

PLM Best Practices in the High-Tech/Electronics Industry

WHITE PAPER

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IDC MANUFACTURING INSIGHTS OPINION

Product life-cycle strategy has moved, appropriately, from an application category in the high-tech company's portfolio to a comprehensive enterprise strategy that is critical to profitable growth. IDC Manufacturing Insights spoke with companies in the industry that can be considered leaders in this area. The research reveals:

- **Innovation.** Leaders make sure that the end-to-end process — from ideation to first article test — is integrated and that decisions are informed by both internal and external data.
- **Collaboration.** Leaders involve the supplier community, particularly their design expertise, in the new product development process. They extend their design tools to the supplier community.
- **Technology.** Leaders use the latest tools available but distinguish themselves in several areas:
 - Eliminating "shadow" IT by bringing investment under the auspices of the IT organization without excluding engineering participation
 - Standardizing on a single process and data management tool
 - Encouraging collaborative decision making through communication unification tools such as portal platforms

Our guidance to other high-tech/electronics firms is to balance IT efficiency and business value. The leaders get tremendous results, but they don't break the IT budget to do it.

SITUATION OVERVIEW

High-tech and electronics firms have become experienced and dependent users of design tools. The productivity of their most critical resource, the engineers, has been significantly enhanced by the broadening capability of electronic, mechanical, and software design tools.

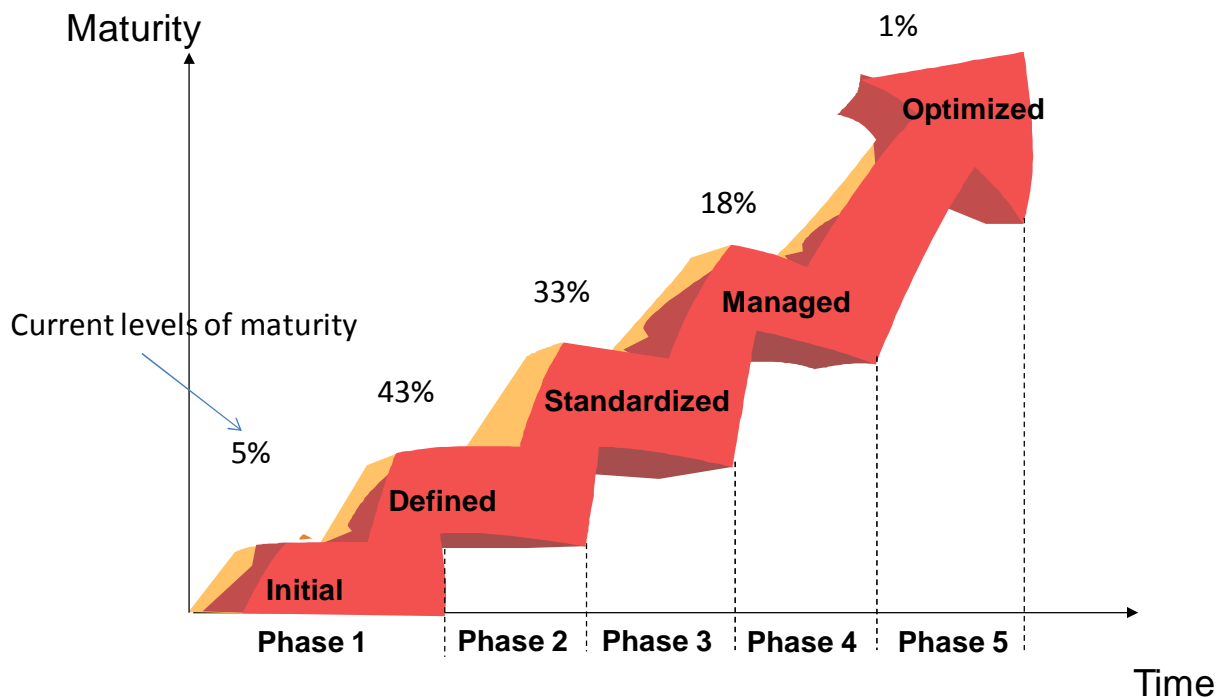
However, this importance may have also held back progress in realizing the business benefits of full product life cycle. Engineering organizations, for good reason, have been protective of their design environments and have held other organizations — marketing, sales, productions, service, compliance — at arm's length. For this paper, we interviewed a select group of high-tech manufacturers that have made the journey to ascertain the challenges and the rewards.

