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Best practices for collaborative product development

Extending the power of PLM to manufacturing process management (MPM)

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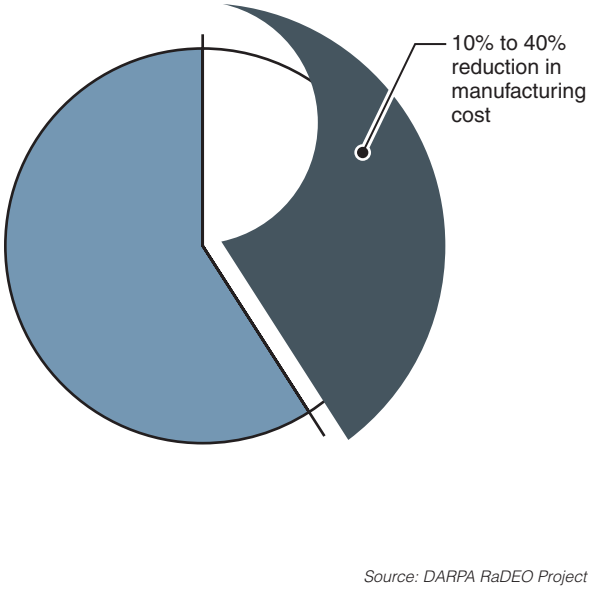
If you want to understand the competitive pressures that manufacturers face today, study the heating, ventilation, and air conditioning (HVAC) industry.

As concerns about conserving energy and protecting the environment increase, these manufacturers are expected to design and build products that comply with a wide range of constantly changing government regulations. They also must make sure their products can be delivered sooner—and at lower prices—than a host of competitors around the globe.

Making that happen consistently requires close collaboration between all parties involved in both designing and building products, something that few corporate cultures—and even fewer information technology platforms—currently support.

The companies that are mastering the art of cross-functional product-related collaboration are also embracing IT platforms that smoothly integrate engineering-centric applications like computer-aided design (CAD) and product data management (PDM) systems with manufacturing process management (MPM) solutions.



Source: DARPA RaDEO Project

Possible cost reduction: Effective manufacturing process management can have a significant positive impact on profits.

Bringing these systems onto a single integrated platform eases the process of moving products from engineering into production, and greatly increases the success rate of product launches.

That happens because data about what features are in a product—typically contained in the engineering-centric systems—is merged with information on how a product is built, allowing for any areas of confusion between the two functional areas to be ironed out in time to avoid costly production delays.

"Unanticipated manufacturing issues and problems that delay production readiness are among the most significant factors contributing to missed market opportunities," says Roy Wildeman, senior analyst for Cambridge, Mass.-based **Forrester Research**, and one of many industry experts advocating the blending of engineering and MPM solutions.

Ed Miller, president of **CIMdata**, an Ann Arbor, Mich.-based PLM industry research firm, is another. "You really haven't finished designing a product until you get it through manufacturing engineering," says Miller. "It's only when you've finished with the manufacturing engineering process that you've truly defined what's required to manufacture the product."

Fortunately for manufacturers, some PLM vendors understand this concept and have begun developing solutions to address it. For these vendors, MPM is not an ancillary component of a PLM suite; it is a core module that connects seamlessly with the CAD and PDM modules. These tight links allow companies to completely automate the creation of documents that guide the manufacturing process—such as manufacturing bills of material (mBOM), process plans, and work instructions—because the engineering data that

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goes into these documents can be pulled directly from its original source, even if that source is a 3D CAD model.

Sharing data with confidence

As these broad-based PLM suites mature, they are beginning to foster some best practices for the actual collaboration that takes place between product design and manufacturing groups—and companies are seeing real ROI from adopting these practices.

LS Industrial Systems, a Korea-based manufacturer of industrial automation equipment, is a case in point. "We make it a point to have our product designers and production engineers work as a team when launching a product development project to ensure their close cooperation," says Jong-Ho Song, a manager with LS Industrial Systems. "This enables them to discuss how to formulate design specifications with actual production kept in mind, minimizing the time wasted in making trial products. The close cooperation between product designers and production engineers can bring about various desired effects, such as minimizing the number of parts used in a product, simplification of the assembly process, reduction of production lead times, enhancement of product quality, and cost reduction."

