected. Product data, design intelligence, project management, and performance analysis are linked and can be managed in almost real time.

These new processes rely on data vaults, networking, and Web-based collaboration. Beyond that, the addition of 3D modeling to 2D drafting, which will never be replaced completely, improves collaboration and helps to avoid misunderstandings about product intents.

Numerous research studies have thoroughly documented the benefits of this approach to corporate performance in product development. However, these studies have also demonstrated that the fully integrated approach to product development, referred to as PLM, is expensive, complex, and not always fully achievable.

PLM requires investments not only in applications software, implementation, integration with ERP applications, and end-user training but also in a well-staffed IT department to reliably run these applications. Clearly, full-blown PLM is not a panacea for every enterprise.

This holds true especially for worldwide small and medium-sized manufacturing sites and for small divisions of larger corporations. Just like large enterprises, these organisations have to deal with the gamut of challenges: cost competition from lower wage countries, performance demands from OEMs and end users, manufacturing

flexibility to satisfy the rapidly changing requirements from supply and demand chains, and little time and capital to invest in developing 'irresistibly' innovative and stylish products.

In reality, many SMB manufacturers have neither the technical savvy nor the time and capital required to invest in the automation of their procedures and to optimise their processes along the lines of the PLM concept. However, there is a way for SMBs to develop an effective method that is low cost and easy to use - digital prototyping.

### Flexible & Focused

Autodesk's definition of digital prototyping includes the basic functions of PLM – industrial design, design and engineering, data vaulting, and collaboration. However, there are several important differences to PLM: While PLM reaches from a product's cradle to its grave, digital prototyping stops at the completion of the digital product and its engineering bill of materials.

As a result, the number of participants in the digital prototyping development loop is considerably smaller than the number of participants in full-blown PLM, and the collection, management, and sharing of data are less complex.

Furthermore, manufacturing can keep its product development activities separate from operations management and forgo the costly and time-consuming integration with the company's applications for enterprise resource planning (ERP), customer relationship management (CRM), and project and portfolio management (PPM), among others. Overall, digital prototyping is more flexible, more focused, and easier to use than PLM.

### The Advantage

Now, let's drill down and take a closer look at product development and the role of digital prototyping. Product development consists of two phases: the digital phase (with computer-aided design [CAD], computer-aided engineering [CAE], product simulation, product information management (PIM), and a bill of materials) and the physical phase (with product manufacturing, physical testing, maintenance, and retirement).

Over the years, the digital product development phase has expanded the number of digital design and simulation steps that replace and/or postpone the need for dealing with the physical product. This of course saves a lot of time and money and also opens the door for easier team collaboration and customer input earlier in the development phase.

The most important enablers of digital prototyping are conceptual or industrial design, detailed CAD, CAE, and PIM. Until recently, the comprehensive use of these categories of software applications for product development has been limited for the most part to larger enterprises, while many SMBs continued to rely on clay for styling, on overdesign for product quality, on paper files for product information repositories, and on phone, fax, and mail for collaboration.

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While it is true that most SMBs replaced their drafting boards with CAD some time ago, the majority of product designs are still executed in 2D rather than in 3D. As a result, communication of a product's features and functions from initial ideation to final launch is error prone, the look and feel of innovative products may not meet customer tastes, and manufacturing may misunderstand a product's intent.

Mr Lambert described his experience: "2D cannot communicate effectively, nor can it simulate real-world situations. The beauty of digital prototyping is that designs can be tested out before they go to manufacturing."

### Innovation, Quality, Style

Over the past five years, life for SMB manufacturers has become a daily struggle for survival. Clearly, companies with average products that rely primarily on price and acceptable functionality don't stand much of a chance for survival. Manufacturers must target three goals. One is technical innovation. As the recent success of Apple's iPhone has demonstrated beyond a shadow of a doubt, customers worldwide are willing to pay premium prices for market-leading novelties.

However, technical innovation by itself cannot ensure lasting success. For vendors to attain long-term brand recognition, products also have to be market leaders in styling and quality.

But how to get there? Manufacturers have to create the right business environment: the right corporate culture to promote innovation, the right skills base among employees, and the optimum combination of in-house talent and outside partners.

This is an attainable goal for large enterprises, but until very recently, it would have been a risky and expensive strategy for SMBs to embrace. However, we are now witnessing a revolution both in available technologies and in end-user expertise that will level the playing field between SMBs and large manufacturing enterprises. In fact, we are at the confluence of a number of trends that will work to the benefit of progressive SMBs:

- Growing end-user demand for superior styling of consumer goods
- Availability of software applications for styling, design, quality engineering, and collaboration that are easy to use and cost-effective
- PCs with amazing power and memory at affordable prices
- A new generation of designers who are computer savvy and experienced in a range of styling, design, engineering, and collaboration applications.

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## DEFINITIONS

The most important steps of digital prototyping are conceptual or industrial design, detailed computer-aided design, computer-aided engineering, and product information management. Collaboration is an enabler of team-based but dispersed product development.

- **Industrial/conceptual design**
  The goal of industrial design is at least threefold: to create a product that is aesthetically pleasing, that is functional, and that has a unique appearance to help manufacturers and retailers to develop brand recognition.

- **Computer-aided design**
  CAD applications allow product design engineers to draw the detailed engineering files for product manufacturing.

- **Computer-aided engineering**
  The goal of CAE is threefold: to test a product's ability to withstand long-term usage, to ensure product quality by digital simulation rather than by relying on overengineering, and to optimise the material selection for product costing, quality, and manufacturing.

- **Product information management**
  PIM serves as a repository for product intent, product structure, and development processes. It supports team collaboration within enterprises and across business partner networks, speeds time to market of innovative products, and opens the door to extensive reuse of parts, components, and procedures.

- **Collaboration**
  Development teams are distributed across the globe, rely on input from a large number of sources, and have to satisfy demands from different global client constituencies. Without easy-to-use workflow and visualisation tools worldwide, distribution of product development and manufacturing would be impracticable or even impossible.

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