PLM Maturity in High Tech/Electronics

The relative maturity of product life-cycle processes at high-tech companies, despite its importance, is fairly consistent with the maturity levels in other industries (see Figure 1). With the majority of companies in the early stages of product life-cycle management (PLM) maturity, there remains ample room for improvement. The companies we spoke with are at higher levels of maturity than the industry overall.

FIGURE 1

PLM Maturity in High Tech



Source: IDC Manufacturing Insights, 2010

Key Areas of Product Management Focus

A simple top-down maturity assessment of product life-cycle processes is insufficient. Rather, the individual elements of product life cycles must all move forward together. These areas include:

- **Innovation.** This involves structuring the ideation process so that the pipeline of new products that optimizes the balance between extending the life of existing technology while introducing new innovation is continuous.
- **New product introduction.** This is a particularly critical area for high-tech/electronics firms. Missing an introduction window can mean being relegated to runner-up status for an entire generation of products. However, shortening the time to market falls on not only engineering but also supply chain executives who must prime the necessary supply network and speed time to volume.
- **Supplier collaboration.** Perhaps no other industry has as considerable a symbiotic design relationship with its suppliers as the electronics industry. Clearly, the application of a new generation of semiconductor, panel display, or piece of embedded software can mean the difference between success and failure. This situation makes supplier collaboration a key element of product life-cycle maturity.
- **Customer requirements.** While iconic brands may feel like they dictate what the customer needs, most companies in the industry must have a mature mechanism for incorporating customer needs into the product management process.
- **Technology use.** The productivity of a modern engineering organization can be dependent on how mature the company is in its use of software tools, how it deploys the tools, and how well integrated the tools are with other systems in the portfolio.

Other considerations that are rising in importance in the industry include regulatory compliance (particularly environmental sustainability) and product end of life. Government oversight continues to expand, particularly around the use and handling of hazardous materials, so leading companies are incorporating consideration for these factors into the design process. Further, there is a growing expectation on the part of both consumers and business customers that practices are in place to properly dispose of products, and decisions made at the front end of the product life cycle can have a major impact on the cost (and efficacy) of that disposal.

Determining the Leaders

Our objective for this research was to understand the practices of companies in the industry that had achieved higher levels of maturity in their product life-cycle processes. The research sponsors nominated customers they felt were advanced, and IDC Manufacturing Insights drew from our network of contacts as well.

We identified 12 companies that had mature processes. The sample included all sectors of the industry, from components to consumer devices to complex equipment. It was interesting that while the overall maturity was advanced, the individual areas identified in the previous section were at different levels of maturity. Overall, the group formed an excellent basis for understanding and valuing best practices.

FUTURE OUTLOOK

None of our interview subjects were at full maturity in all areas, but a composite of their experiences provides an excellent guidebook for advancing product life-cycle maturity in high tech/electronics.

Lessons from the Leaders

The companies we spoke with have a strong sense of alignment of the product life-cycle process with business strategy, market trends, and research and development activities. The whole process is driven by this convergence of business goals, customer needs, and available technology innovations.

However, there was a strong sense from the group that this convergence was too ad hoc and that, in order to drive additional benefit, the companies had to establish a more formalized approach. Most pointed to expanding the use of phase gate planning and portfolio management tools and the need to make sure these capabilities are well integrated into the rest of the toolkit. Some interesting other activities included:

- Two companies discussed implementing a more rigorous technology/customer needs alignment process. One company has created a formalized analysis methodology for matching the technology road map to specific customer needs in order to achieve "right product, right time, right investment, and right price" goals. Another company has invested in improving its assessment of competitors' plans as part of its alignment analysis in order to identify opportunities that may be more profitable.

- Two companies discussed recent efforts to do more auditing of actual results. These efforts validate the assumptions made for the success of new products at introduction and at various points thereafter. Both companies talked about creating a feedback loop to the alignment process that could help eliminate common mistakes made when forecasting a market response to a product over time.
- One company has created a collaboration hub that allows internal constituents, key suppliers, and lighthouse customers to contribute to the alignment process.

