Expanding the Enterprise: Breaking the Barriers to Collaborative Product Development

Learn How Best-Practice Technology is Enabling Partners, Customers and Distributed Global Teams to Work Together

Abstract

Product development has never been easy, but in today's global market, the pressures facing industrial manufacturers are greater than ever. With more and more stakeholders involved in the product development process, collaboration and communication are critical to driving competitive advantage. The fact is, the product development team has grown outside of the engineering department, to now include cross-functional internal resources, suppliers, partners, and customers located around the world.

Your challenge: to bring all these globally dispersed product stakeholders into the same virtual room – in real time – to help drive your next generation of innovative products. If you ignore this mandate and fail to connect your global team, your product development process is likely to become a long and painful effort marred by miscommunication, poor resource utilization, and costly rework. If you succeed, you will be leveraging a highly tuned network of global resources to maximize existing bandwidth, increase innovation, speed time-to-market, and reduce costs.

Cross-functional Collaboration: Extended Teams, Partners & Customers

In the vast world of industrial manufacturing today, there are as many 'flavors' to product development as there are product development organizations. While some see product development as merely synonymous with engineering, truly effective manufacturing organizations know that product development now involves a variety of cross-functional participants from marketing, procurement, manufacturing, sales, and service departments.

And in today's global manufacturing environment, many of these resources may not even be internal; ever-increasing outsourcing is now forcing suppliers and manufacturing partners into direct roles in the product development process. In addition, thanks to Internet-based communication and visualization tools, your customers—located down the street or across the ocean—now want more direct involvement in every facet of product development.

The growing ecosystem of participants in product development is adding massive complexity to the product development process. These cross-functional, interdepartmental, and external third-party team members are bringing with them multiple priorities, drivers and expectations that have to be consolidated and managed. Decision-makers with varying degrees of engineering knowledge must be able to review and provide feedback on design and execution at multiple stages of the product lifecycle.

In addition to integrating these new human resources into the process, you must also take into account the corresponding technology systems and processes they bring with them into the development cycle. These technologies and processes must also be incorporated into your product development lifecycle, so that all involved can exchange, interpret and retain data and present it in a way that is relevant to each user. In practical terms, this means your collaborative processes and supportive technology must be highly optimized to coordinate so many access points and to manage each project's timeline, scope and ultimate success.

When Physical Distance Increases Product Development Complexity

Another barrier to success, which most industrial product design teams face in today's world of global product development, is physical distance. True, technology and communication advances now provide instant access to a global talent pool, and manufacturers are taking advantage of these new resources. In fact, in a 2008 survey conducted by PTC of more than 350 industrial decision makers, 89% of those surveyed reported working with global teams on product development. However, managing a global development team means that you must collaborate while dealing effectively with multiple time zones, language barriers, cultural differences, and in-county laws and regulations, among other factors.

Despite these inherent challenges, many manufacturers see multiple reasons to engage global resources. Some firms are setting up design centers in low-cost areas so as to lower operating costs and increase profit margin. Some are tapping into overseas labor markets because of a shortage of skilled engineering resources in their own geographies. Some are acquiring companies overseas, then integrating them into their current product development infrastructure. Still others are partnering with third-party vendors to deepen their portfolio with specialized expertise, or opening local offices to provide regional support to targeted overseas markets.

Regardless of their motivation, companies are finding that distributed global product development is a proven method of staying competitive in an increasingly global playing field, and it is a trend that is only increasing. In fact, in the previously mentioned survey, over 44% of respondents said that globalizing key business functions and processes was one of their top three corporate initiatives, up from just 28% the year before. While advanced technology, processes and tools have made these long-distance collaborations more likely, the very nature of physical separation still adds additional complexity to the collaborative relationship.

So, how do you successfully build these global, cross-functional, collaborative product development networks? Achieving effective collaboration often requires manufacturers to alter their processes and their product design structure – changes that industrial companies have historically been reluctant to make. As a result, many fail to realize the anticipated ROI. Gartner Group studies show that about 50% of outsourcing deals – a predominant form of collaborative product development for industrial manufacturers – end in failure. Despite that statistic, nearly a quarter of the industrial decision-makers responding to the PTC survey said they needed to improve their collaborative global relationships. Realizing value from distributed product development requires an understanding both of the challenges of collaboration, and the tools, technologies, and processes needed to address those challenges.

