



OPTIMIZING THE ART OF PRODUCT DEVELOPMENT

The Role of Program Management in Product Lifecycle Management (PLM)

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INTRODUCTION

Product development initiatives are born within programs. A new product initiative starts as a program, with a program manager defining a roadmap, detailing timelines, intermediate deliverables, and high-level requirements. The selected project team then executes the program, crossing departmental boundaries and collaborating with suppliers, contractors, partners, and customers to achieve its objective within the time and cost parameters of the program.

The organization creates working methodologies and business processes to develop and deliver the product. While the uniqueness of these processes is key to distinctive products, collaboration and information sharing are universal enablers in product development. Better tools for collaboration and information sharing lead not only to better products, but also make the product development process more efficient.

However, there are hurdles. The program manager assigns resources and tracks the progress of the designers and engineers who create and use technical data, specifications, test results, etc. While he uses program management tools, this product data is held in separate applications. Project decisions involve querying multiple systems and assembling information manually. The systems are synchronized by manual data entry, and so cannot provide current status. These shortcomings hurt both the speed and quality of product development decisions.

In this paper, we discuss the central role of program management and execution in the product lifecycle – both in product development (PLM) and in manufacturing (ERP), and develop a strong case for an integrated capability.

THE ROLE OF PROGRAM MANAGEMENT IN THE PRODUCT LIFECYCLE

The commonly used broad understanding of PLM systems encompasses a number of specialized functions that are linked through the use of a common operating platform and back-end databases:

- Data vaulting including version management and fine-grained access control,
- General services and tools like notifications based on events, visualization of drawings and documents,
- Administrative tools for granting and changing user privileges, setting up and modifying workgroups, etc.
- Core data management functions like BoM and configuration management, product classifications, and workflow execution.

Even as PLM applications expand their scope to cover larger and larger pieces of the product lifecycle (Figure 1), they usually do not incorporate program management (PM) functions like schedules, team management, resource tracking, etc. However, because of cost and speed-to-market considerations, program management is becoming fundamental to the success of a product development effort. Moreover, since most companies run multiple programs, portfolio tracking and management is another reason for the importance of PM in product development.

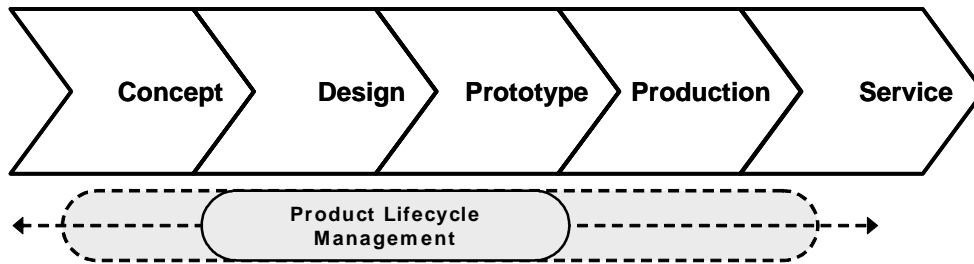


Figure 1 The Growing Scope of PLM

Many manufacturers, especially midsize and small ones do not engage in extensive product development. This is because they use ready designs provided by customer companies, and may need to make few or no changes at all to these designs. In other cases, midsize manufacturers produce parts from existing drawings and specifications, with minor changes and customizations for individual customers. In such cases, efficient program execution and management becomes the pivotal product lifecycle function, since accurate and rapid execution constitute a key differentiator for the manufacturer in a competitive marketplace.

For large manufacturers too, who design their own products, PM plays an increasingly significant role. Product teams are cross-functional, geographically distributed, and often include suppliers at multiple tiers. Product development efforts are run like programs. Program managers assemble these teams, authorize appropriate access, and create full project plans with work breakdown structures, tasks, deliverables, deadlines, and costs. In recognition of this need, a number of commercial PLM applications offer some form of program management capability.

Program execution and management creates value in a number of ways for the product development organization. This value creation is the reason for its inclusion and increasingly important place in the PLM space.