Longstanding cultural issues are among the challenges facing manufacturers who wish to promote this type of collaboration. Historically, there has been a natural tendency for product engineers to resist sharing information before designs are fully approved.

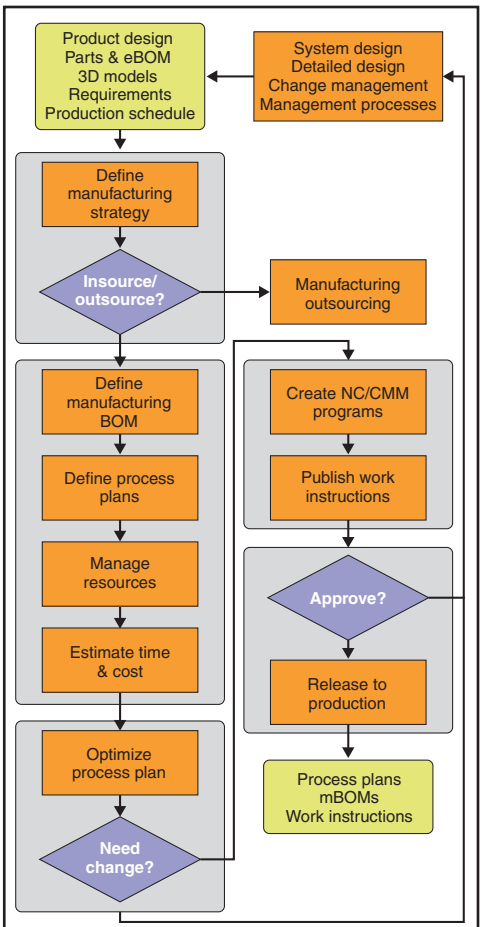
"There's a natural paradox at work here," notes Forrester's Wildeman. "Early review of product designs provides the most leverage for impacting costs associated with manufacturability, but the early stages of design are also where there's less detail for analysis."

A fully integrated PLM/MPM suite can alleviate some of these issues by supporting fluid, bi-directional flow of information throughout all stages of the complex process of bringing designs from concept to production. The proper platform architecture, with built-in safeguards, can ensure that product engineers can confidently share designs early in the process while simultaneously maintaining their rightful stewardship responsibilities over those designs. It also ensures that manufacturing engineers have the visibility necessary to review designs early enough in the cycle to provide the proper feedback for improving design for manufacturability at the lowest possible cost.

When working with an integrated PLM platform that includes MPM, the whole process is characterized by a continuous sharing of information and commentary throughout the entire product lifecycle, seeding and feeding ideas for how both product design and manufacturing processes can be changed and improved to accelerate time-to-market and reduce costs on an ongoing basis.

This concept—known in industry circles as concurrency—is one of the emerging best practices for cross-functional product-related collaboration.

"The idea is that both product and manufacturing engineers are involved in the definition, analysis, and approval process," says Michael Distler, director of solutions marketing with leading PLM software vendor **PTC**. "The key to success is doing this throughout the full product lifecycle, not just once at the beginning. Whenever change is necessary, it's vitally important that all affected groups fully assess and understand the impact."



MPM process flow: The most effective manufacturing process management initiatives involve both product and manufacturing engineers in the definition, analysis, and approval processes.

Industrial products manufacturers have felt the need for this capability for years, but until recently haven't had a simple and easy means of addressing the complexity of working with highly engineered products. With global competition heightening the need for bringing innovative products to market quickly, manufacturers are showing a greater desire to address this problem.

Song, the LS Industrial Systems manager, says an integrated PLM platform promotes concurrency by enabling proper processes for handing over design information to all the relevant individuals in the initial development stage, enabling them to work on the design simultaneously. "The relevant sectors can supply feedback to the product design sector, thereby upgrading the level of perfection at the design stage, which means a reduction of failure costs," Song says. "Such a process also makes swift communication and decision making possible."

