

Tech-Clarity

making the value of technology clear

The Complementary Roles of ERP and PLM

**Leveraging Enterprise Applications
to Maximize Product Profitability**

Introduction

Choosing from the menu of available enterprise applications for manufacturing is a confusing and challenging task. Enterprise applications such as ERP, Supply Chain Management (SCM) and Product Lifecycle Management (PLM) help companies meet their strategic goals and run their businesses more efficiently and effectively. Today, software technology is embedded in almost every aspect of business, and helps companies implement their strategies to be more competitive, increase revenue and enhance profitability. While the need for—and benefits available from—enterprise applications may be evident, the path to achieving that value is not always as clear. For manufacturing companies in particular, choosing applications from a diverse array of vendors offering applications with overlapping claims of functionality can be frustrating.

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One particular area of confusion in today's enterprise application market is choosing the right solutions to enhance product profitability. The primary goal for product-oriented companies—whether they are manufacturers or brand owners—is to offer competitive products that provide solid financial returns to the business. To achieve this, these companies must have well-defined business processes for product development, engineering, and product management. In the past several years, interest in Product Lifecycle Management (PLM) business processes and software applications has increased as a way to address those needs. PLM strategies have proven to provide significant benefits to companies adopting them, but have also added complexity to enterprise application strategies because of confusion between the roles that ERP and PLM should play.

One particular area of confusion in today's enterprise application market is choosing the right solutions to enhance product profitability

ERP and PLM play key roles in enterprise application strategy for manufacturers—but they are certainly not the only ones. Customer Relationship Management (CRM), Supply Chain Management (SCM) and others can play important parts in supporting the business. Unfortunately, these application suites also provide overlapping capabilities with ERP. For the purposes of this paper, however, we will focus on the need for manufacturers to develop clear product development strategies and support them with appropriate enterprise applications. The paper provides an overview of the roles that ERP and PLM can play, touches on some examples of how companies have approached the use of these applications, and introduces some key considerations to help manufacturers determine the right application approach for their business.



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Business Strategies

The primary reason for a business to exist—if not the only reason for a business to exist—is to make money. Company executives are responsible for developing strategies that improve the performance of the business and provide a solid return for the shareholders. The business strategy for two companies in the same industry may be very different, of course, because there are often multiple successful options. One manufacturer, for example, might decide to compete by being a “*fast follower*.” They may not innovate as well as other manufacturers, but they can study the innovations of others and rapidly incorporate those innovations into their own products. Another manufacturer may decide to compete by being the “*low cost provider*”, servicing customers that are willing to sacrifice on innovative product features in return for a lower cost. Still another company may compete as an “*innovator*”, focusing their attention on continually bringing the newest and most appealing products to market. What is important is that a company proactively defines their strategy and manages the business according to the strategy. No one business strategy is right for any given industry or set of market conditions, but having a strategy is critical.

Enterprise Application Strategies

You can't “*cut and paste*” your application strategy from a competitor or from a research report. In the same way that a generic business strategy does not apply to all companies, no one application strategy is right for a given manufacturer. This paper does not attempt to offer a “*one size fits all*” answer, but provides guidelines to help align application roles properly to help achieve the business strategy. Manufacturers must choose which functions will be carried out by ERP, which will be supported by PLM, and which will be supported by other applications. This is an important decision, because the approaches and capabilities to address a particular business need can be very significantly different between ERP and PLM.

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Companies have to choose the right tool for the right job. The decision on which application should support a given function must be made on strategy, but also based on an analysis of the capabilities of each system. Some functions will be easy to assign to the appropriate application based on the kind of company and the available features, but other decisions may be more difficult. For example, there are widely different strengths and weaknesses between ERP and PLM for developing product costs. ERP, for example, may provide visibility to historical procurement costs. PLM, on the other hand, may be a better source for developing costs for new items.

Analysis of application capabilities is particularly important as more ERP vendors begin to offer PLM solutions. For best results, the analysis of ERP and PLM should extend beyond the product into the software vendor's capabilities for training, provision of best practice templates, business knowledge and solution implementation. One important consideration when defining the roles between ERP and PLM is that software vendors can't be expected to define the appropriate boundaries for applications—the manufacturer must do this for themselves.

