Aberdeen Group

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The Configuration Management Benchmark Report

Formalizing and Extending CM to Drive Quality

February 2007

— Underwritten, in Part, by —

Executive Summary

Configuration management (CM) problems can negatively impact product profitability by effecting product quality, delaying product launches, and increasing product development, direct product, and product lifecycle costs. Yet ongoing engineering changes – especially in cases in which there are multiple product configurations – make it difficult to keep bills of material (BOMs) and other product data accurate and synchronized across the enterprise and the product lifecycle.

Key Business Value Findings

Companies that are best in class at configuration management (CM) hit each of the product development and lifecycle targets that drive product profitability, on average, 89% or more of the time – providing a significant performance advantage over their peers. These targets include product quality, launch dates, product development cost, product cost, product revenue, and product lifecycle costs.

Implications & Analysis

- Best in class are 38% more likely to have standardized processes for developing and maintaining product data such as BOMs, for managing product changes (200% more), and for communicating these changes downstream (80% more).
- Best in class companies extend CM to downstream and upstream stages in the lifecycle and to more product-related information, for example, to product documentation, manufacturing instructions, electronic design, and specifications.
- Best in class companies are twice as likely as other companies to leverage centralized product data to improve control of product configurations, twice as likely to use specialty configuration management solutions, 20% more likely to use workflow, and over 300% more likely to use service management solutions.

Recommendations for Action

- Formalize CM processes, particularly for analyzing, approving, and communicating changes – and educate the company on the importance of configuration management.
- Extend CM practices, starting early in conceptual design and extending it to cover product-related information beyond mechanical BOMs.
- Enable CM by using centralized data management for greater visibility and control of current, authoritative configuration data, leveraging information technology to promote standardized processes, and providing CM-focused capabilities across the lifecycle.

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Chapter One:
Issue at Hand

Key Takeaways

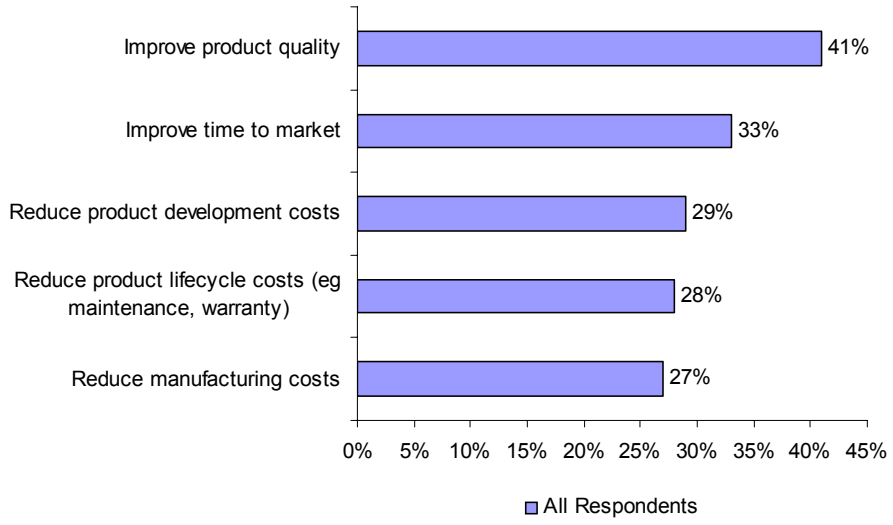
- Configuration management (CM) problems can negatively impact product profitability by effecting product quality, delaying product launches, and increasing product development, product lifecycle, and manufacturing costs.
- Ongoing engineering changes – especially in cases where there are multiple product configurations – make it difficult to keep bills of material (BOMs) accurate and synchronized across the lifecycle.
- Manufacturers are addressing these challenges by taking action to better manage release to manufacturing and changes downstream from engineering in addition to taking actions to improve change management and configuration control in design.

Managing bills of material (BOMs) and related product data effectively can be a challenge. Keeping BOMs up-to-date for all product configurations requires attention from multiple participants in design and the value chain. As products pass from design to manufacturing and are, ultimately, put into service, configuration management responsibility crosses organizational boundaries, increasing the complexity of keeping BOMs accurate and synchronized. In particular, miscommunication of the ongoing product changes throughout the lifecycle can lead to inaccurate data. This, in turn, can result in decreased quality, increased costs, and delayed time-to-market.