- **Program Tracking** A PM application stores information in a central repository – not just schedules, timelines, and deliverables, but product data like designs, specifications, test data, packaging specs, etc. The repository relates each program with its associated product data, enabling a clear, real-time view of the state of a program, and a portfolio of programs. Managers can analyze information related to progress, resource usage, pending issues and problems, and make decisions to ensure success across a set of programs. By relating program and product data we create a valuable information link that did not exist before.
- **Program Execution** While management is an important function, PM applications with integrated execution offer significant benefits. Execution and management take place on the same platform, using and updating the same information repository. This ensures management and execution functions have access to the same information, leading to better communication of issues and concerns.
- **Risk Management** Product development programs are inherently risky. Risks come in a number of forms – product manufacturability risk, technology risk, supplier performance risk, etc. By making all information readily available, PM tools give program managers more time to anticipate issues and problems, and address them. In other words, the information links between PM and PLM provide a means of risk management and mitigation.

- **Repeatable Processes** By capturing the successes of past program execution experiences, PM tools help create well-defined business processes that can be reused in new programs. Furthermore, some PM applications provide the flexibility to adapt these best practices to the needs of new programs by offering convenient tools for capturing program templates, and recording best practice workflows for convenient search and reuse.
- **Visibility Across the Enterprise** The success of product development efforts no longer depend on a small group of engineers working in isolation. As noted earlier, product teams are cross-functional and comprise members from various internal departments, as well as business partners across company boundaries. In this setting, efficient program execution requires seamless communication for all members, regardless of affiliation or geographical location, during all phases of the product development process. PM tools provide this capability, effectively affording visibility to the program to all program participants.
- **Execution Speed** As mentioned earlier, manufacturers are pressed to execute rapidly, to meet their customers' time-to-market demands. PM tools improve execution speed through faster communication, making available up-to-date information to all users, and allowing proactive decision making.
- **Reuse** Product development is an expensive proposition. Using existing components in new designs provide the reliability of a tested component, cost reduction for both the design and procurement functions, and better time to market.

COLLABORATIVE PROGRAM EXECUTION

Collaborative program execution is a logical assembly of a large number of functions (Figure 2) that are linked together to offer a fundamental departure from traditional project management: while traditional project management is strictly a management tool, collaborative program execution enables both execution and management on the same platform. The result is greater all-round efficiency that frees up time for other value-creating activities.



Figure 2 Elements of Collaborative Program Management

The first order benefit of collaborative program execution include improved efficiency, lower overhead costs, better decision making, and greater creative output.

- **Improved Efficiency** results from improved information visibility – which eliminates dependence on stale hard copy data and reduces miscommunication, thereby reducing mistakes. Since information is accessible regardless of geographical location, project team members can work from anywhere, and distributed project teams become possible. Also, since PM capabilities offer a single, online repository for all information, members maintain fewer copies of

- documents, preferring to access the repository instead. This eliminates the need to have multiple local copies of documents, which are usually difficult to reconcile.
- **Lower Overhead Costs** result from the reduced need for informational meetings. Since all information is always available on the repository, team members need to meet to make program decisions, not to inform one another. Furthermore, electronic availability of documents eliminates the need for printing and shipping, and the associated delays. In some cases travel can be eliminated as well, leading to cost savings.
 - **Better Decision Making** is possible for two reasons. First, team members have access to the latest information at all times and can therefore make informed decisions. Second, they do not have to wait for the latest information. This leads to better and faster decisions.
 - **Greater Creative Output** is the natural result of collaborative interaction. A common program execution platform increases opportunities for collaboration by involving all parties as users of the system. Also, the efficiency improvement described earlier leaves team members with more time for creative work.

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INTEGRATING PM and PLM

As discussed above, PLM is a product-centric application intended to speed up and improve the quality of the final product while controlling cost. However, in an increasingly distributed environment, product development needs many aspects of program management.

It is a significant challenge is to seamlessly integrate the Program Management and Product Lifecycle Management solutions. Information should not only flow within the program management and product data management, but also across the two applications as required. Figure 3 is an example of such integration. It is clear how the linkage (denoted by ❶) can provide immediate two-way updates of information to both functions.