The Challenges of Collaboration: Technology and Processes

Technology Challenges: Keeping the Product Data Set Complete and Secure

Technology is the single, underlying backbone of collaborative product development; it is the advancement of information technology that has made most forms of collaboration a practical reality. Technology – including data management, project management, or web-based collaboration tools – enables manufacturers to manage the entire lifecycle of a product, from its conception, through design and manufacture, to service and disposal. This extended product lifecycle, known as the "Digital Product Value Chain," incorporates a variety of processes and supporting software systems. The two main components of the Digital Product Value Chain are Product Lifecycle Management (PLM) and Enterprise Resource Planning (ERP). PLM refers to the creation, management, and sharing of product development information, and includes tools for design (CAD/CAM/CAE), engineering content and data management, process management, documentation management, engineering calculations, and visualization.

ERP, also known as Manufacturing Resource Planning (MRP), includes operational planning, order management and financial planning, and material requirements planning (including both worker resources and raw materials/parts), and product data management. For both PLM and ERP, the underlying functions can be comprised either of a single system, or point solutions connected with multiple integrations. PLM and ERP systems are each typically independent but integrated, as the functions of each vary too widely to be managed within a single architecture.

Typically, new product development begins in the product development system – that is, the software application or set of applications that encompass all the aspects of PLM described previously (CAD/CAM/CAE, etc.). For most engineers, this solution set is the primary technology used for creating, managing and sharing product development information. The complete product design that is created in the product development system will be translated into a bill-of-materials (BOM) and communicated to the ERP system for manufacture and assembly.

Because the product development system is the main collaboration tool used during product design, it has a direct impact on the ability of extended teams to work together effectively. Today's best-in-class product development systems allow industrial manufacturers to:

- **Get Digital.** By eliminating paper and moving to a purely digital product modeling approach, companies can make their intellectual property highly portable between locations, third-party partners, and internal team members. It is this portability that allows engineers in dispersed offices and across multiple time zones to collaborate on product design around the clock. The consistent use of 3D CAD (computer-aided design) software, in particular, is a prerequisite to any meaningful outsourced design strategy, while the use of complementary CAM, CAE, and visualization technologies is required for these partnerships to realize their full potential.
- **Get Control.** Using an effective information and process management environment, companies can fully capture digital data content, securely control its various versions and configurations, manage concurrent changes, and automate the flow of information between members of the product development team. Having a baseline of information and process control is a critical prerequisite for avoiding chaos during the transition to, and ongoing operation of, global product development.
- **Get Global.** The introduction of Internet-based collaboration technologies enables companies to establish "virtual team rooms" that allow dynamic sharing of digital product information across both geographic and company boundaries. When collaboration tools and data management solutions are integrated, companies can share enterprise information with offshore partners in a select and secure manner, thus boosting productivity without compromising the proprietary nature of intellectual property.

In addition to having your human resources sharing information during the product development lifecycle, various technology systems must also share data created during product design as well – including both downstream ERP systems and, quite frequently, other internal and external product development systems. To limit the number of needed data transfer points, an effective product development system will support as many of the varied PLM functions as possible in a single, integrated system. Picking and choosing product development "pieces" – for instance a CAD tool from one vendor, a data management tool from another vendor, and a documentation tool from a third vendor, is a strategy that might seem, on the surface, to provide more options. Alternatively, it may seem like too great an effort to move users from a pre-existing "legacy" system to a new product development system, motivating manufacturers to keep some PLM tools even when choosing a new product development vendor.

Integrating multiple product development technology 'pieces' usually requires massive resource efforts, and in the end may result in poor system-to-system communication, slow and cumbersome transfer processes, and data loss. The lack of data interoperability and the need for ongoing integration maintenance required of a non-integral product development system can make product development unnecessarily complicated and costly to maintain – for the system integrator, the system administrator, and the manufacturer.

At a technical level, these architectures suffer in terms of usability, performance, scalability, security, and availability. Also, by retaining legacy systems for some aspects of product design, you may be retaining technology that does not offer the most up-to-date features and functionality, which limits the efficacy of the entire solution.

Conversely, with a single, integrated product development system, all of the application's features and functions work together seamlessly, allowing integration teams to focus on links to other enterprise systems. This approach has far-reaching future benefits as well, as it allows for an easier routine upgrade and update processes, as a finite number of integrations to the ERP or other PLM systems need to be updated in kind.

