IBM Business Consulting Services

Cost-effective supply chains: Optimizing product development through integrated design and sourcing

White Paper

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Contents

Business challenges for new product development

In today's global economy, industrial manufacturers face complex challenges, such as fluctuating market conditions, aggressive competition, pricing pressures and rising costs for raw materials. Against this backdrop, manufacturers must continue to bring new, highly differentiated products to market – cost-effectively and within compressed time frames.

Toward these ends, companies are deploying next-generation digital design initiatives to reduce costs, improve product quality and speed time to market. Indeed, digital design technologies and techniques can help design engineers fully exploit existing investments in knowledge assets and integrate key suppliers into the product development process – essential in today's hyper-competitive marketplace.

More specifically, best-in-class industrial firms are embracing core design principles that focus on collaboration, reuse and standardization to reduce costs and improve performance.

Platform commonality, standardization and design reuse

Reusing existing designs and other knowledge assets can help streamline the product development process and, at the same time, significantly improve product quality by standardizing and reusing proven components and assemblies. A formal program of commonality and reuse can also help reduce direct materials procurement costs, speed time to market and improve product quality.

Highlights

To achieve the full benefits of commonality, an integrated tools enviornment must support business processes.

Closed loop design and sourcing

In order to further accelerate product development and improve product quality, it is critical that industrial firms access and leverage the specialized skills and knowledge available through their strategic suppliers. Managing this process effectively requires a tight integration between the manufacturer and the supplier, through a collaborative design process and tight linkage between the design and sourcing processes. This gives manufacturers the capability to manage product cost and target profitability over the product design lifecycle.

Integrated design tools environment

Today's mechanical design, electronic design and supply chain processes typically operate independently, with their own isolated silos of information. To achieve the full benefits of commonality, an integrated tools environment must support business processes. By extending access to the product data management environment, firms can share design and cost information across business units, and collaborate with strategic suppliers to accelerate design and sourcing processes across and beyond the enterprise.

Highlights

Design commonality and component standardization begins at the product platform architecture level.

Commonality, standardization and design reuse: Principles and building blocks

Design commonality and component standardization begins at the product platform architecture level. The product platform architecture should specify the hierarchy of functional components that defines an allowable set of product options, and facilitates innovation and change within a particular product feature while protecting the integrity of the platform design. As well, an architecture that is defined as a hierarchy of building blocks can help manufacturers simplify the creation of the engineering bill of materials (BOM) and facilitate component standardization and reuse. Moreover, by integrating cost information into the product hierarchy, design engineers can gain early lifecycle visibility on the total designed cost and determine whether the product can be built within marketplace cost and time constraints. Indeed, design engineers can evaluate the impact of design changes on direct materials costs, engineering design costs and manufacturing costs by allocating target costs to major building block components. This knowledge provides the incentive to implement standardization and reuse, which can have a significant impact on improving product cost and quality.

Highlights

Standardizing steel grades and thickness has significantly reduced costs for steel.

John Deere: The business impact of standardizing steel

In 2003, John Deere and Company launched an initiative to standardize the steel used in its product lines. Standardizing steel grades and thickness has significantly reduced costs for steel. As well, this standardization helped Deere avoid production shutdowns in the face of dramatic demand increases for specialty steel in 2004.

In order to achieve the benefits of design standardization and reuse, the following principles should be considered in defining the product architecture:

- Create a product structure that anticipates change and localizes the impact of change.
- Leverage product data management tools and decision support tools to identify standardization and reuse opportunities across component designs, design processes, tooling and supplier expertise in the design of purchased components.
- Align engineers according to functional product areas in order to create centers of excellence in a specific design discipline.
- Leverage common tools and design processes to improve engineering efficiency and effectiveness.
- Create governance processes and metrics, and deploy tools to identify and measure the downstream impact of asset reuse, component standardization and commonality on cost, quality and time to market.

Highlights

The most efficient way to launch a comprehensive program of commonality and reuse is to start with commodity components.

Next Steps: Executing a comprehensive program of commonality and reuse

Once commonality and reuse initiatives have been defined from the top down – at the architectural level – industrial firms must implement this strategy from the bottom up. The most efficient way to launch a comprehensive program of commonality and reuse is to start with commodity components. Standardizing the design specifications for common components such as sheet metal, fasteners and electrical and electronic parts can help firms capture substantial cost savings and set the stage to standardize and reuse more complex components. Standardization spurs successive, associated benefits such as:

- Standardization and reuse create opportunities to aggregate spend with a smaller number of suppliers
- Increased spend volume provides greater leverage with suppliers
- Higher purchase volumes allow buyers to negotiate lower prices and achieve greater assurance that critical components will be available in the quantities required.