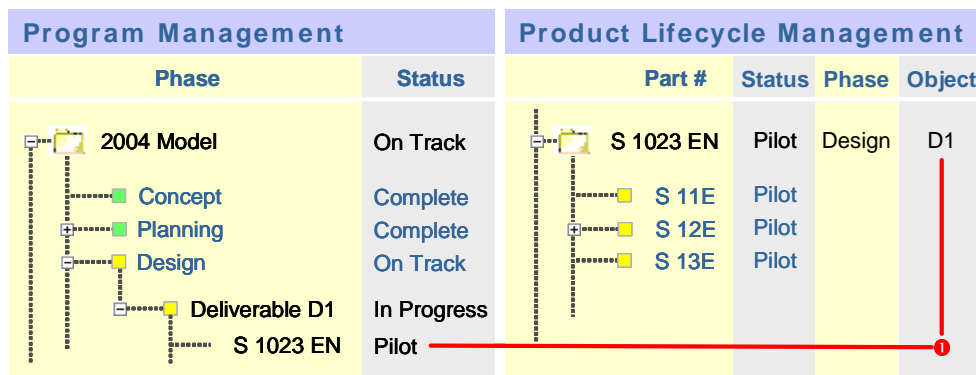


Figure 3 An Example of PM-PLM Integration

A critical integration point is the notion of *deliverables* in a program. Deliverables could be CAD models or drawing, or other specifications for a part. When the design engineer *releases* this part, the status of the deliverable changes from *In Progress* to *Complete* and the program manager receives an automatic alert.

This linkage provides immediate updates to the program manager.

INTEGRATING PM and ERP

Traditional ERP is heavily transaction focused and is used to manage essential operational functions such as commercial, materials management and procurement planning, and order tracking and logistics. ERP applications are multi-module in nature, and often include finance and human resource management as well. ERP is just as applicable in high volume manufacturing as it is in build-to-order (BTO) or configure-to-order (CTO) operations. In these scenarios, each order translates into a set of tightly linked operational steps that have to be tracked and managed through the life of the order. The issues include customer and supplier and product management while tracking cost, quality, while adhering to product, packaging, and logistical constraints. In other words, every order can be viewed as a project or program which kicks off when the order is merely a quotation and concludes only when the order is complete, and sometimes running beyond completion to support customer management functions.

ERP is highly applicable both in program and product-based industries. The details of business processes and requirements are different for each industry vertical, but all require up-to-date information about the program or product. This translates into the common requirements of information integrity and availability at the right time and in a right manner. While some of this information is the domain of ERP systems, the rest is program management information that has no place in ERP, but is essential for program execution. In spite of this oft-noticed shortcoming, there are little or no program management links to traditional ERP.

Typically, manufacturing industries do not use enterprise-wide program management and execution applications. At best, desktop project management software may be used, which have no links to live ERP systems and offer little or no collaboration and execution features. The result is an information gap between day-to-day program management activities and ERP-enabled functions like materials and procurement planning, logistics, and manufacturing. Consequently, key activities like cost, quality, and schedule management functions lack up-to-date information.

This is where Program Execution and Management applications can help the manufacturing organization.

By bridging the information gap between traditional ERP-based functions and high value operational management functions, such applications can provide reliable real-time information linkages to enable high quality decision making. Further, modern web-based Program Execution and Management applications offer powerful, cross-enterprise collaborative features, which allow supplier and customer participation throughout the lifecycle of the program.

Close examination of the common business processes of manufacturers yields several obvious integration points between Program Execution and Management and ERP. The following section provides examples in that apply equally well to product and program oriented operations.

Program Progress and Cash Flow

In typical program-based, BTO/CTO operations, a customer order is equivalent to a program. When the program kicks off, details like contract value and commercial terms are entered into the ERP system. The commercial terms are normally associated with specific deliverables and delivery dates. In order for the program to be planned and executed, these deliverables and dates must be available to the program manager and his team. If the program manager has access to this information from the ERP system, he can make sure that the work breakdown structure (WBS) of the program aligns with and reflects each deliverable, date, and other conditions stated in the commercial terms. Once established, this information link between the ERP and PM will enable not only

effective program management, but also offer real-time information updates to ERP-based functions on program execution progress.