While, ideally, each facet of the Digital Product Value Chain is managed by only one enterprise solution, such as one ERP and one PLM system, with little or no duplication, this is frequently not the case. As a result of acquisitional growth, department-level decision-making, distributed implementation resources, and company politics, companies often find themselves working with duplicate or overlapping internal systems. For example, within a single company, engineers in North America may be using one CAD tool while engineers in an acquired division in France may be using a different CAD tool, even though the two groups are working together on the same design. When internal teams must work with disparate tools and systems on the same product development projects, there is often a dramatic negative affect on collaboration. While in some cases the manufacturer in this situation can choose to migrate to a single, company-wide tool or system, the available resources or lack of centralized support for such initiatives often make integration between existing tools the only feasible solution. Integrations between these systems must ensure that product data, including change and configuration history for product designs, is fully usable across tools, so as to prevent costly rework.

Even without system duplications, some integrations are necessary; any product development system must share data with other systems during the product lifecycle. Because product development is by its very nature an iterative process that requires changes at all stages, data that passes between PLM, ERP and other enterprise systems often goes in both directions, as opposed to a simple 'push' from one system to the other. This means that integration between these systems must be able to manage a broader set of product and design data points than each system needs individually, to ensure that information is not lost during these bi-directional flows.

Finally, because your partners and customers involved in product development are generally independent entities with autonomous decision-making teams, they may be using an entirely different set of tools for their function in the product lifecycle. This can be an issue for collaborative product development, when product data must be passed to and from external partners. The needs of these partners, in terms of data-sharing, can vary from relationship to relationship; some partners might need full access-control when participating in product design, while some may just want to view the product model to ensure their component is compatible with the existing design.

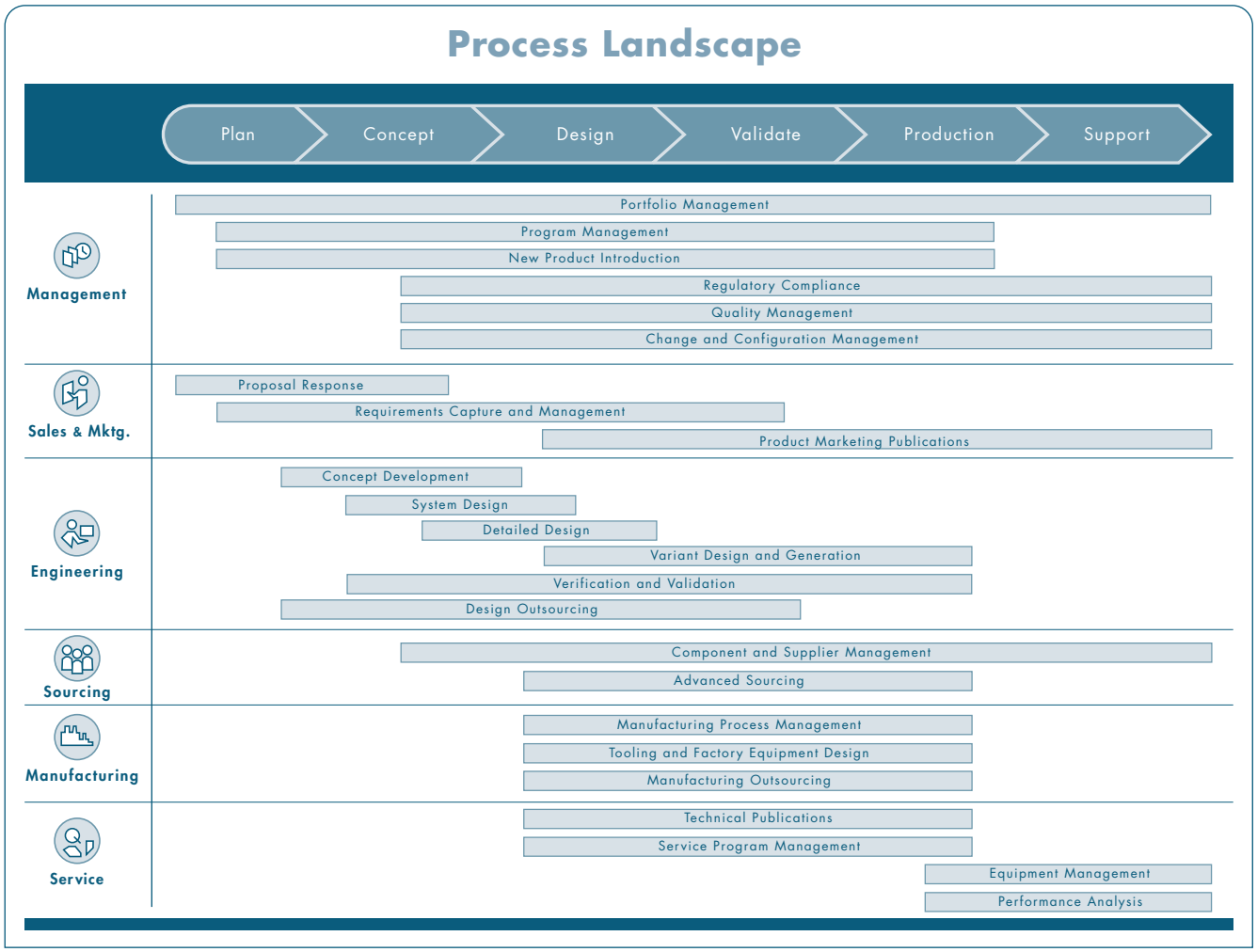
While the responsibilities and the level of interaction with partners and customers in the product development design chain may vary, there is generally at least some level of integration needed. In addition to providing partners with access to the data they need, these external integrations must account for multiple, role-driven data access rules, data security, and the retaining of change and configuration history (or audit trail) when data moves back and forth between parties.