Similar benefits can be achieved for designed components, purchased assemblies, and tooling, plant and equipment. A consistent product architecture — supported by common design processes and metrics — provides the foundation for “design anywhere, build anywhere” capabilities and facilitates global sourcing. By creating better visibility over component design requirements, the product platform architecture and current business needs, industrial firms can improve optimize aggregated component and equipment purchasing requirements and negotiate cost reductions for strategic components and assemblies, and other asset classes.

Highlights

Similiar benefits can be achieved for design components, purchased assemblies, and tooling, plant and equipment.

These assets can include:

- Production assets, such as plant automation, machine tools, jigs and fixtures, material handling equipment and test equipment, as well as intangible assets such as manufacturing processes, training materials and quality programs.
- Purchased components, including assemblies, engineered components, electronics and embedded software, raw materials and commodity components.
- Processes spanning product development, product verification and testing, and after-sale service and support processes.
- Knowledge assets, including computer aided design (CAD) design information about products and components, as well as the core knowledge of how to design, manufacture and sell products, and how to manage the supplier population.

Highlights

IBM has developed deep expertise in planning and deploying commonality and reuse initiatives.

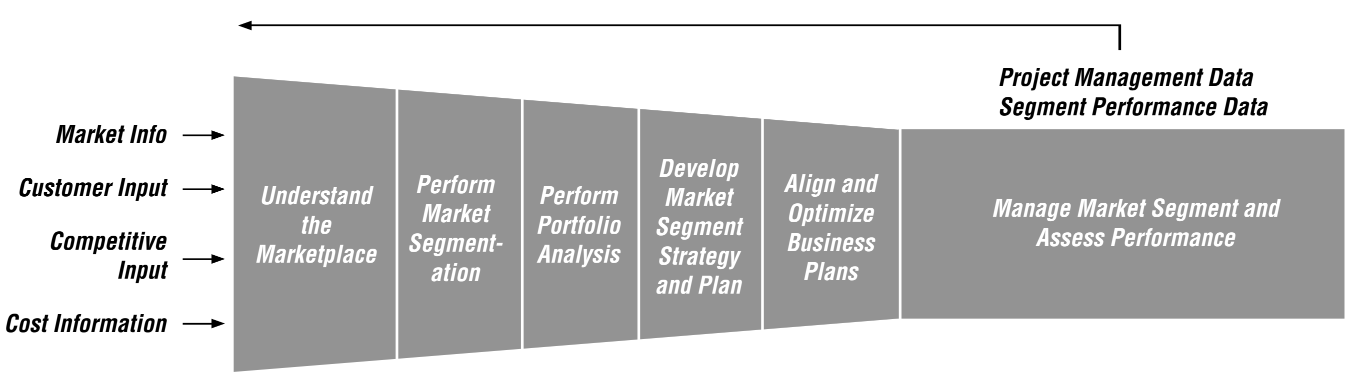
Key enablers: Strategy and process

Although most executives have an intuitive understanding that commonality and reuse strategies are critical to business effectiveness, the creation of a comprehensive program to drive product commonality, standardization and asset reuse can be a daunting task for many businesses. Through our experience with large industrial customers and our own internal computer design practice, IBM has developed deep expertise in planning and deploying commonality and reuse initiatives. Indeed, we have identified a set of key business processes that must be deployed in order to create a comprehensive program for platform commonality and reuse, including:

Portfolio Planning

Through portfolio planning, a company can acquire a detailed understanding of its customers' wants and needs, and can translate this understanding into a set of high-level design requirements for product platforms and the development of product models from the product platform. As part of the portfolio planning process, it is important to define and organize the product architecture into a hierarchy of "common building blocks." This enables simplified "as designed" and "as built" bill of materials structures, and creates downstream opportunities for component standardization and asset reuse. The output from the portfolio planning process should be a precise definition of the target market and customer requirements, platform architecture and product model specifications, product financial targets, and product development roadmap.

Portfolio Planning Process



Highlights

The portfolio planning process defines the product architecture and creates design parameters and targets for the product set.

Design for commonality and reuse

The portfolio planning process defines the product architecture and creates design parameters and targets for the product set. The design process translates these requirements into an engineering bill of materials and product design specifications. The engineering BOM is then converted into a set of manufacturing BOMs that specify how the product will be built in each individual manufacturing sites. By leveraging design and sourcing tools and motivating design engineers to reuse assets, the business can significantly improve the efficiency and effectiveness of the product development process and achieve structural product cost reductions. While it takes time to deploy tools and processes that enable commonality and reuse, and to stimulate design engineers to reuse existing assets, the anticipated net result is a leaner and more effective product development process that enables manufacturers to “design anywhere, build anywhere” within the enterprise.

