Siemens PLM Software

Enabling innovation through knowledge and intellectual property management

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white paper





- Synchronize product data and processes across organizational boundaries to accelerate innovation and reduce costs.

PLM Software

Answers for industry.

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Table of contents

Executive summary 1

Enterprise knowledge and IP management strategy 3

Global knowledge access 5

Knowledge-driven automation 9

Summary 11

Executive summary

Knowledge: your key innovation asset

"The one sure source of lasting competitive advantage is knowledge."
– Ikujiro Nonaka, The Knowledge-Creating Company

Industry experts agree that knowledge – "actionable information," according to management guru Peter Drucker [Drucker, The Coming of the New Organization, 1988] – and intellectual property are increasingly critical for long-term success. Indeed, accessing the right knowledge at the right time is "the fuel of innovation," says Dave Burdick of research and consulting firm Collaborative Visions [http://www.collaborativevisions.com].

Clearly, knowledge is a strategic asset that deserves greater investment of time, energy and resources. This is especially true for:

- *Collective product design and manufacturing expertise*
- *R&D knowledge and trade secrets*
- *Tacit and explicit knowledge such as procedures, customer and competitor knowledge*
- *Patents, copyrights, trademarks and brand*

While unquestionably valuable, knowledge is highly dispersed, hard to identify and resistant to easy categorization. The trend toward globalization has made companies more fragmented, scattering important knowledge and intellectual property across multiple, heterogeneous systems. OEMs are now served by Tier 1 and Tier 2 suppliers, who in turn may rely on sub-tiers of geographically distributed suppliers of parts, components or raw materials.

Despite the advance of IT and knowledge management solutions, business-critical knowledge often resides only in the heads of experts, many of whom may not long remain at the company. In our volatile economy, private sector companies can expect to lose as much as 20 percent of their staff every year. To make matters worse, high-value knowledge workers are the most likely to depart. For example, some industries expect to lose 60 percent of their engineering staff within the next 5 years. In many cases, valuable knowledge is forever lost when expert staff leaves the company. [AMR, Introducing the Active Knowledge Framework, 2005]

Not all information is of equal value. For manufacturing companies, critical knowledge is invariably linked to the design and manufacture of products. This knowledge must be identified, stored and contextualized – that is, linked to other relevant product knowledge. For this reason, product lifecycle management (PLM) solutions are often an ideal backbone for an effective knowledge management initiative that seeks to:

- *Eliminate lengthy redesign cycles by leveraging enterprise-wide knowledge*
- *Protect consistency and quality of company innovations and brand attributes*
- *Reapply corporate innovations in new product environments*
- *Protect corporate IP across a global environment of partners and suppliers*

Although the effort of implementing knowledge and intellectual property (IP) management can be all-consuming, the rewards are clearly there. Leading manufacturers who have launched successful initiatives report impressive results:

- *Improves process efficiency by 70-80 percent or more*
- *Increases throughput/improves product development productivity: engineering changes 90 percent faster, RFQ response 30 percent faster*
- *Supports decisions for better understanding of investment impact*
- *Makes process knowledge available across the entire enterprise*
- *Increases product innovation by re-using knowledge contained within the enterprise*
- *Enables less experienced resources to process complex work*
- *Improves the design integrity of the product by capturing and re-using company best practices*

This whitepaper discusses both strategic and tactical approaches to a knowledge and IP management initiative. It describes how companies can turn knowledge and IP into strategic assets that directly contribute to top-line growth. A knowledge management and IP initiative seeks to provide higher quality, repeatable innovations by capturing and organizing the distinctive knowledge and expertise of the organization.

Companies that want to implement a successful knowledge management and IP initiative need to focus on these key areas:

- *Developing an enterprise knowledge and IP strategy*
- *Providing global knowledge access*
- *Implementing knowledge-driven automation*

A knowledge management and IP initiative: Definitions

Knowledge management has to do with creating, transferring and re-using the collective knowledge of the organization, while *intellectual property management* has to do with creating, patenting, copyrighting, licensing, protecting and commercializing proprietary technologies.