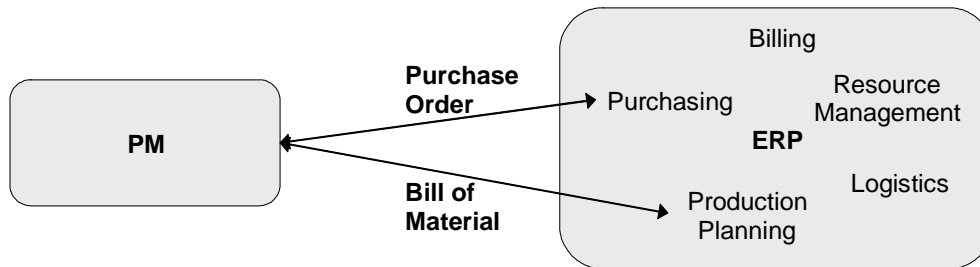


Figure 4 Areas of PM-ERP Integration

The resulting two-way information flow is a truly transformative change for the better. The information updates that become possible through the above integration allow for radical changes to business processes. For instance, since the PM system is accessible online to suppliers, updates like schedule changes and outcomes of change requests become quickly available to this system, and through the integration, to the ERP system as well which is instantaneously updated. Without the integration, the updates would be reflected in the ERP system at a much slower pace.

Released Drawing and BOM

In discrete manufacturing companies, an important piece of product data is the Bill of Material (BOM). When a product design is released for manufacture, the details of the BOM are essential for material procurement, a process managed through the ERP system. Based on this information, the material procurement department will place orders and schedule deliveries.

Many midsize and smaller companies usually build to their customers' designs. These companies do not require full PLM functionality and often do without a PLM system, depending on a combination of business processes and simple computer-based automation. In such situations, PM functionality serves as a surrogate for PLM. Each order from a customer is a program and the PM repository is used to manage the product designs and BOMs associated with the program.

In this situation, if the flow of information between PM and ERP is automated, there would be significant benefits:

- Procurement of components based on the BOM can begin immediately, without the need for manually loading BOM information into the ERP system.
- Since the PM system spans enterprise boundaries and is used as common platform by the manufacturer, its customers, and suppliers, members of this extended team will keep information in the PM updated. The link to ERP will then provide immediate updates to internal functions that rely entirely on the ERP system, enabling better decision-making at their level.
- Change management is an important and expensive part of product development and manufacturing. If change requests and orders are managed quickly, or if their number is reduced, a lot of savings could result. The PM-ERP linkage addresses this issue very well. Empowering customers and suppliers to process change orders directly through the PM system speeds up the change and eliminates the time lag for updating the ERP system to reflect the change.

Furthermore, the improved overall information visibility offered by the PM-ERP link aids timely decision-making and reduces the number of changes requested.

- Changes to designs occur often and impact the manufacturer since both procurement and manufacturing operations are affected. Whenever a new revision of a product design is created, the PM application could compare the revised BOM with the earlier one and notify the ERP-based functions of these changes. This not only reduces the time lag between new design release and material procurement but can also save money by eliminating or reducing redundant inventory.

CONCLUSION

Web based program management and execution applications are the new breed of tools that have a natural place in program driven companies, which include most manufacturers since product development typically takes place within the framework of a program.

Combined program execution and management provides visibility, predictability and repeatability to product lifecycle activities. The enterprise and collaborative nature of these applications ensures the right information is available to the right people and at the right time. The usefulness of these applications can further be enhanced by integrating them with PLM and ERP applications.

Seamless information flow between elements of a program's work breakdown structure and product development deliverables result in improved visibility of the entire process and better cost, and quality of innovation benefits all of which are essential in competitive markets. Similarly, there are inventory cost and response to change benefits from integrating a program's data elements with that of ERP, for example in the context of customer purchase orders and bills of material.