Integrated design and sourcing tools

An effective program of commonality and reuse cannot be achieved without an integrated design tools environment that links design, procurement and manufacturing. IBM is working closely with IBM Business Partners to create the data standards and functional requirements that will result in a flexible, interoperable design tools environment. IBM has created a Product Development Component Reference Model that leverages IBM middleware and the Websphere® Integration Framework to enable the integration of software tools from multiple vendors in the following areas:

- Mechanical CAD tools
- Electronic CAD tools
- Software design tools
- Computer aided manufacturing design tools
- Knowledge management tools
- Configuration management tools
- Design analytics
- Cost management tools.

Highlights

It is critical that design tools portfolio and supplier management tools become more tightly integrated.

Closed loop product design and sourcing

The newest generation of design tools makes it possible to design products and identify opportunities for component standardization and reuse. However, while design tools are becoming more effective at identifying components that could be reused, they have not yet evolved to provide decision support capabilities that will empower design engineers to determine if component designs should be reused. This decision depends on an understanding of component costs, an assessment of whether performance must be enhanced to meet customer requirements, and a determination as to whether the component can properly address safety, quality or regulatory requirements.

Toward these ends, it is critical that design tools portfolio and supplier management tools become more tightly integrated. Integrating design information and product cost information into a wholly aligned design collaboration and sourcing environment creates a closed loop product design and sourcing environment. This allows design engineers to evaluate the cost and feasibility of alternate design strategies, and makes it possible to monitor the product actual cost versus target cost, so that program managers can modify component design specifications to achieve cost, quality and customer value targets set during the portfolio planning process.

Highlights

A closed loop design and sourcing enviornment can serve as the foundation for managing the product development lifecycle against target costs.