Given the extended nature of current product development processes and the significant transfer of electronic and digital content on a day-to-day basis, technology is now a critical part of any secure data management scheme. For industrial organizations to operate safely and securely, they must incorporate both technology tools and processes that deliver seamless integration across distributed product development participants. All these parties must be plugged into the process "at the right time, with the right access to the right data." This challenge is heightened due to the complexity of product data and the robust nature of industrial product development processes today. To support effective internal and external collaboration, companies must carefully consider their security needs, including the integration between the disparate systems, the overlying process definition, management, and governance, secure end-user access, and security of data and data exchange.

Process Challenges: Moving Data through the Product Lifecycle

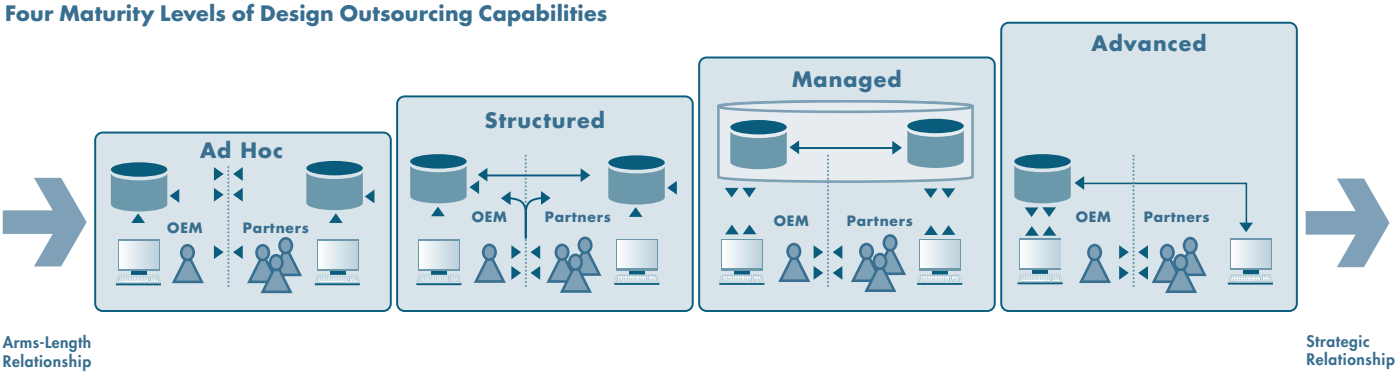
In tandem with technology, processes are central to establishing effective collaborative relationships – with highly effective processes being critical to successful collaboration. Without effective processes, even the best technology infrastructure will be less effective. Just as product development includes many cross-functional participants, cross-functional processes are involved as well. Implementing effective processes requires a full understanding of your entire organization's cross-departmental product development processes, and how the product development lifecycle impacts those processes.

For instance, you need to understand your company's Proposal Response process in order to understand how changes to an outsourced component will affect that process in the future: How will the change affect development costs, product time-to-market, and variant options? How is this information distributed to teams preparing customer quotes and proposals? How are special customer requests, which are outside the partner's current capabilities, addressed? How is feedback from customers or the service department communicated to the partner? And what is the process for incorporating this feedback into later versions of the component?