Knowledge comes in two basic forms: in **tacit knowledge** (human education, experience and expertise) and **explicit knowledge** (documents and data). Computer systems can automate portions of both tacit and explicit knowledge. If the knowledge is predictable and can be **structured** in standard and sharable ways, then it can be managed with computer-based solutions. However, if it is **unstructured** (buried in paper documents, spreadsheets, email or simply housed in the minds of knowledge workers), knowledge can be very difficult to manage. Consequently, Knowledge management depends on both cultural and technological processes of creation, collection, sharing, recombination and re-use.

Intellectual property most commonly refers to patents, copyrights, trademarks, trade secrets and brands – the embodiments of a company's proprietary ideas. Since there are numerous legal aspects to intellectual property, companies must establish and follow rigorous processes to ensure legal protection for their intellectual capital.

Enterprise knowledge and IP management strategy

According to *Knowledge Management* magazine, the goal of knowledge and IP management is to create new value by improving the efficiency and effectiveness of individual and collaborative knowledge work while increasing innovation and sharpening decision-making.

Manufacturers that harness the power of their corporate-wide knowledge can innovate far more effectively than those that don't. On a fundamental level, knowledge management and IP initiatives aim to eliminate non-value-added work, such as manual tracking and validation. Engineers report that they spend 50 percent or more of their time looking for the information they need to do their jobs. When tedious and manual tasks are automated, knowledge workers can focus more time on what they do best – creating innovative new products. Making knowledge readily available and putting it where it's needed can clearly impact time-to-market.

A knowledge management and IP initiative requires a strategy focused on:

- Setting clear knowledge management and IP goals
- Identifying the processes and business-critical knowledge required to execute the processes that support the goals
- Prioritizing the most important and "doable" processes in order to ensure a successful start to the initiative and get near-term payback
- Identifying bottlenecks or failure points and the knowledge that is required to address them
- Leveraging existing IT investments, such as a PLM backbone

Since knowledge management is virtually infinite in scope while IT budgets tend to be limited, companies must prioritize what is truly business-critical knowledge. They should start by focusing on key areas that are likely to deliver immediate value and not lose focus. For example, the design/build process can be looked at primarily from the design perspective of capturing and sharing designs. It can also be looked at from the perspective of value chain collaboration. Before companies dive into implementations, they must decide which perspective is most important.

Unfortunately, large amounts of valuable knowledge have eluded corporate computer systems and remain unstructured. Much of this knowledge is in paper-based documents (notebooks, standards manuals, reference books) which are hard to update and distribute. Valuable unstructured information can also be found in spreadsheets, emails and blogs. Companies must find ways to identify, categorize and store unstructured knowledge in a centralized, accessible repository and organize it so the right people can find it quickly. Often, PLM technologies provide the ideal infrastructure for managing enterprise knowledge and IP.

It would be a mistake to assume that structured knowledge stored in enterprise systems is easy to access and use. The truth is, automation has actually created knowledge gaps and erected barriers to collaborative information sharing.

To generate business value from knowledge, companies must disseminate it throughout the organization and across the global innovation network. Each new user added to the mix brings new linkages and resources into the collaborative environment. As a result, the total value

grows richer than the sum of its parts. Knowledge management is a process, and it has cultural, organizational and technological dimensions that must be cultivated to ensure success. Successful knowledge management and IP initiatives seek to implement digital product development solutions that enable continuous knowledge capture, re-use, automation and management. The aim is to generate real business value from the collective intellectual assets of the Global Innovation Network.

Often, knowledge management and IP initiatives focus on the higher level infrastructure or digital environment enabled by product lifecycle management solutions. These solutions are designed to provide collaborative environments supported by a single source of product and process information. They securely share information by providing open access only to authorized contributors. To succeed, these systems must integrate silos of knowledge and expertise, fostering instead a comprehensive, enterprise-level approach to knowledge management.

According to AMR, a comprehensive knowledge management strategy must consider a platform – a set of focused applications and existing systems that can be leveraged for knowledge management and IP initiatives. Enterprise-wide infrastructures built on PLM can provide many of the basic tools needed for effective knowledge management. It just makes sense to capture and store all of a company's product-related data and best practices in PLM. The best of these PLM tools help companies to automatically capture expertise at every stage and to automate the application of that expertise in day-to-day jobs. Another benefit of PLM is that it can be implemented or enhanced in cost-effective stages.