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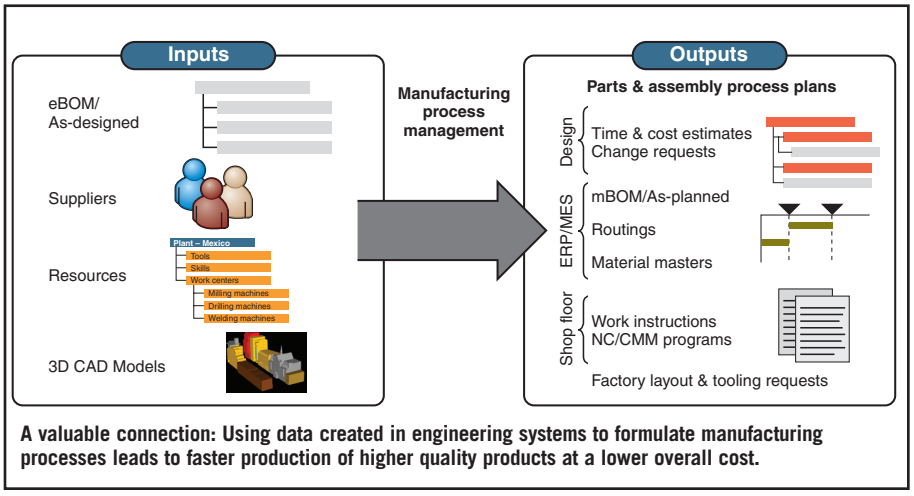

A valuable connection: Using data created in engineering systems to formulate manufacturing processes leads to faster production of higher quality products at a lower overall cost.

Clearly, comprehensive PLM platforms that embrace both engineering and manufacturing capabilities in an integrated framework have begun to move into the market. Their full utility, however, will be derived by understanding and adopting the emerging best practices for cross-functional collaboration. Already, a baseline set of best practices is emerging for how best to use this new class of solutions. These practices include some timeless ideals now powered by new capabilities, as well as some new notions for how to maximize enterprise resources using a common, comprehensive PLM platform.

Here, we offer eight best practices worth emulating:

1. Make concurrency a fundamental part of the entire design/production process: MPM must be viewed as integral to the product development process. As design engineering became an automated process, manufacturing suddenly became the principal barrier to achieving faster time to market. In many companies, manufacturing groups are constantly being asked to adjust their processes to ensure that products are built as designed. But they also are being told they cannot comprise product release dates. Making MPM a fundamental element of the product design/production process eliminates a major barrier to concurrency by establishing a tight collaborative link between what should be two highly *interdependent*, complimentary processes—product design and manufacturing process design.

2. Provide real-time visibility to engineering changes: Concurrency is not merely a matter of manufacturing engineering providing feedback to design engineering; it also requires these two groups to stay in constant sync in regard to updates and changes made to a design. "It shouldn't be incumbent on design engineers to determine the appropriate time to transfer design change information," says Jean Philippe Provencher, PTC product management director for manufacturing business processes. "Instead, notice of changes should be made visible as they occur so manufacturing engineers can determine how best to incorporate them in the manufacturing process."

3. Drive the power of digital development into manufacturing process planning: Manufacturing engineering is responsible for developing several key deliverables to support production. These deliverables include the mBOMs, process plans for routing products through work centers, as well as the detailed work instructions operators need to fabricate or assemble components or finished goods. "There's tremendous benefit in being able to develop manufacturing process design deliverables in the same system used to develop digital engineering designs," says Albert Siciliano, PTC product management director. "By using the same environment as design engineering teams, manufacturing engineers can leverage many of the same tools, directly re-use engineering data within their manufacturing deliverables, and avoid costly data duplication. In addition, the manufacturing engineers cannot only view 3D design mock-ups, they can also digitally create manufacturing deliverables. This makes manufacturing engineers more efficient and improves product quality."