Cross-functional Processes of the Digital Product Value Chain

Four Maturity Levels of Design Outsourcing Capabilities



In addition to internal processes, your partner's processes will also impact your ability to collaborate effectively with them. Collaborative design relationships between manufacturers and partners can vary, and are sometimes defined by the "maturity level" of the shared processes. The maturity level of a process can range from being 'basic', that is, undefined and ad-hoc, to an advanced level where processes are formally defined and supported by integrated technology. The above graphic depicts four maturity levels exhibited by companies who are outsourcing design capabilities. Each higher step depicts how advancement in maturity level leads to more collaborative and strategic relationships, which ultimately drive greater value. Below is a description of the characteristics of an organization that is operating at each level:

- Level 1: Ad Hoc Processes
  - Independent and ad-hoc design processes at both manufacturer and partner
  - Ad-hoc process for engaging and collaborating with design partners
  - Little or no virtual design collaboration or collaborative project management
  - Product data is exchanged using email and FTP, or by sending hard-copy documents
  - No transaction traceability or content management
- Level 2: Structured Processes
  - Formal design outsourcing process at a departmental or functional level
  - Controlled process for interaction and data exchange (manual or automated)
  - Manufacturer maintains different processes for each partner
  - Limited or no insight across different outsourcing projects
- Level 3: Managed Processes
  - Formal design outsourcing process consistently applied across the company
  - Common, controlled and verifiable procedures – often automated – for collaboration and data exchange
  - Overall project management with shared design milestones and deliverables
  - Process enables early design-partner involvement and fosters strategic relationships with partners
  - Close collaboration and ongoing design feedback during the lifecycle of the project
- Level 4: Advanced Processes
  - Formal design outsourcing process used consistently across company and partners
  - Process accommodates multiple types of partner relationships, from arms-length to strategic
  - Manufacturer and partner each have identical design tools and methodologies

By having an understanding of the maturity level of various relationships – not only the current level but the desired level as well – manufacturers can better identify process deviations, as well as their integration needs and collaboration challenges. Keep in mind, however, that the ideal maturity level can vary based on your goals and the constraints of your partner relationship. For instance, Level 4 maturity may not be appropriate in all cases. If you need to make changes to processes, procedures and technology to reach the ideal maturity level, then you'll need to create a plan to properly manage the process. Your plan should consider not only the desired goal of changes, but also how much effort and time are required for both the manufacturer and the partner to adopt the new processes. Without this plan, implementing drastic change can be nearly impossible, as it becomes a struggle to manage all of the required people, process and technology changes at a rate that product development practitioners and budgets can absorb.

Perhaps the one process that is most crucial to the success of collaborative relationships is the Change and Configuration Management (C&CM) process. Many industrial organizations today are attempting to manage a multitude of change processes across an extended global enterprise. Many companies still use manual, paper-based processes, while others use technologies that are either homegrown or custom-made, and yet others use myriad combinations of each, all in an attempt at automation. This lack of a single, standardized, automated C&CM process creates a variety of problems, most notably schedule and program delays, duplication of effort, added expense, and multiple avoidable errors due to the lack of visibility and accurate information.

Disorganized C&CM processes can also result in incompatible or inefficient synchronization of interdependent, but independently managed, product development activities, such as software, mechanical and electrical development processes, or development of connected product modules by separate design and manufacturing teams. If changes have not been effectively communicated and managed across these independent design and manufacturing teams, you may be faced with costly, time-consuming design rework very late in the product development lifecycle.

When working with partners and external teams who are passing data to and from enterprise systems, your in-house PLM system must have a defined change management process, as well as highly effective integrations and inherent configuration management capabilities. Designers and manufacturers need immediate visibility into changes and configurations being made to the product design, and must be able to immediately identify any changes in product design that could jeopardize integration with the larger product interfaces or manufacturing.

Solving Collaboration Challenges: Technology, Processes, and Integration

Technology and Processes

As daunting as the challenge of creating a collaborative product development relationship may seem, the economic and competitive benefits make it an initiative that the majority of industrial manufacturers deem worthy of pursuing. Collaboration throughout the entire product lifecycle, from design to manufacturing and beyond, can be done effectively with best-in-class technologies and practices. By choosing the right technology platforms, by consolidating duplicate and overlapping systems, and by creating highly effective system integrations, industrial manufacturers can create a strong technology foundation for successful collaboration practices.