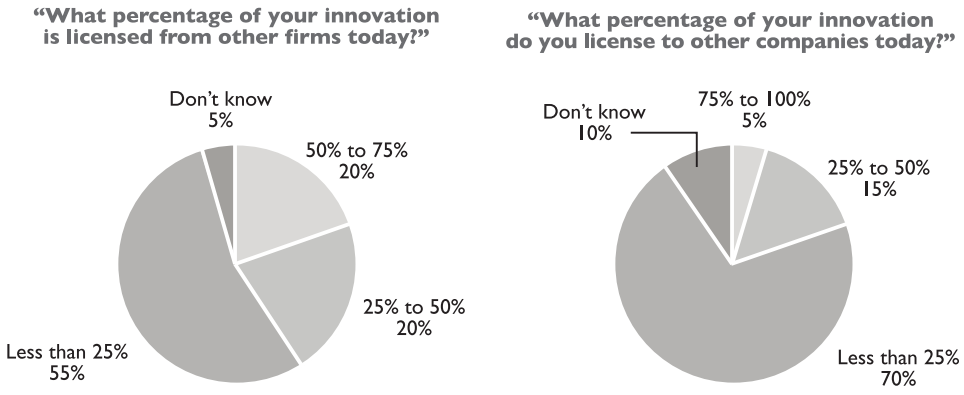
Case study: GE Aircraft Engines – Knowledge is strategy

The world's largest producer of engines for commercial and military planes, GE Aircraft Engines makes jet, turboprop and turboshaft engines that power aircraft from cargo, executive and passenger jets to bombers and helicopters. Faced with an explosion of knowledge locked away in widely dispersed departments and design groups, the company turned to knowledge-based engineering to help automate the entire PLM process for complex products, including automatically generating designs.

Knowledge-enabled tools helped streamline the new product introduction process. GE Aircraft Engines' master model maps across nearly a dozen domains, from engineering analysis to machining and fixturing. Parametric models with embedded design rules guide an automated development process.

As a foundation of its product-driven development philosophy, GE extended its knowledge management and Six Sigma initiative beyond the manufacturing realm into product design. The methodology of Design for Six Sigma – including Design for Reliability and Design for Producibility, reduces variation in the design and manufacture of new products. With this program, GE has effectively linked independent information silos and broken down the walls of isolation.

Firms no longer cling to vertically integrated innovation models



Base: 20 executives at product manufacturing firms worldwide

Source: Forrester Research, Inc., 2004

Without a centralized home to manage information, there is little opportunity for knowledge sharing and re-use. Companies can waste time either searching for the knowledge they need, or in re-inventing the wheel – performing unproductive and repetitive tasks over and over again. The impact on overall product development and time-to-market is considerable and can significantly compromise innovation.

To avoid these problems, complete and accurate information needs to be identified and collected in a centralized repository that provides universal access in secure ways on a 24X7 basis. This unified environment can effectively identify, share and re-use collective knowledge, best practices, designs and competencies across key functions (such as dispersed engineering design groups) and value chain networks. To ensure that the right knowledge is captured and effectively shared, users themselves should have the ability to identify and classify documents, spreadsheets, email and other important content.

A centralized knowledge repository ensures that the right knowledge is retained and shared with the right people. New employees come up to speed much faster and valuable knowledge remains with the organization when an employee leaves the company. Users can locate relevant information, proven methodologies and techniques in seconds regardless of where it is created or stored. This empowers employees to complete the task at hand more quickly and effectively.

Digital knowledge capture

To effectively share and use product information, companies must first capture, store and manage it. Since this information is often found very close to where products are designed and manufactured, a digital PLM environment can be an excellent way to capture the knowledge and experience of a company's key employees, suppliers and strategic partners at every stage of the product lifecycle.

Capturing *all pertinent* knowledge – whether it's in a spreadsheet, a legacy system, a scanned image or a hardcopy – is the first critical step when building an effective knowledge management system. Companies now realize that a great deal of knowledge is unstructured – that is, not easily captured by computer systems. According to Forrester Research, fully 80 percent of a company's knowledge falls into this category. ["Information Management 101," 2006] This means that manufacturers are making business critical decisions based on 20 percent of what they know.