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ERP and PLM are very different. The ERP market is relatively more mature and more commoditized than the PLM market, with many products having similar product footprints and capabilities. Because of the relative maturity of ERP, the selection of the appropriate PLM system may have a greater impact on the business than the selection of the ERP system. superDimension is the manufacturer of the Bronchus medical bronchoscopy system which was recognized by MIT's Technology Review magazine as one of the "Five killer patents of 2003." In an interview last year about their SMARTEAM installation, superDimension's VP operations Yoav Ron commented that "superDimension found it advantageous to install PLM before ERP because in the early stage of a company, when they just begin design, the ERP functions are not so important. It is more critical to focus on building the product infrastructure for configuration management and for cataloguing, which will make it later much easier to have the ERP complement the PLM and not vice versa." Manufacturers must develop an application strategy like superDimension did for their applications —although tailored to their own business—and then put in place a program to achieve it. This strategy must take into account the relative value and priorities of PLM and ERP, leveraging the power of each.

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- Yoav Ron, VP operations superDimension

The Power of ERP

Let's look at what makes ERP valuable. The primary value of ERP comes from integrated business processes. ERP came to prominence at a time when companies were focusing on streamlining the flow of transactions and information across departmental boundaries. Functions that were previously handled with narrowly focused software solutions were incorporated into a broader view of the flow of business. As departmentally-focused decisions and ways of doing business were being re-evaluated—or reengineered—ERP provided a structure to help different areas of the business work more effectively together. The way that ERP helped to break down departmental barriers was to focus on two central themes—managing orders and financial control.

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ERP Theme – Managing Orders

ERP is very good at managing the flow of materials. The first theme that ERP focused on was the flow of orders through a business. ERP evolved from Manufacturing Resource Planning (MRP) systems that were designed to balance the flow of demand and supply for products. The process that most manufacturers were using did not provide a well-structured approach to predicting customer demand for products, planning the appropriate inventory to address that demand, capturing orders from customers and then satisfying the demand by supplying the appropriate products at the right time. ERP united disconnected steps of order-related transactions and decision-making to improve the level of responsiveness to customer and market demand changes.

ERP is very good at keeping a business in control

ERP Theme – Centralized Control and Accounting

ERP is very good at keeping a business in control. The second theme that ERP adopted was centralized financial and cost accounting. As ERP captured transactions across multiple business areas, it provided a level of financial control and visibility that was previously unachievable. By providing a comprehensive visibility to the flow of goods through the business, ERP allows manufacturers to identify bottlenecks and improve process efficiency by highlighting key areas of opportunity. This approach has also greatly improved the speed, accuracy and level of control over the fiscal performance of the organization.

The ERP focus on control dictated a technical approach. To accomplish integrated order flow and accounting, ERP required an integrated data model. Previously disconnected information was now assembled and managed in a centralized, structured database approach. ERP paved the way towards a highly structured, centralized view of the operations of a business. This integrated data model provides numerous benefits, including the ability to summarize, report from and mine the database in order to make better business decisions.

ERP Focus
Balancing Demand and Supply
Managing Orders
Cross-Departmental Transactions
Integrated Business Processes
Central, Relational Database
Operational Efficiency
Financial and Cost Accounting

Table 1: Focus and Themes

ERP was intended to cross organizational boundaries of the business. Unfortunately, due to the transactional focus of ERP applications the product development and engineering functions were left out of the streamlined business processes. To be fair, few R&D or marketing leaders were clamoring to be involved in the projects. The Engineering and R&D departments continued to develop their own solutions in parallel to ERP in order to continuously improve the way that they brought new products to market—resulting in today’s powerful PLM systems.

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The Power of PLM

Now, let's look at what makes PLM valuable. The primary value of PLM, similar to ERP, comes from integrated business processes and information. The flow of work and data required to manage a product through its lifecycle, however, are by their nature not as linear and structured as those addressed by ERP, which focuses on transactions. This is not to say that product research, design, development, introduction and management processes should not be disciplined. Innovation-related processes still clearly benefit from streamlined processes flows, data sharing, visibility, and centralized information. But the requirements to manage the product innovation processes rely much more on flexibility and the ability to manage large volumes of information and complex relationships. To make matters more challenging than ERP, the data does not lend itself to be stored in simple table structures, but relies on complex geometric models in Computer Aided Design (CAD) and more free-flowing information found in documents. The power of PLM, therefore, comes from the ability to effectively provide enough discipline and control on the product innovation environment to allow people to share information and follow best practices, while simultaneously providing a flexible, dynamic environment that does not hamper the creative process.