Today's best-in-class PLM and ERP technologies are able to support effective processes via automated workflows and advanced capabilities. 'Automated' means that product data is moved from one step in the product development cycle to the next, triggered by events or the completion of tasks. On the PLM (Product Lifecycle Management) side of the Digital Value Chain, in the product development system, this data can include MCAD and ECAD data, calculations, illustrations and technical publications. This entire set of product development data, including a history of changes, moves through the product lifecycle as a single representation of the entire product. Because the entire set of data needs to be kept complete, yet also needs to be filtered based on the needs and rights of the user, the product development tool should be a single, integral system that incorporates a common database schema, business objects, process models and web-based user interface, including single login.

The most effective product development systems work natively with the many forms of product data that must be shared across resources, including data generated from other PLM systems. This results in faster data conversion and transfer, data presentation that is appropriate to the role of the specific user, and workflow management to keep complex, multi-departmental schedules on time.

In addition, a system architecture that is built upon industry standards is better able to support the variety of users who must participate in product development workflows – including people from various departments within the company, as well as external users, such as suppliers, partners and customer communities.

The ultimate purpose of the product development system is to optimize the business processes that companies need to execute in order to develop competitive products and achieve their business initiatives. A system that merely delivers a hodgepodge of features and functions is not optimized to facilitate the execution of specific business processes. Recognizing the fact that business processes are what drive product development, best-in-class solutions automate and optimize business processes, both those that are contained within the product development solution and those that extend beyond into other enterprise PLM and ERP systems. Consolidated enterprise systems can also play an important role in increasing a company's competitiveness by allowing continuous improvements and automation of business processes and procedures.

By starting with a solid product development system base and an understanding of the related product development processes, you can focus your integration efforts on connecting PLM with ERP and coordinating with other best-in-class solutions for other enterprise capabilities (CRM, etc).

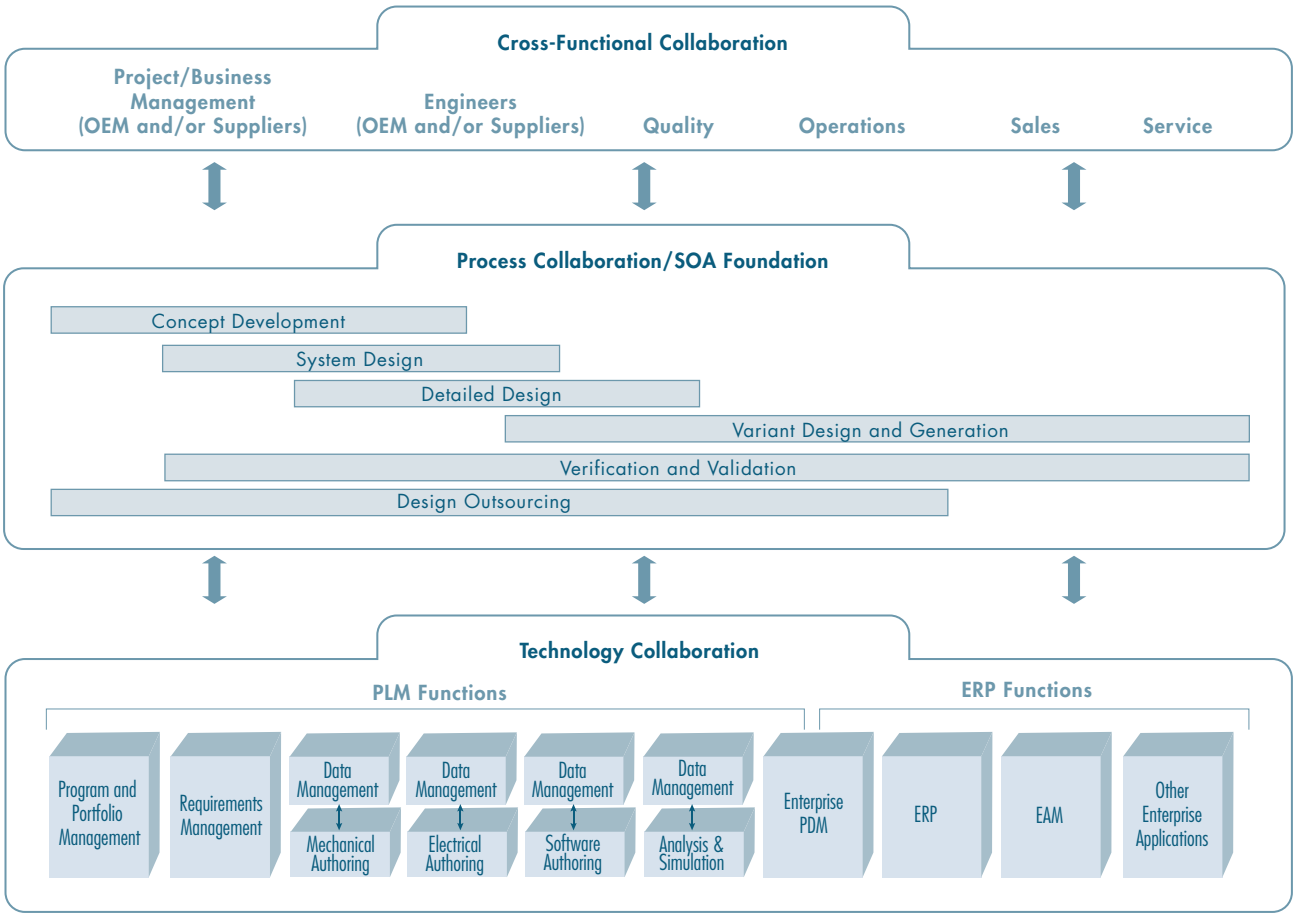
Implementing End-to-End Digital Product Value Chain Processes and Solutions