To make matters worse, companies have multiple versions of the same design or product information. If content is not intelligently standardized upfront, business-critical data may not be searchable. What's more, rules for reporting and action-triggering processes that fit into existing business processes may be difficult to implement.

How can companies effectively manage the knowledge gathering process? To begin, put in place tools that enable a domain or discipline expert (for example, a CAE analysis specialist or a designer) to easily capture cumulative knowledge. For example, companies can create a systems-level template of a product, with governing rules for how subsystems interact, and then rapidly morph through different variants and configurations. Domain or discipline experts also have the ability to inject knowledge into the virtual product model, tying it dynamically to engineering formulas, rules, requirements and continuously checking/monitoring whether or not the knowledge complies. (For more on this, see "Knowledge-driven archetypes" on page 9.)

Once these tools are in place, companies should not rest on their laurels. Innovation requires constant vigilance over knowledge. They should constantly drive toward the elimination of paper documents or lab notebooks. They should always ask "what are we missing?" and continuously invent better ways to digitally capture new forms of knowledge.

IP process enforcement and document control

As knowledge has exploded, many companies have lost IP process enforcement and documentation control. If they want to get global innovation initiatives back on track, IP management must become an integral part of everyday workflow. In many ways, IP is one of the key assets of a company – past innovations are the foundation for future innovations. What's more, knowledge and IP management are essential in increasingly stringent regulatory environments.

Electronic Laboratory Notebooks (ELN), a concept pioneered by R&D groups, help researchers move to new levels of efficiency while cutting costs. ELN eliminates hardcopy notebooks and stresses the digital capture and documentation of ideas and processes that contribute to competitive advantage. Pioneered by research-intensive industries like Chemicals and Life Sciences, ELN can capture and share detailed experimentation histories. ELN can be applied at any stage of the product lifecycle and has an important role to play in effective IP management.

To facilitate patent application and support legal claims or defense, Electronic Laboratory Notebooks automatically record dated and authored information. They also facilitate adherence to company standards for documenting intellectual property among employees as well as suppliers and strategic partners. Seamless integration with document management, knowledge management, business process automation and portal applications ensures high levels of IP management.

According to AberdeenGroup, almost half of companies surveyed on the value of intellectual property say that better tracking and management of IP are top priorities. Management believes that leveraging IP for internal use can be improved and that a better understanding of third-party licenses or patents is needed. More than three-quarters of survey respondents indicate that they are actively pursuing capabilities to capture product and research knowledge, document the generation of IP, keep product knowledge secure, capture manufacturing knowledge and make this knowledge easier to search for and retrieve.

These capabilities were linked to enablers such as idea management, requirements management and patent management. These capabilities are also strong drivers for product data management (PDM), computer-aided design (CAD) and digital manufacturing solutions that effectively capture, store and make re-usable the knowledge about products that contain valuable IP.

Many engineers and researchers still use hardcopy notebooks for documentation – a practice that is not conducive to collaboration across the Global Innovation Network. ELNs enable engineers and scientists to easily share valuable knowledge while simultaneously protecting it. Shared knowledge leads to shorter development cycles and intellectual property teams are able to do their jobs more effectively. Currently, IP professionals manually review information as they attempt to gather documented evidence to support proprietary knowledge claims. ELNs can automate the entire process.

Case study: Procter & Gamble

Brand behemoth Procter & Gamble Company (P&G) is the world's #1 maker of household products. The company dominates its markets through continuous investment in R&D but needed better ways to share knowledge across R&D units. "The paper-based notebooks our R&D people have traditionally used are essentially not searchable," says Keith Caserta, Ph.D., Associate Director and Head of HealthCare R&D Information & Decision Solutions at Procter & Gamble. "That made it tough for one researcher to know what other experiments have been done or are ongoing."

When P&G moved to an Electronic Lab Notebook (ELN) system extending across about 30 R&D vertical systems, the company was able to effectively reapply knowledge both upstream and downstream in the areas of chemical and biological R&D. The system supports queries across multiple systems managing similar data, such as ingredients. Most importantly, it enables users of these vertical systems to promote their information to the ELN environment without leaving their familiar work systems.