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PLM Theme – Managing Product Knowledge

PLM unlocks the value hidden in product data. The first theme that PLM addresses is the ability to manage the potential chaos inherent in designing a new product, bringing it to market and managing the product over its lifecycle. Introducing a product or product revision to market often involves multiple organizations, and is an iterative process of designing and refining products. Along the path to developing a product revision, a lot of learning occurs. New approaches may be tested, new materials may be employed, different suppliers may be called on to provide input, and customer feedback may be collected and analyzed. Much of this information does not get incorporated into the final product, but furthers the corporate knowledge at the manufacturing company. The ability to manage this knowledge leads to better product designs and faster, more efficient development practices. This information is also critical later in the product lifecycle to support the service lifecycle.

Product data is both broad and complicated. The information involved in a product design is often complex, and complex relationships mean that changes to one aspect of a product often unexpectedly impact other aspects of the product. Complexity and flexibility dictated a technical approach. To manage this information, PLM systems adopted a flexible data model that supports complex relationships between processes, projects, products and product designs. In addition, much of the information from the innovation process is difficult to access. PLM must be able to share information from within documents and needs to understand the CAD structure to share the information that is locked away in the CAD model.

“Given the variety of CAD designs we do, without a PLM system to manage electronic files, I can’t imagine how we would do it-- we would be lost”

- Ken Sellers, vice president of engineering Gunnebo Johnson

Gunnebo Johnson is a manufacturer of industrial crane equipment headquartered in Tulsa, Oklahoma. Gunnebo’s business requires them to be able to archive and retrieve product designs and customer documents rapidly. Prior to implementing a PLM system, they used a homegrown electronic document management system, but it could not handle 3D-CAD drawings which require a large number of files. “*Given the variety of CAD designs we do, without a PLM system to manage electronic files, I can’t imagine how we would do it—we would be lost.*” said Ken Sellers, vice president of engineering for Gunnebo Johnson. Gunnebo describes how PLM systems work very closely with the CAD information, understanding the complex links of files required to view a simple drawing. PLM really exposes the relationships between all of the information within CAD – it’s about the relationships and associations. “*Anybody that considers getting into 3D-CAD must have a management system like SMARTEAM,*” Sellers added. “*It would be an utter disaster without it.*”

Better managing product data is not the ultimate goal, of course. Better access to information allows manufacturers to decrease product and process costs by making the right decisions at the right time in the development cycle

Better management of product data is not the ultimate goal, of course. Better access to information allows manufacturers to decrease product and process costs by making the right decisions at the right time in the development cycle. Earlier decisions such as identifying a potential design flaw before production has been started can save tremendous cost. Better product data can also enable efficiencies that can translate into faster projects.

PLM Theme – Speed to Market

In product development, time is critical. Another core theme addressed by PLM is speed. The market rewards companies that get to market faster than their competition. Bringing a poor product to market fast, however, does not provide the desired rewards. Therefore speed to market must come from increased efficiency and better program management—not by cutting corners. In fact, some of the increased development speed can come from better management of product knowledge as discussed above. Companies that store disparate information in a way that it can be readily accessed can apply existing designs instead of duplicating past efforts. What's more, if they can readily access past history and product decisions, they are likely to avoid repeating past mistakes. By leveraging past investments, manufacturers can develop high quality designs in less time. Corecess Inc. produces telecommunications infrastructure products for the local access network. Yong Seok Choi, a section manager at Corecess, commented that PLM allows them to sufficiently manage projects by effectively managing all of their drawings, parts and documents derived throughout product development. *“Our PLM, SMARTEAM, contributes to reducing time for development and cutting our development costs,”* Mr. Choi explained.

Speed to market must come from increased efficiency and better program management—not by cutting corners

ABB Xiamen Switchgear also commented on the value that PLM plays in decreasing time to market. ABB Xiamen Switchgear specializes in the production, sales and service of medium voltage switchgear, vacuum circuit breaker and related apparatus. *“We are in a very dynamic market, most of our business depends on how fast we can respond,”* says engineering manager Andrew Xu, *“We saw a big return with SMARTEAM, dramatically cutting lead-times by 30% by automating a lot of manual work and doing some work in parallel.”* Mr. Xu went on to indicate that design lead-times were critical, because in the switchgear industry manufacturing design lead-time represent a large percent of the overall order lead-time. *“We more than doubled our business in two years,”* stated Mr. Xu, although he pointed out that those results were not all to do with PLM.