When implementing PLM, ERP and other enterprise solutions, industrial manufacturers often attempt custom integrations. Often, this 'one-off' approach can fulfill the needs of a given business process. However, one-off applications typically require high levels of ongoing administrative attention and manual exception handling. In most cases, companies don't recognize or understand the high cost of resources – human and financial – consumed by the ongoing administration of their application interfaces. The more custom code a company develops, the more code it must maintain, using either its own IT department or an outsourced development service. Beyond the resources needed to create custom software code, resources are also needed to test and implement this code; these tasks are difficult and time-consuming for most traditional IT departments who, as a rule, are more likely to leverage commercial applications whenever possible.

One of the most difficult aspects of working with customized software applications is that every time a new release of the source code or target software is available, much of the development process has to be redone. Scalability is also an issue with custom integrations; as business processes expand to support a growing enterprise, they often fall short of evolving business requirements and are too inflexible to accommodate additional systems. Inevitably, the shortcomings of these integrations are "fixed" with manual processes that are resource-intensive and prone to error. The result is pockets of efficiency with significant process and information gaps in the overall enterprise system.

Commercial middleware applications are helpful, but they don't offer any business logic to support manufacturing business processes, thus leaving a significant portion of the integration efforts to in-house or outsourced third–party integration teams. As a rule, traditional approaches to integration don't yield all of the expected benefits.

SOA Foundation and Reference Architecture



Effective integrations consider not only the technology platforms that need to be connected, but the business processes that these technology platforms are intended to support. Business Process Management (BPM) is a discipline that combines software capabilities and business expertise to accelerate process improvements and facilitate business innovation. BPM relies on an enabling technology called Service Oriented Architecture (SOA), an IT architecture that supports integrating a business as linked 'services'.

SOA is a methodology or approach on how to integrate different software applications. It is not a software product or a communication standard. However, there are certain kinds of middleware and certain software standards that are typically used when implementing an SOA solution.

When integrating two enterprise applications, there are typically three main components:

1. An integration layer or module for the first application that utilizes an Internet communication protocol such as XML
2. A middleware application (such as IBM WebSphere)
3. An integration layer or module for the second application that utilizes an Internet communication protocol such as XML

Protocols, such as XML, can significantly reduce the work involved in developing an interface. In addition, an existing interface can be reused with other applications instead of having to develop a new interface.

SOA can greatly lower the amount of effort in developing composite applications that rely on information from a number of different applications. SOA also enables IT to simplify application and system integration, and to better reuse existing applications. Thus, the overall business value of SOA is that it lowers the IT total cost of ownership.

Helping manufacturing companies extend the value of their investments in enterprise applications, by better leveraging vital data across the enterprise, will not only improve collaboration, increase productivity and reduce the time and cost to bring new products to market, but it will also enhance the strategic importance of these applications to all users in the enterprise.

The combination of PLM with SOA concepts eliminates integration and process complexity issues by changing the way data is structured and handled. With this approach, a 'federated' information mechanism, based on open standards, is created, from which all applications access and share data. Here, business processes exist independent of specific applications and are viewed and accessed by all companies participating in a product development value chain. This allows business flexibility and better responsiveness to changes in the competitive landscape. Portals provide access and visibility into all business processes relevant to particular user roles, enabling support of better business decisions as well as role-based access to information.