"We expect to increase R&D productivity for the 5,000 users by about 12 percent," Caserta says. "A five percent improvement will come from reducing the time to enter notebook information by approximately two hours per week. And a seven percent improvement will come from eliminating the repetition of experiments that have already been done, thanks to the search-ability of the system."

AMR, for example, stresses the following benefits for ELN solutions:

Collaboration – secure information exchange with check-in and check-out functionality, version control and built-in decision support tools.

Productivity – quickly find and copy relevant research from prior experimentation, giving companies huge benefits from re-use and time savings.

Cost cutting – automatically provide auditable content. Attorneys can find needed information quickly to head off costly, protracted audits. ["Electronic Lab Notebooks," AMR Research, 2005.]

Effective IP management solutions require mechanisms to document key information relative to innovations, such as who/when/how contributed. This is especially important in a complex distributed organization that includes multiple suppliers.

The best knowledge management solutions are built on enterprise PLM systems with full-featured document management and robust search capabilities to centrally manage, re-use and share relevant documents and/or parts and component information. These systems provide benefits that extend enterprise-wide:

- Allows companies to establish and automate defined processes for managing IP, whether that IP is created in R&D, design engineering, manufacturing engineering, factory floor or marketing
- Benefits legal department by creating the defined process that supports legal action
- Have a sourcing element: help identify and define who provided what IP and when

Global shared knowledge environment

Once knowledge has been identified, contextualized and stored, companies must find ways to share this knowledge internally and externally across the value chain. Global Innovation Networks are all about sharing knowledge with the right contributors – the goal is to make sure that no one is left out who can contribute to the innovation process. Because the corporate world has embraced outsourcing, collaboration can no longer be confined within the four walls of the manufacturing company. All stakeholders must have the ability to evaluate and contribute to ideas.

To effectively collaborate, companies must build an adaptive and secure environment that combines a rich set of collaboration capabilities with the centralized data repository. The resulting environment enables widely-dispersed knowledge workers to visually collaborate in both formal and ad hoc product-focused teams. When implementing knowledge and IP management initiatives, manufacturing companies have a wide variety of options to choose from.

These range from heavy-duty customized solutions that automate virtually all knowledge relating to specific products to easy-to-use, low-cost tools that help capture, store and share knowledge as an integral part of automated workflow.

Case study: Volvo Aero

Volvo Aero, a leading aviation supplier with a reputation for high quality and safety, implemented a PLM solution that included a custom programming project with highly effective knowledge and IP management capabilities. These projects automated complex, engineering-intensive product development tasks and improved efficiency by 70 to 80 percent.

Engineers at Volvo Aero used knowledge-driven automation applications to manage all product-related knowledge. As Volvo Aero saw it, knowledge management tools designed to support the company's specific knowledge management needs would simultaneously boost efficiency and revenue. Highly skilled staff would no longer be bogged down by routine tasks, such as checking drawings for compliance with internal standards.

The results were impressive. Engineers at Volvo Aero are now able to create complex jet engine parts by simply entering into its knowledge-driven software application functional specifications such as aerodynamic definitions of gas flow, key geometrical interface positions, cost requirements and assembly methods. The software automatically compares and matches this data and guides engineers as they define the required product configuration. The engineers have the right knowledge at their fingertips during every step of the process.

Collaborative environments:

- Enable teams to establish virtual communities where they can perform one or more collaborative processes – including forming outsourcing teams, conducting program concept studies, performing program and design reviews and managing product change
- Invite individual users to join virtual teams with membership drawn internally – from current company's user communities – and externally from the suppliers, allied partners and trusted customers to actively engage in the product lifecycle
- Capture ad hoc product knowledge that individuals generate informally (i.e., unstructured knowledge that resides in emails, individual desktops and team members' minds). Team members leverage the collaborative community to access and share this knowledge on an informal basis

Product teams can take the unstructured product knowledge they capture during the work day and easily integrate it with structured PDM information. This enables product teams to structure their ad hoc product knowledge and re-use it in both current and future product lifecycles. Teams can also share and exchange both structured and unstructured product information in the same environment.