“Our PLM, SMARTEAM, contributes to reducing time for development and cutting our development costs”
- Yong Seok Choi, section manager Corecess

PLM Theme – Collaboration

Developing and managing products is a team effort. Another theme supported by PLM is collaboration. Collaboration is a topic that was highly over-discussed during the beginning of the Internet era. Enterprise application vendors, among others, proposed drastic changes to business models based on the ability to share information easily via the World Wide Web. With the benefit of hindsight, it is clear that the technical capabilities to collaborate have outstripped the pace of business adoption of the concept. Interestingly, one area that has delivered on the collaboration theme is collaborative product design. Product design collaboration may be as straightforward as sharing design information across departments—interdepartmental collaboration—or as complex as selectively sharing product design and project information across a multitude of customers and suppliers in a secure environment.

PLM Focus
Innovation
Speed to Market
More Profitable Products
Collaboration
Product Knowledge
Design Reuse

Table 2: PLM Focus and Themes

Sharing information internally across departments may seem like a regular occurrence for users of ERP. After all, with a centralized database any user with authority can see the transactional information they are looking for. For complex design data like a 3D CAD model, access to the data is not enough. Without access to PLM or the CAD tool itself, the data is worthless. PLM provides the ability to view a product design and its relationships and dependencies quickly, including drawings, thumbnails and three dimensional renderings—and even “*mark up*” the document with suggested changes. This ability has led to better decision-making at all levels of the organization, including the executive level, by extending the knowledge of CAD and project details to non-engineers and others that don’t typically use CAD or other tools used to create the data.

***For complex design data like a 3D CAD model,
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Moreover, PLM is truly being used for cross-enterprise collaboration. Unlike some collaboration ideas, design collaboration was driven by a real business need to shrink product lead times, improve design quality and support outsourced manufacturing.

ERP and PLM Roles

ERP and PLM both have their purposes. From the history of ERP and PLM it is clear that ERP and PLM systems have a different focus. Put simply, ERP supports operations while PLM supports innovation and optimization at the heart of the manufacturing business—its products. From a foundational level, PLM is a knowledge management application that was designed to manage a complex array of product information. This information is structured in order to provide rapid access and search capabilities to offer product knowledge and intellectual property to the right person at the right time. It is also designed to manage one core entity—the product—from the very beginning of understanding product requirements, through systems engineering and into the service lifecycle. PLM has grown into a business process centric application as well, managing the core processes that help to leverage the product for profit today and into the future.

Put simply, ERP supports operations while PLM supports innovation and optimization at the heart of the manufacturing business—its products

ERP also has a critical role in managing a manufacturing business. Few today would argue that they can keep a complex, multi-national business operating effectively without strong transactional support and financial control. ERP has been optimized to manage transactions and large volumes of historical transaction data, and to provide integration between different departments that must come together to satisfy customer orders. Mr. Xu explained that at ABB Xiamen Switchgear, they use ERP to drive manufacturing through production orders and material planning. “*ERP is for material handling and financial information—when to produce and by who comes from ERP,*” Mr. Xu said, “*PLM provides all of the product information.*” Mr. Xu described that no drawings are sent on paper to the factory, and that PLM handles all approval processes as well as feedback to the design engineer.

***“ERP is for material handling and financial information—when to produce and by who comes from ERP,” “PLM provides all of the product information”
- Andrew Xu, engineering manager ABB Xiamen Switchgear***

That is not to say that ERP can't play a role in product development. Mr. Choi of Corecess described the relationship of ERP to PLM for product development. “*For Corecess, PLM directly supports the product development process, while ERP indirectly supports it,*” Mr. Choi said. For instance, he explained, “*PLM contributes to reducing time for development and cutting costs by effectively managing drawings, parts and documents derived throughout the product development process.*”

Mr. Choi further described that when the product information was approved, the part and BOM information for the new product is transmitted to ERP through an approval workflow. “From that point forward,” Mr. Choi explained, “ERP supports development cost management and part purchase based on the data.”