There are classic change management challenges to aligning an enterprise product life-cycle strategy with business objectives — people, time, and money. There was a strong sense, although perhaps a bit biased since we were speaking with people directly involved in product management, that these efforts were underfunded and that the expectation for time to complete was unreasonable. However, the most common area of conversation was people. Getting personnel, especially engineers, on board in incorporating change was an enormous communication challenge and, once they were sold on the idea, an even larger training challenge given the number of people these initiatives impact.

There was consensus among the participants that these efforts to better align product life-cycle processes with the business are paying significant dividends. At one level, respondents spoke in general about heightened management awareness with regard to the critical nature of these processes. Others spoke about how they were now able to measure return on investment for product initiatives including specific tracking of schedule attainment, market share, profitability, and quality performance. The most mature of the companies we spoke to not only could measure these areas but also could point to tangible improvements as a result of their efforts.

How Leaders Manage Innovation

Innovation is a high-tech company's birthright. Almost without exception, companies in this segment have gotten to where they are because of innovative product design, and our interview subjects are no exception. However, being innovative doesn't necessarily mean your company is good at *innovation management*.

In fact, the companies we spoke to felt there was room for improvement. We would put the companies in three camps: those that struggle to solicit, evaluate, and approve the sheer number of ideas available to them; those that struggle with executing quickly on good ideas; and those that have issues on both sides. What distinguishes the more mature (and the industry is very immature overall in this area) innovation managers is that they recognize the importance, acknowledge the weaknesses, and are willing to take steps to improve.

Practices for managing innovation are largely centered on some periodic review process that looks at the portfolio at a high level. There is very good discipline from the leaders around ensuring that market needs are addressed, profit targets are aligned, and resources are allocated. However, it struck us that the companies were very good once product ideas were well defined but that they were less competent at the initial stages when there were hundreds of potential product ideas to be vetted.

The tools supporting the innovation management process range from spreadsheets to commercial applications specializing in the process. Most of the companies we spoke to were actively considering a more comprehensive view of the software used to support the efforts and had interest in applying portal tools to encourage more enterprisewide transparency and collaboration.

Most of the companies we spoke to felt that there was natural workflow integration between innovation management and new product development that didn't necessarily require a formal initiative. Some discussed how marketing and high-level design engineering became involved to better describe product specifications before embarking on detail design. For many, these connections existed because they used a standard phase gate approach.

How Leaders Manage New Product Introduction

No industry, with the exception of pharmaceuticals, spends more on research and development than high tech. The companies we spoke to were generally increasing those investments, although several talked about some restraint during the difficult economic situation in 2009. There was a general consensus that it was imperative that companies be able to do more product introductions with fewer engineering resources in the future. Product management productivity is a critical competitive differentiator in these markets.

At one level, one would think it is easy to evaluate whether or not a new product introduction was successful — did it meet the profit expectations? However, the companies we spoke to could only, at best, estimate the success rate at their companies. This situation is a glaring weakness even for the leaders. How can a company improve if it doesn't know how effective it is currently?

And there are many moving parts. Did the product get to market on schedule but encounter early quality problems? Did competitors take a different design approach and achieve a cost advantage? Did we misread the market or customer preferences? Was the product late or perhaps early? Did we cannibalize an existing successful product with one that was less effective? These issues were all mentioned as key reasons for failure in the new product introduction process.

Despite lacking a good picture of overall success and dealing with many significant challenges, the companies we spoke to are leaders in new product introduction. Most assessed their level of maturity between standardized and optimized, while most of the industry is between the initial and standardized levels of maturity. And continuous improvement in this area was a priority for all the companies we spoke with.

The initiatives being undertaken center largely on refining the process, making it more standard across organizations and creating the ability to better measure results and perform root cause analysis. One company discussed an initiative around "lean new product introduction" that calibrated activity to market demand much like lean manufacturing does for plant resources. The idea is to identify and eliminate waste in the process. Another company discussed its efforts to create specific positions to support new product introduction, with these personnel bringing a mix of marketing, engineering, and supply chain knowledge to the process. Expectations for benefits from these initiatives were well balanced between improving the business outcomes and lowering the process costs.