Individual users can be assigned personalized portal views so the product information they see and the processes in which they participate match their functional responsibilities. Team members can leverage a wide range of visual collaboration tools – including 3D product visualizations, instant messaging, digital calendars, digital schedules and process-driven workflows – to exchange knowledge, make collaborative decisions and gather lifecycle insights.

The next step is to apply captured information, transforming it into what Peter Drucker insists is the essence of knowledge: "actionable information." This is where linking information to other relevant data comes into play. A knowledge management system must be sophisticated enough to match the right data elements – for example, all the designs for the components that comprise a jet engine, or the history of all the molded plastics required for a line of toothbrushes.

If done properly, knowledge-driven automation can deliver significant benefits, such as dramatically reduced product development cycles. For example, over the last 20 years automakers and other manufacturers have effectively changed their business processes through the deployment of IT enablers featuring knowledge-enabled components. Building on PLM technologies such as CAD and PDM systems, they have successfully linked engineering and manufacturing knowledge to create effective knowledge management tools accessible by multiple departments and knowledge workers.

Because knowledge management requires sharing information across multiple groups and disciplines, investment in the knowledge management and IP initiative may be wasted if companies do not execute on the initiative consistently as a single team. It's not enough simply to capture knowledge; knowledge must be put to work through the implementation of better processes across the enterprise.

The next level of productivity will require leveraging knowledge that is developed and captured offline before program execution and applying it during the actual product program. Knowledge-enabled archetypes and built-in multidisciplinary validation tools contribute significantly in this area.

Knowledge-enabled archetypes

Companies need tools that can model not only product geometries but also capture the design intent and knowledge behind the product. This allows engineers to pre-validate the manufacturability of the product as opposed to identifying flaws after the fact through manual validation or quality control inspections. Knowledge-enabled archetypes have proven to be highly useful in this area, especially when running on a PLM platform supporting a knowledge-driven engineering and manufacturing initiative.

Knowledge-enabled archetypes are templates that embed product and process knowledge and make it available in the form of "recipes for success." These tools capture knowledge to support multidisciplinary validation early in the product lifecycle, thereby ensuring rapid and successful design and build. The project lead and senior product designers often devise the framework of the archetype. Increasingly, however, companies are inviting all team members to contribute to the archetype, adding the checks and intelligence as they design the granular parts and features. Analogous capabilities for modeling products are needed on the process side.

There are several approaches for building knowledge-enabled archetypes. Some require extensive and costly custom programming and business process reengineering, whereas others require only incremental investments, are more flexible, and yield immediate returns. Though costly, knowledge-enabled archetypes built through custom programming and knowledge-based engineering technologies can yield large benefits.

Knowledge-enabled archetypes

Knowledge-enabled archetypes are templates that capture expertise and make it available as "recipes for success." These archetypes can include guidance on what needs to be done to create innovative products, how to effectively implement new designs, where to find key ingredients or components for products and what to avoid.

Knowledge-enabled archetypes allow users to collect a comprehensive storehouse of product knowledge. Designers will have quick access to the knowledge that went into all current products, plus detailed information on viable alternate approaches that were not used in the past but may prove highly feasible. All contributors throughout the product lifecycle add their "recipe" variations on specific products or process designs, allowing future designers to take advantage of a storehouse of useful options.

Knowledge-enabled achetypes are most useful when they are integrated into normal workflow. Over time, knowledge-enabled archetypes become a key part of a company's collective knowledge assets. Numerous processes become highly streamlined. For example, engineers are able to pre-validate the manufacturability of the product as opposed to identifying flaws after the fact through manual validation or quality control inspections.

Knowledge-enabled archetypes have proven to be highly useful in creating and speeding innovative products to market. They are especially effective when running on a PLM platform supporting a knowledge-driven engineering and manufacturing initiative.

The best PLM systems enable the capture and re-use of knowledge and facilitate the embedding of knowledge in day-to-day workflow processes. They include tools that team members can use to incrementally capture and apply knowledge as they perform their development and manufacturing tasks, as well as accessible tools for building step-by-step wizards that leverage and distribute the know-how of seasoned experts.

These capabilities ensure that marketing, documentation, support and design are supported by one centralized and coordinated system, so new employees can leverage the cumulative knowledge of the organization.