While the Corecess scenario is relatively common, there are clearly direct roles that ERP can play in product innovation. Frequently, for example, current product costs are maintained in the ERP system and accessed by PLM to support design decisions. Likewise, some companies use PLM to support manufacturing operations. Gunnebo, for example, uses their PLM application to provide information directly to plant personnel. “On the floor, SMARTEAM has given immediate access to drawings that we didn’t have before,” explained Gunnebo personnel. “This is a significant time savings—people need information right at that moment. If they have to wait for Engineering to respond, it can delay an entire project.” In fact, PLM can provide value throughout the lifecycle of a product. Companies are finding ways to leverage clean, consistent product information in their PLM systems for more effective bidding, improved customer service, more efficient maintenance, managing regulatory requirements, data synchronization and numerous other ways.

ERP and PLM roles will vary by company. The way the business operates will dictate the relative priorities and requirements of PLM and ERP

ERP and PLM roles will vary by company. The way the business operates will dictate the relative priorities and requirements of PLM and ERP. This is also highly dependent on the way that a company competes for business. For example, an innovative company may focus much more of their efforts on top line growth and new products. They may rely on PLM to achieve the best possible designs and get them to market rapidly, while leveraging ERP to ensure that the product is produced with quality and to better understand customer demand. For those that are fast followers, rapid product design and execution are key. These companies may not focus as heavily on the design engineering aspects of PLM, but focus on the information sharing and new product development capabilities. In regards to ERP, fast followers may focus on making handoff from PLM and ramping up production quickly. For companies that compete by offering low cost products, PLM may focus on achieving the optimal product design and cost while ERP can provide tight control of purchasing and manufacturing operations to keep costs in line.

Clearly the roles and focus of each application will vary depending on the business strategy of the company, and the alignment of business processes to applications should be approached with this in mind. Table 3 compares of the characteristics of PLM and ERP to help companies determine the best fit for different functions in their organization.

ERP	PLM
Transaction Focused	Innovation Focused
Steady State	Manages and Promotes Change
Order Lifecycles	Product Lifecycles
Controlled Business Processes	Disciplined, but Flexible Design Process
BOM Aware	Complex Design Relationships
Final Revisions	Product Iterations and Decision History
Item Aware	Design Aware
Central Theme of Control	Central Theme of Speed
Enterprise Focused	Enterprise and Cross-Enterprise Focused
Order Focused	Project / Program Focused
Manage Cost Performance / Variances	Ensure Base Cost is Optimal
Rigid Data Model	Flexible Data Structure
Structured Data	Documents, Unstructured Information
Simple Data Relationships	Dynamically Related Data
Data Mining	Knowledge Search and Retrieval

Table 3: Comparing Characteristics of ERP and PLM

ERP and PLM – Better Together

Clearly a manufacturer can't choose between product innovation and corporate execution—both are critical elements of the manufacturing business model. Further, there is some amount of overlap between the two disciplines. This is equally true for PLM and ERP applications. Innovation and execution must work hand in hand to efficiently support a manufacturer. While the roles can vary by manufacturer, common integration points between ERP and PLM are new product introduction and the introduction of engineering changes. These are the functions within a business that have the most interaction between innovation and execution.

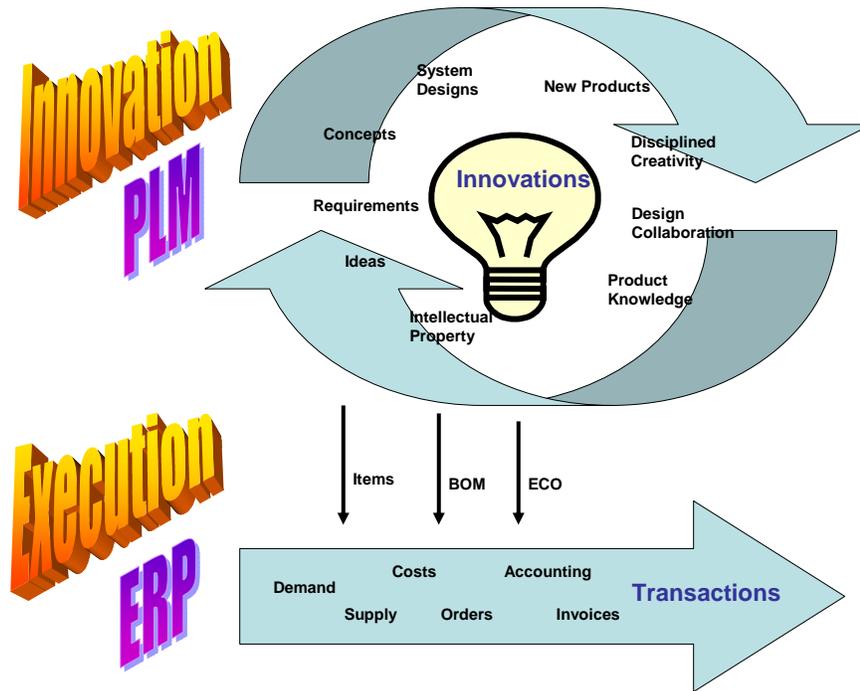
Clearly a manufacturer can't choose between product innovation and corporate execution—both are critical elements of the manufacturing business model