Investment in software tools to support the process centers on having a modern PLM platform in place. There was general consensus that this investment was critical to improving new product introduction performance. Other areas mentioned were better bill of material management including better coordination with the supplier community, more design analysis tools, and the use of blade server technology to reduce the cost of operation.

How Leaders Manage Supplier Collaboration

The electronics value chain is very symbiotic. There isn't always a definitive hierarchy between the brand owner and tier suppliers in the electronics industry, unlike other manufacturing segments, such as automotive. For example, Intel and Microsoft play a huge role (and capture a significant share of the profits) in the personal computer/laptop segment. A supplier's ability to innovate and execute reliably is critical to a product line's success.

The companies we spoke to have a strong sense of supplier performance — design capability, quality, cost, and delivery reliability are chief among the areas measured. The accepted practice is to have regular business reviews. This includes covering performance on a long-term basis as well as a near-term review of requirements and cost trends.

The common challenges in supplier collaboration are exchanging product information and processing engineering change orders. Most of the companies we spoke to have real concerns about protecting their intellectual property when it comes to sharing product information and are looking for portal investments that can let in key suppliers while

limiting the company's risk. The time it takes to process an engineering change when a supplier has to be involved is alarmingly high (55 days for one respondent) and is an area that continuously draws attention for improvement.

The leaders we spoke to could generally quote specific data on how well their suppliers met requirements, particularly in the quality area. One interesting thread was the notion that over a product life cycle, performance can drift negatively over time. This statement is counterintuitive to the notion of "learning curve" where a supplier gets better over time, but it makes sense in the context of the supplier being more focused to win the deal and acceptance early in the process. The consensus is that supplier collaboration must extend past design and first article test and continue throughout the entire life cycle.

We asked our interview subjects to list the three most common reasons suppliers don't meet expectations. The responses were quite diverse, but we can categorize them into three main areas:

- **Quality.** Respondents lamented the lack of fundamental quality control, particularly among smaller suppliers. The companies took some of the responsibility, stating that they needed to get more involved with assisting these suppliers on good practices and to communicate requirements better. One subject discussed poor communication between the suppliers and their suppliers (tier 2, supplier's supplier) and the need to improve the change management process across the highly distributed teams.
- **Cost.** This is a delicate balance between pushing suppliers for cost reductions while not sacrificing product quality or delivery reliability. There is also the possibility of poisoning relationships by making them too adversarial.
- **Delivery flexibility.** Suppliers struggle to meet delivery commitments, especially in a rebounding economy. Companies also talked about suppliers struggling to ramp up volumes quickly enough to meet demand.

Despite these challenges, the companies we spoke to were at higher levels of maturity than the industry overall. Most were in the managed range, with a couple even considering themselves optimized. All of the companies we spoke to identified supplier collaboration as a high priority at their company and a critical element of their product life-cycle initiatives.

The initiatives being undertaken at these leadership companies largely involved technology-enabled collaboration — data exchange, process harmonization, scorecards, and unified communication. The expectations are ambitious — better, faster design times; higher quality; and a more stable supply chain. Leaders generally have

enjoyed benefits already in this area and see the opportunity to expand their programs. PLM software and portal platforms are seen as central to aligning requirements with design, testing, and validation. The software capabilities improve launch readiness and optimize the new product introduction process.

How Leaders Manage Customer Requirements

Is a product that is so innovative and ahead of its time a good thing? Not in the near term for certain. High-tech companies must deal with a fickle market and be able to make optimum use of finite resources to be successful. In the high-tech industry, perhaps more than any industry, understanding customer requirements is a critical element of mature product life-cycle management.

The leaders aggressively aggregate market information in both the B2B domain and the consumer domain. A lot of external data is aggregated, including market forecasts, cost analysis, and competitive intelligence. This data is summarized and is central to helping product marketing articulate the needs to design personnel. The companies we spoke to have a formal planning process to incorporate this information into product planning.

What really distinguishes the leaders in this area, however, is the closed loop nature of their process — they put a lot of emphasis on learning from their mistakes. These errors can include high adverse quality costs, anticipated market share gains that never materialized, or cost targets not achieved. The leaders use these experiences to inform the next generation of products being developed.