Multidisciplinary validation

Knowledge management and IP initiatives necessarily span multidisciplinary communities of practice (such as design engineering and manufacturing) and support mutual validation. If automated properly, multidisciplinary validation speeds processes across the product lifecycle by ensuring that all disciplines touched by a design or manufacturing change can validate its impact and ensure that needs are met from the beginning. This includes incorporating key product criteria, including check points for all processes and across disciplines. Validation becomes an integral part of the automated development workflow.

Multiple disciplines are involved in product development. Conceptual and industrial design, product design, engineering analysis and manufacturing are often separate departments that work on the design and manufacture of a product. The manufacturing personnel want to ensure that the product can be produced efficiently. The stylist wants to make sure that the surfaces of a vehicle body maintain continuity, so that it reflects light in an aesthetically pleasing way, and looks great at the auto show or on the dealer's showroom. So from each of their perspectives, they need to ensure that the design is valid.

The engineering analysis specialist wants to ensure that the product performs under service conditions using calculations or digital simulation. The manufacturing people have to validate a part to make sure, for example, that it can be injection molded (ensuring that there are draft angles and no undercuts, so it can be ejected from the mold). A service and support specialist would want to make sure that components are accessible for maintenance or replacement. So each discipline must apply its own domain knowledge in continuous monitoring and checks that validate the design as it develops.

As companies build multidisciplinary validation capabilities, they extend processes across disciplines and domains, allowing everyone to work on the same instance of product definitions. This ensures accuracy and synchronicity. As more knowledge is pulled in, more players are brought into the process and actively contribute. Also, validation is performed automatically across all domains, instead of performed in a separate validation process after the fact. With automation, checking moves to the forefront; it is no longer an afterthought.

Summary

"If we had realised the value of capturing and re-using knowledge in our process when we were doing our evaluation…knowledge management would have been at the top of our selection criteria."
– Graham Blair, Unilever HPC

Knowledge is clearly a top corporate asset. According to the AberdeenGroup, "the ability of enterprises to manage the knowledge in their organizations is a prime determinant of overall financial and operating performance and a critical component of relative competitive position." The challenge is to find cost effective ways to capture the right knowledge and make maximum use of it throughout the product lifecycle. [AberdeenGroup, Learning and Beyond: Leveraging Organizational Knowledge for Better Business Results, 2005]

Knowledge management has become progressively more problematic in recent years. The growth of the amount of knowledge that product-focused companies must manage has grown explosively. As companies have become increasingly global they have had to manage more data within and outside of the enterprise. According to the AberdeenGroup, "knowledge workers today are losing productivity in an endless search for information that they know resides in the organization, but is not easily accessible." [AberdeenGroup, Learning and Beyond: Leveraging Organizational Knowledge for Better Business Results, 2005]

Despite the widespread use of computer systems, only a small fraction of corporate knowledge is effectively structured – that is, managed by enterprise-class applications. According to Forrester Research, fully 80 percent of a company's knowledge remains unstructured. Until recently, unstructured knowledge – such as that buried in paper documents, spreadsheets and email – has proven difficult to automate.

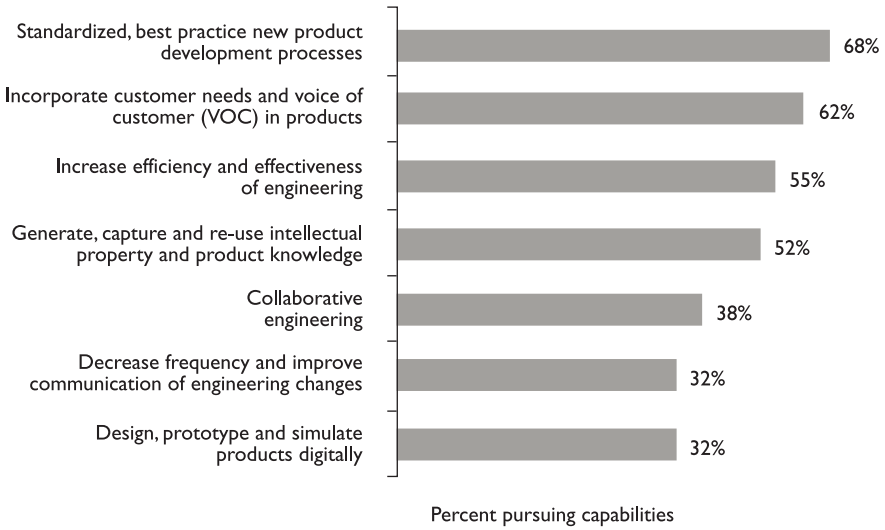
Many now believe that harnessing the power of unstructured knowledge is the key to continuous innovation. Gartner's 2006 report, Knowledge Management Enables the High-Performance Workplace, suggests that effective knowledge management initiatives are critical to keeping companies on the road to global innovation. Knowledge is the fuel that powers the engine of the high-performance workplace. And systems that are able to identify, capture and contextualize unstructured data represent the next frontier of corporate automation.