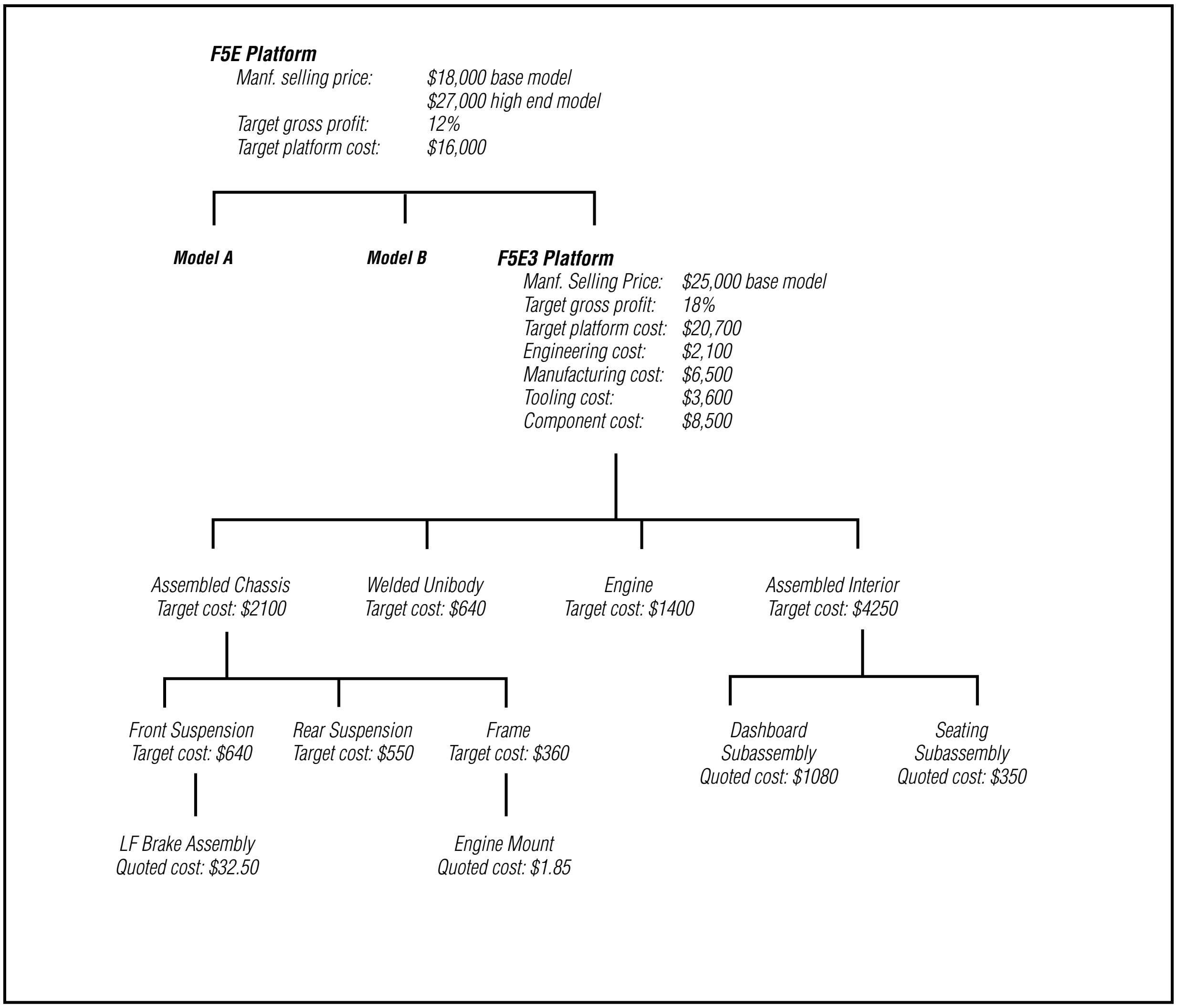
Total Cost Management

A closed loop design and sourcing environment can serve as the foundation for managing the product development lifecycle against target costs. On a more granular level, a system of total cost management allows design engineers and executives to extract product costs from the product selling price and required gross margins, in order to calculate the financial impact of design alternatives. Indeed, cost modeling can help manufacturers accurately predict total landed product costs, design costs and manufacturing related costs and, in turn, set appropriate cost targets and optimize product content at each stage of the product design cycle.

The common building block process: Inside IBM

In response to a highly dynamic IT marketplace, IBM has defined a reference architecture for each of its product lines, categorized by major market segments. At the highest level, this architecture defines the target market, the competition, and the life span of the product platform and the value of price versus computing capacity. On a more granular level, the plan defines functional capabilities of the models within the product line and traces the upgrade path. At the design stage, engineers carefully isolate product functionality and define standard interfaces among subsystems – demonstrating the ability to enhance performance and capacity without comprehensive component replacement. IBM maintains a library of reusable product design templates and a searchable catalog of components designed within the guidelines of the common reference architecture. IBM also supports an up-to-date catalog of available components from approved vendors.

Sample hierarchical product structure



Highlights

To be successful in the global economy, product must be tailored to meet local customer preferences, but it is often too costly to create unique product for each marketplace.

The Next Wave: Design for Reuse in a Global Economy

The newest generation of design tools integrates sourcing with design to create a closed loop design and sourcing environment and enables the alignment of the participants in the product development lifecycle into a seamless, extended enterprise development team. Tools, common processes, and governance and metrics strategies give design engineers the information and motivation to leverage existing designs and reusable assets to create better products more efficiently and effectively.

This capability has become the new imperative for industrial companies focusing aggressively on global marketplaces. To be successful in the global economy, products must be tailored to meet local customer preferences, but it is often too costly to create unique products for each marketplace. To meet this challenge, design engineers must understand local preferences and then leverage existing product platforms and available resources to design products that will be profitable within each geography. By providing visibility to local customer requirements at each stage of the product design process — from portfolio planning to manufacturing design and build — engineers can create local variants with a cost structure and product features that are designed to allow the products to be successful in each target market.

Highlights

The anticipated net result is greater flexibility in facing new markets--a quality that can provide a distinct competitive advantage.

The same strategies for commonality, standardization and reuse that can be used to improve the efficiency and effectiveness of the design and manufacturing process can provide an even greater competitive advantage in foreign markets. Closed loop product design and sourcing, total cost management tools, and integrated design and sourcing are designed to make it much easier to understand the impact of changes mandated by local content rules, integrate local suppliers into the design and manufacturing processes, and assess the impact of local preferences and requirements on the product architecture. The anticipated net result is greater flexibility in facing new markets – a quality that can provide a distinct competitive advantage.

About the Author

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Bob McCarthy joined IBM Software Group as the Industrial Sector Alliance Manager focused on extended enterprise collaboration issues. Prior to joining IBM Software Group was an Associate Partner in the Supply Chain Strategy practice within IBM Global Services providing consulting services to clients across a broad range of industries, including retailing, high-tech electronics, aerospace, consumer products, process and petroleum, and other industries. Mr. McCarthy can be reached at remccar@us.ibm.com.

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