The relative maturity of the companies we spoke to was much more dispersed in this area, but a couple of the companies were at the optimized stage. However, most identified the discipline as a priority for improvement.

The specific initiatives discussed focused on integration with three different vectors:

- **Overall PLM process.** Several companies talked about bringing market data and performance history into the front end of their PLM automation efforts as another key domain of product information.
- **Ideation.** Companies are exploring the use of social networking tools, with market data exposed to the community, to better vet product ideas with specific customer needs.
- **Mechatronics.** One company expressed an interest in making sure that the market information informed not just the design of the electronics but the mechanical and software as well.

The expectation of benefits for improving customer requirements management was a bit more high level, but this area was identified as critically important. Truly optimized product management, what IDC Manufacturing Insights refers to as "lean innovation," is dependent on market requirements setting the cadence for the product life-cycle process.

How Leaders Use Technology

One would expect that those involved in the high-tech/electronics industry would be leading-edge users of the software and infrastructure that enable the product life-cycle process, and that is certainly true. However, two central issues tend to arise in the industry. First, there can be tool proliferation with the company owning practically one of everything that is available. Second, because engineering organizations are comfortable with the infrastructure, it is common to find "shadow IT" organizations within the engineering group. What distinguishes the leaders is that they have reversed these situations and have more focused and more effective use of the technology available.

On the software front, the leaders have moved to a PLM platform approach where there is a primary provider of product data management and preferred, although not always exclusive, providers of design tools. This tactic is paramount to enabling more consistent processes that free resources to put their time into more value-added activity. One respondent told us that before implementing the platform, the company had half of its resources on detail design and half on high-level design of new products. Today, because the mundane tasks are automated and controlled, that ratio has shifted to 75% being able to produce new designs.

Another common characteristic among the leaders is the ability to extend the PLM system to nonengineering personnel both within and outside the company. This capability is achieved through the use of advanced portal platforms and further augmented by unified communication tools. Of particular importance was the ability to integrate these tools with the PLM product information and collaboration capabilities to provide a unified approach despite the presence of two distinct platforms (PLM software and collaboration tools). It is important to note that the leaders we spoke to see PLM as an enterprise strategy and not just a mechanism to improve product data management.

Eliminating Shadow IT

The critical first step to unifying a company's PLM tools and driving improvements is the unification of infrastructure resources. We had detailed discussions that revealed numerous benefits, including:

- **Elimination of duplicate spending.** Having servers and storage in two places to support product management is highly inefficient. Assigning that buying to the IT organization, where acquisition and management skill is highest, makes tremendous sense.
- **Application rationalization.** One company had close to 150 applications (both off the shelf and bespoke) associated with product management running between engineering and IT, and many overlapped. Unifying the infrastructure has lowered the number of applications to less than 10.
- **Project rationalization.** In line with application rationalization, projects can be consolidated and capabilities improved.
- **Integration.** In many cases there is no integration between systems or manual reentry at best. Where there is some level of automated integration, it is costly and inaccurate and comes with a high degree of latency.

A good rule of thumb for companies with shadow IT organizations within engineering is that \$300,000 can be saved for every \$200 million of revenue, but this can scale up if a large percentage of annual revenue is dependent on new product introductions.

Our group of leaders, almost universally, has completely eliminated shadow IT organizations. The challenge wasn't the financial justification, but the change management. Engineering groups didn't like losing control of these important tools and feared that IT lacked sufficient knowledge of their process. IT had to understand that its normal change processes had to be adapted to the unique needs of the engineering group. The IT organizations had to be diligent about allowing the engineering personnel to influence the direction of the tools. Generally, most had happy endings — companies improved their PLM processes while lowering costs.

Other Considerations

In addition to the standard elements of product life-cycle management, we wanted to discuss emerging issues with the leaders we interviewed. Specifically, we asked about the growing emphasis on regulatory compliance and managing the product end-of-life process.

Regulatory Compliance

One might expect a group of high-tech/electronics companies to discuss industry-specific regulations such as Restriction of Hazardous Substances (RoHS) when considering regulatory compliance requirements. While the companies certainly talked about RoHS, Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) was equally prominent. Subjects also discussed regionally specific requirements in China and Western Europe and at the state level (e.g., California).