Working with ERP, PLM can play the innovation role for product development and introduction—providing a flexible environment to effectively manage the design and development processes. Working with PLM, ERP can effectively execute and manage the steady-state flow of fulfilling customer orders and managing the operations to ensure that costs are kept in line with plans.

Working with ERP, PLM can play the innovation role for product development and introduction— providing a flexible environment to effectively manage the design and development processes

ERP and PLM remain very different disciplines. Although some ERP vendors are now offering PLM-oriented solutions, the solutions from PLM vendors still remain the most robust options. PLM vendors understand the depth and richness of product information and relationships, and how to best leverage product-related data and business processes. In 2003, Tech-Clarity published a paper in Technology Evaluation, entitled Can ERP Speak PLM?, prompted by ERP vendors beginning to offer PLM solutions. Key findings from that report were that manufacturers should first make sure that the PLM functionality that they require is available from the solutions they choose—in other words “*Innovation is King*”. The paper also mentioned that significant value should be placed on integration—that is “*Integration may be Queen.*” The key takeaway from these statements is that while integration is very important, functionality must be considered a higher priority. For dynamic businesses with frequent product change or for businesses with complex products, this is even more important.

Graphic 1 (below) provides a final thought on the roles of ERP and PLM. The graphic highlights the iterative, ongoing product innovation that occurs during a product's lifecycle. This could include quality improvements, new feature introduction, introduction of complementary products, new revisions and also eventual retirement and replacement. This process is fundamentally different from the transactional flow of business, but should also be connected to achieve maximum benefit.



Graphic 1: The Independent and Interrelated Roles of ERP and PLM

Recommendations

- Enterprise application strategies should be developed to support business strategies
- Enterprise application strategies should be accomplished by incremental, tangible projects with short-term ROI and aligned in an overall Enterprise Application Program
- ERP and PLM are both important to manufacturing companies, although the roles that they play may vary
- PLM is not a module, it is an application suite that manages product processes from requirements management, through design and development and all the way through the service lifecycle
- PLM is not simply an extension of the ERP architecture, data model and business processes
- Integrated ERP/PLM offerings may provide part of the solution for simple design environments, although PLM specialists often offer more depth in functionality, flexibility, and domain expertise
- Relative capabilities should be based on analysis of products and references, as not all systems are alike. This is particularly true for PLM because the market is not yet fully mature

Summary

PLM and ERP are key components of any manufacturer's application strategy, and should be adopted in a way that helps the company achieve their specific business strategy and objectives. PLM provides strong capabilities to encourage and support product innovation, whether that innovation is focused on products that are new to the market or a rapid, competitive response to another company's innovation. PLM also provides capabilities to reduce costs by developing low cost designs and executing product development programs more effectively. ERP, on the other hand, provides strong capabilities to manage the supply and demand for a business, execute plans to meet the demand and provide financial oversight and control. Both PLM and ERP are important, and should be prioritized and selected based on business need and relative product capabilities with the understanding that ERP products are more of a commodity purchase and PLM products are more diverse. PLM and ERP provide value as independent solutions, but can also provide greater value when they play their respective roles in combination to support the business.

About the Author

Jim Brown has over 15 years of experience in management consulting and application software focused on the manufacturing industries. Jim is a recognized expert in software solutions for manufacturers and has broad experience in applying enterprise applications such as Product Lifecycle Management, Supply Chain Management, ERP, and Customer Relationship Management to improve business performance. Jim began his professional experience at General Electric before joining Andersen Consulting (Accenture), and subsequently served as an executive for software companies specializing in PLM and Process Manufacturing solutions.

Jim is the president of Tech-Clarity, a research and consulting firm dedicated to making the value of technology clear to business, where he is a frequent author and speaker on applying software technology to achieve tangible business benefits. Jim also serves as the PLM Analyst for Technology Evaluation Center and The PLM Evaluation Center.

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