Case study: IMMI

A leading designer and manufacturer of safety restraint systems, Indiana Mills & Manufacturing, Inc. (IMMI) is committed to developing, marketing and manufacturing quality safety systems for the heavy truck, off-highway (construction and agriculture vehicles), child seating, emergency vehicle and outdoor industries.

Because its OEM customers demanded shorter lead times on inquiries and quotes for seat belts, the company launched a product lifecycle management initiative using knowledge-enabled engineering tools to automate the quotation and product development process. The company built a customized on-line product configurator that reduces a month-long configuration/quotation process to a few minutes. The system also improved time-to-market and product quality.

Product innovation capabilities to increase revenue



Source: AberdeenGroup, 2005

But what systems are most effective for knowledge management? There are plenty of knowledge management tools on the market – perhaps too many. Which is why companies should standardize their approach to knowledge management on a platform that makes the most sense for their business.

PLM solutions are often the best knowledge and IP management tools. For one thing, PLM is already focused on the most likely source of valuable knowledge – design and manufacturing. The best PLM solutions are designed to provide collaborative environments supported by a single source of product and process information. They provide open access to authorized contributors. To succeed, these systems must break down silos of knowledge and expertise, fostering instead a comprehensive, enterprise-level approach.

All physical products began as ideas, and new products leverage the intelligence embedded in legacy products. While the effort of implementing a successful knowledge management and IP initiative is considerable and can affect multiple departments across the value chain, the rewards can be substantial.

- Improved process efficiency by 70-80 percent or more
- Increased throughput/improved product development productivity: engineering changes 90 percent faster
- RFQ response 30 percent faster

Product-focused companies naturally value the tangible over the intangible. But knowledge management itself should be considered the most tangible of intangibles. After all, knowledge management delivers very tangible results.

Case study: Callaway Golf

Callaway Golf, a leader in high-end, breakthrough golf clubs and equipment, must continuously innovate in order to thrive. A knowledge-driven enterprise, Callaway structures the entire company around R&D. As part of a highly successful new product development initiative, the company formed a design group focused on advanced manufacturing concepts and powered by advanced product lifecycle management (PLM) tools with knowledge-management capabilities.

Callaway's new PLM tools enable the company's design group continuously capture and evaluate a wide spectrum of product knowledge. "The technology allows us to experiment with a far greater number of concepts than we would otherwise be able to do," says Alan Hocknell, Callaway's VP of innovation and advanced design. "And it also allows us to produce more extreme concepts than we would have been comfortable committing prototyping resources to in the past."

Many efficiency gains are attributed to the PLM system's knowledge management capabilities. Some design and tooling issues with suppliers are now resolved twice as fast as on past projects. Version control and notification capabilities keep design groups in sync and automated knowledge access speeds the delivery of increasingly complex products. "The club designs are much more intricate, but we are still able to get them to market in the same amount of time, or less than in the past," according to Steve Ehlers, Callaway's VP of product design and development.

About Siemens PLM Software

Siemens PLM Software, a business unit of the Siemens Industry Automation Division, is a leading global provider of product lifecycle management (PLM) software and services with nearly six million licensed seats and 56,000 customers worldwide. Headquartered in Plano, Texas, Siemens PLM Software works collaboratively with companies to deliver open solutions that help them turn more ideas into successful products. For more information on Siemens PLM Software products and services, visit *www.siemens.com/plm*.

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