While overall responsibility for compliance usually fell to a governmental affairs or sustainability executive, the people we spoke with saw a clear role for PLM to support the reporting requirements — specifically, the ability to create a "bill of substances" that would be able to identify hazardous materials used in component parts and separate the quantities. This capability is considered key to making good design substitution decisions and enables reporting avoidance where possible.

Product End of Life

Closely related to regulatory requirements associated with product content is the growing oversight by governments on how products are handled once they are no longer useful to buyers. The companies we spoke to have recycling programs in place and make every effort to obtain industry-standard certifications to show that they meet regulatory and market expectations. The issue is not a tremendously high priority, and most companies would like to outsource as much of the administration as possible.

However, PLM tools were seen as a way to minimize the impact by making better design decisions. Thinking about how and at what cost products can be disposed of and, more importantly, how the percentage of product content that is recycled can be increased is becoming an integral part of design decisions.

CONCLUSIONS

Our conversations with the PLM leaders yielded a number of interesting practices and serve as a basis for helping other companies think about their own product life-cycle journey, how to identify the business benefits, and how to bring the right mix of people, process change, and technology deployment to the initiative.

The Journey to Lean Innovation

Improvements to the product life-cycle management process happen in two dimensions — improving the productivity of the process (efficiency) and improving the business outcomes (effectiveness).

Efficiency considerations include:

- **Standard tools.** Both rationalizing the software and running that software on a unified infrastructure support process automation and connect information to the knowledge workers that need it.
- **Process consistency.** Having standard tools enables companies to have a standard process. Variability is the enemy of efficiency, and driving more consistent execution delivers efficiency gains.
- **Better data/better decisions.** Consistent processes also equal better and standardized information. Better information leads to better and more efficient decision making.
- **Higher resource utilization.** The legacy of one engineer/one system is highly inefficient. Eliminating shadow IT allows for higher utilization of the necessary hardware infrastructure, and PLM and collaboration platform approaches do the same.

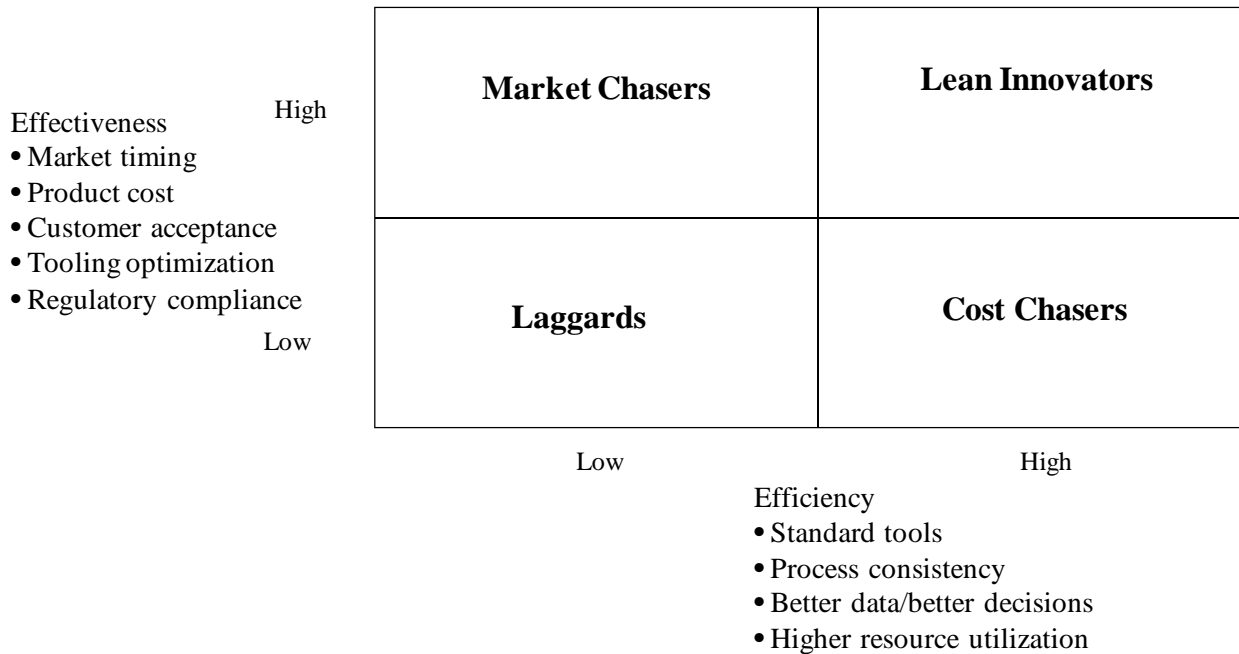
Effectiveness considerations include:

- **Market timing.** Improvements in both time to market and time to volume deliver better market share capture, especially in high tech. It is not always about being first; rather, it is about having the right product, at the right price, at the right time.
- **Product cost.** Much of the long-term cost of a product is determined at the design phase, but important improvements can be made with responsive change processes. Improving on both fronts lowers product costs and raises profitability.
- **Customer acceptance.** Letting specific customer needs dictate design choices equates to more successful products and higher market shares.
- **Tooling optimization.** The topic of nonrecurring engineering and tooling costs associated with new product rollouts is not discussed often. Having the tools to make better trade-offs between tooling, product costs, and design goals means higher returns.
- **Regulatory compliance.** Both eliminating hazardous substances and improving recycle content percentages lower downstream costs and improve long-term profitability.

Figure 2 lays out these dimensions and categorizes companies on the basis of the four possible combinations.

FIGURE 2

Evaluating PLM Performance



Source: IDC Manufacturing Insights, 2010

Laggards have stayed tied to ad hoc management and shadow IT decisions, leaving them neither efficient nor effective. The market chasers pursue new product opportunities aggressively, but create a disadvantage for themselves via inefficient and costly product management processes. Cost chasers are more timid, focusing on taking costs out of product development, but at the cost of being less effective in their goals for profitable growth.

The upper quadrant is reserved for lean innovators. Our interview subjects have either achieved or are on the way to achieving lean innovator status. These companies calibrate the product life-cycle process to the market need using advanced automation, decision, and collaboration tools. Lean innovators are leaders, delivering both higher levels of product management efficiency and better business outcomes.

Finding the Business Benefit

The companies we spoke to generally consider the business benefits of PLM to be fairly self-evident. Perhaps this speaks to a cultural bias that has allowed them to be leaders. However, others may have to articulate details in order to secure investment in a PLM

transformation. Table 1 aligns the areas of improvement with the potential impact on both effectiveness and efficiency.

TABLE 1		
Areas of Business Impact		
Area	Effectiveness Impact	Efficiency Impact
Innovation management	Market timing, customer acceptance	Idea vetting
New product introduction	Market timing, product cost	More closed loop decision making
Supplier collaboration	Product cost, tooling optimization	Better information exchange
Customer requirements	Customer acceptance, regulatory compliance	Integration costs
Technology use	All areas	Resource utilization, process consistency

Source: IDC Manufacturing Insights, 2010

The table is meant to be a guide. Specific circumstances will guide the appropriate level of use. Return rates will be sufficiently high and payback periods sufficiently short to justify embarking on a path toward lean innovation.

ESSENTIAL GUIDANCE

Transforming product life-cycle management processes at an enterprise takes the right amount of change in the following areas:

- **People.** IDC Manufacturing Insights recommends establishing a program management office if product management is highly centralized or a corporate center of excellence if the company is structured more as independent divisions. These groups are essential to setting, selling, and executing the incremental projects that deliver the desired business outcomes.
- **Process.** A full life-cycle view of the process from ideation to recycle is needed. The PLM process is not an exclusively engineering domain. Make sure marketing, supply chain, procurement, and other functional contributors are integrated into the vision.

- **Technology.** A great catalyst to transformation is the deployment of enabling technology. Companies should invest in three areas:
 - **Consolidated hardware.** Eliminate shadow IT and ensure that servers, storage, and networking can handle the computing needs.
 - **Process platform.** A PLM application that integrates modeling, simulation, and product data management is a critical element.
 - **Unified collaboration.** Incorporate a range of messaging, portal, and social networking tools to make sure all relevant personnel are contributing to better decision making.

Evaluating the necessary changes to people, process, and technology will allow a company to follow the leaders toward a lean innovation mindset and higher levels of performance.

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