4. Embed manufacturing standards specifications in one common PLM data repository: Well maintained, easily accessible manufacturing standards are critical to quality and efficiency in production. A certain part, for example, might require a welded seam; but floor supervisors and workers on the line need to know what type of welding equipment is required, and what level of welder certification is permissible or mandated. Standards are an essential element in the manufacturing process, and should be maintained in the same repository that delivers process routings and work instructions. "Centralizing all product and process information in a common repository provides for better, more accurate information that can be shared more securely and more efficiently across the enterprise," says Wildeman.

5. Support flexible translation of eBOMs into mBOMs for better manufacturability: Designers conceive and develop product designs differently from how manufacturing engineers approach the organization and flow of production processes required to fabricate and assemble finished goods. Typically, eBOMs mirror functional requirements; while mBOMs reflect produc-

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tion requirements. Past attempts at merging the two into one universal BOM proved problematic.

Today, in a truly integrated PLM environment, mBOMs are derived from the digital eBOMs developed by design engineering. Still, mBOMs need to reflect the unique realities of the equipment and configuration of production lines that comprise a company's manufacturing capabilities. Therefore manufacturing engineers need to have the flexibility to fluidly configure design elements to maximize production efficiencies in the plant, given available equipment, tools, and fixtures. This level of inherent flexibility has become increasingly important as global enterprises have moved toward centralization of design with decentralized production among numerous plants distributed globally. Though a company might market a common global product configuration, each of its manufacturing facilities very likely employs slightly different equipment, lines, and cells for building that product. Being able to easily reconfigure mBOMs to take advantage of each individual plant's capabilities has become essential to strategic global production.

6. Maintain one common system for managing and tracking all product lifecycle changes: Having a single integrated PLM system offers many benefits. The system becomes the repository for registering and viewing all design changes, even those that may not significantly impact production (e.g. a change in color of a procured part). It also provides a window into the current status of production so that design engineers can always keep abreast of changes in the manufacturing process.

"From a design engineering perspective, if you have faster access to the intended manufacturing process, you can make better informed judgments about engineering changes, and the exact details of those changes can be adjusted more rapidly, reducing or eliminating the iterations you might have been forced to do otherwise," says Marc Halpern, research director at Gartner, a Stamford, Conn.-based industry analyst firm. But the benefits don't cease once the product is shipped. An integrated system tracking both engineering and manufacturing throughout the full product lifecycle helps facilitate better after sales service and support.

7. Deploy automated workflows to support both standard and ad-hoc process management: As products become commoditized, having processes that allow for quick response to customer demands is important for global competitiveness —and being agile enough to quickly change those processes is crucial. Flexible, automated workflows improve both process responsiveness and agility. In initially designing workflows supporting an integrated PLM process, collaborative teams can decide when it makes the most sense to release designs to manufacturing and which individuals in both organizations should be included in the routing and approval processes. Once those decisions are made, a workflow component of the PLM system can manage the execution of these processes.

8. Drive ERP propagation and updating through MPM: As the product design and manufacturing groups work currently, they each should be on the same page with regard to information that is released to and reflected in the ERP system. Though ERP doesn't contend with the detailed perspective of an eBOM, it is very much dependent upon the information provided by an mBOM. Because the mBOM in an integrated PLM environment is seamlessly tied to the eBOM, it ensures that the entire corporate information system is always in sync, ensuring that concurrency is maintained from product concept through manufacturing to the highest management levels of the enterprise.

Concurrency Comes of Age

The advances made in the optimization of product design productivity are beginning to be extended into manufacturing with expansion of PLM to include MPM capabilities as part of a seamless, integrated platform. PLM that includes MPM is of particular relevance in the industries characterized by complex product designs, potentially protracted lead times, and increasing competitive pressures to be more responsive to customer requirements. The industrial products sector clearly fits this profile.

MPM is a management concept rightfully attracting increasing interest among leading manufacturers as a means of addressing these issues. Integrated solutions that offer this level of functional breadth make it possible to reduce manufacturing costs by up to 40 percent, and to eliminate missed market opportunities due to delays in moving designs into full production. In short, the concept of concurrency is gaining currency in exemplifying a new level of industry best practices that are not only desired, but are now readily achievable.

For more information

For more information on how to synchronize design and manufacturing engineering visit:

http://www.ptc.com/products/windchill/mpmlink/