Why Is 'SOA for PLM' Critical for Collaboration?

A truly successful Digital Product Value Chain requires an understanding of:

1. The 'big picture' view of the enterprise technology systems involved in the product lifecycle
2. The interdepartmental processes that are affected by product development and product management
3. The interrelation between technology systems and processes

This big picture view includes both internal processes, and the related processes of your partners. Thus, in order to be successful, any related integration effort must also consider all of these extended, collaborative relationships. Only with these relationships in mind are you best able to:

- Formalize repeatable processes around best practices at all levels
- Improve people's capabilities to execute the processes in day-to-day work
- Deploy software and service capabilities designed to support process
- Plan the changes to coincide with product development programs

Mapping out the processes enables you to identify integration points between your processes and your partners' processes. This allows you and your collaboration partners to:

- Establish a common understanding of terminology, scope and relationships between processes selected for improvement
- Provide the basis for validation of process flow, including tasks, roles and software alignment at multiple maturity levels
- Provide documentation of multi-level, best-practice procedures for training

By eliminating traditional information silos and making vital product information visible throughout an enterprise, an SOA-enabled Digital Product Value Chain connects the distinct systems, processes and resources, and creates a unified source of all product information. An SOA-enabled, end-to-end solution provides business decision support, increases flexibility and responsiveness, and improves integration with the value chain, enabling CEOs to continually innovate their products, their business processes, and their PLM infrastructures. SOA also creates an ecosystem in which multiple solution developers, integrators and IT consultants can collaborate, replacing competition with cooperation – a profound benefit to the client.

By permitting heterogeneous hardware and software to operate together smoothly through a shared commitment to open standards, SOA truly delivers on the long-held client dream to mix and match best-of-breed PLM and ERP applications to achieve a system uniquely suited to their special goals and challenges. The result can be client solutions tailored for the various industries, such as aerospace and defence, automotive, consumer products, electronics and industrial products.

Conclusion

For many of today's industrial manufacturers, the Digital Product Value Chain involves cross-functional, interdepartmental, geographically dispersed, and third-party team members, along with a variety of technology applications, and a plethora of interrelated processes. Progressive manufacturers must move away from silos of information and processes, and transition towards a view of the product lifecycle as an integrated flow of product data.

To optimize collaborative product development, whether you are collaborating with internal or external resources, you must have a complete view both of technologies and processes in order to succeed. Companies are most successful in attaining the value they expect from collaboration initiatives when they follow these best practices and supporting methodologies:

- Build PLM process on a strong, integral product development technology foundation. Best-in-class product development systems make engineering data and intellectual property highly portable, eliminating the barriers of time zones and enabling collaboration on product design around the clock. They support the control of product information and the management of changes and configurations – which becomes increasingly important as product data moves to and from other PLM and ERP systems. Product development systems should also support the sharing of information with partners in a select and secure manner, enabling productivity without compromising the proprietary nature of intellectual property.
- Understand your organization's end-to-end product development processes. Include those processes that happen both internally and externally with partners. By looking at product lifecycle processes across all departments – and not just those processes within your engineering department – you can anticipate which concurrent, dependant, or intersecting processes will be affected by changes.
- Effective product development collaboration requires effective product lifecycle management, or PLM. For effective PLM, both the technology tools and the business processes that support the entire lifecycle of product data need to be connected. These integrations must incorporate an understanding of the enterprise technology systems and the interdepartmental processes that are affected by product development, and how these systems and processes are interrelated. This big picture view includes both internal processes, and the related processes of your partners.

Whether you need to respond to increased competition, or you need global resources to meet engineering bandwidth demands, you must develop strong collaborative relationships to be successful. Without the right technologies and processes in place, productivity will decrease, changes will take longer to manage, costs will go up, and time-to-market will suffer. Effective collaboration is not just a bonus; it can make the difference between sinking or swimming in a competitive global market. Understanding the challenges of collaboration, and how to best address them through technology, processes, and a "big picture view" of the Digital Product Value Chain, is the secret to realizing the potential benefits of these new product development opportunities.

Above all else, when optimizing your processes, choose technology providers who offer best-in-class solutions, proven expertise, and an understanding of the entire product development lifecycle. Whether your organization consists of distributed internal teams, or a network of global design partners, you should select providers that understand the product lifecycle framework both inside and outside of the internal engineering department, so they can help you achieve success.