The Importance of Configuration Management (CM)

In fact, Aberdeen research indicates that quality, time to market, and costs are top pressures driving companies to improve configuration management (Figure 1). The cost pressures are not limited to product development costs, but impact direct products costs as well, which, in turn, can affect margins. Perhaps even more important, the pressures include total lifecycle costs, such as service or warranty costs – making configuration management a significant driver of total profitability across the product lifecycle. This is increasingly important as more manufacturers develop strategies to increase revenue by extending into maintenance lifecycle, particularly for those that enter into performance-based service agreements where excess maintenance costs are absorbed by the manufacturer. (For more on this topic, please read Aberdeen's *Managing Risk and Reward in the Performance-Drive Service Chain Report*.)

Figure 1: Pressures Driving Improvements in Configuration Management



Source: Aberdeen *Group*, February 2007

Why is configuration management critical in these areas? CM provides the blueprint by which products will be produced and services delivered. Without clear information, manufacturing and service processes will be inefficient at best. At worst, mistakes due to poor configuration information can lead to severe quality and product performance issues, impacting a company's reputation as well as driving service or warranty costs out of control. A clear, current and accurate product definition is critical to ensuring that products meet quality, time to market, and cost targets – the targets that ultimately lead to product profitability.

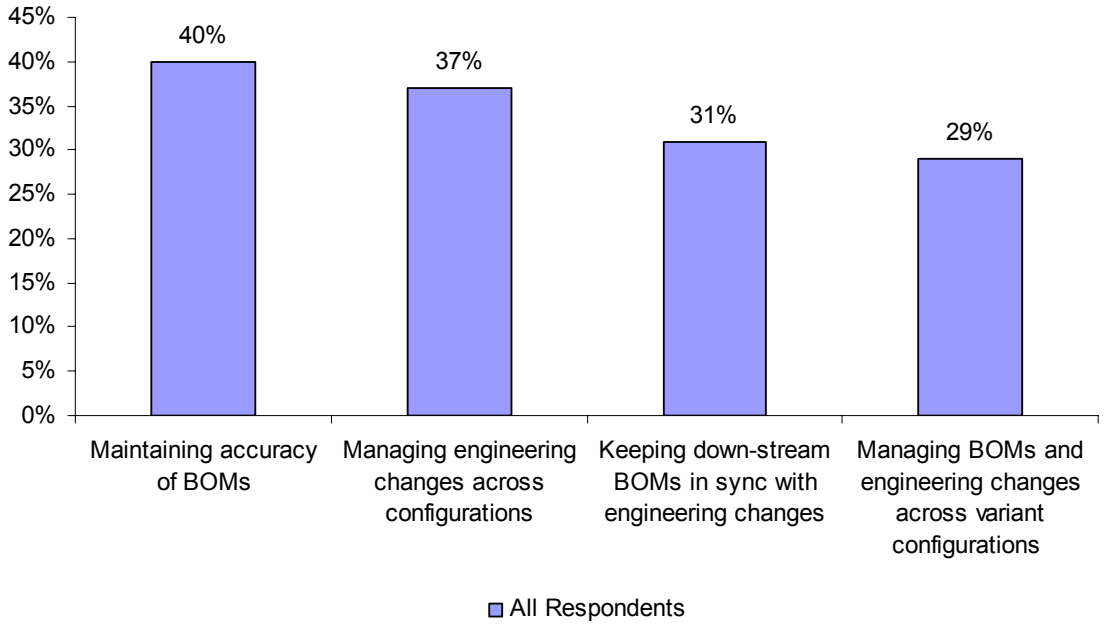
Defense Manufacturer

"For our company, it's a question of compliance with our customers. Having configuration management is an expectation that major airframe customers have, its' almost a price of entry. It's a customer requirement to know what's in each product and lot in case of component failure, and obviously configuration management is the way to handle this."

Managing Configurations: Easier Said Than Done

While it's clear that effective configuration management can have a significant impact on product profitability over the lifecycle, a number of challenges inherent to keeping product configurations up to date and accurate make this difficult (Figure 2).

Figure 2: Top Challenges to Effective Configuration Management



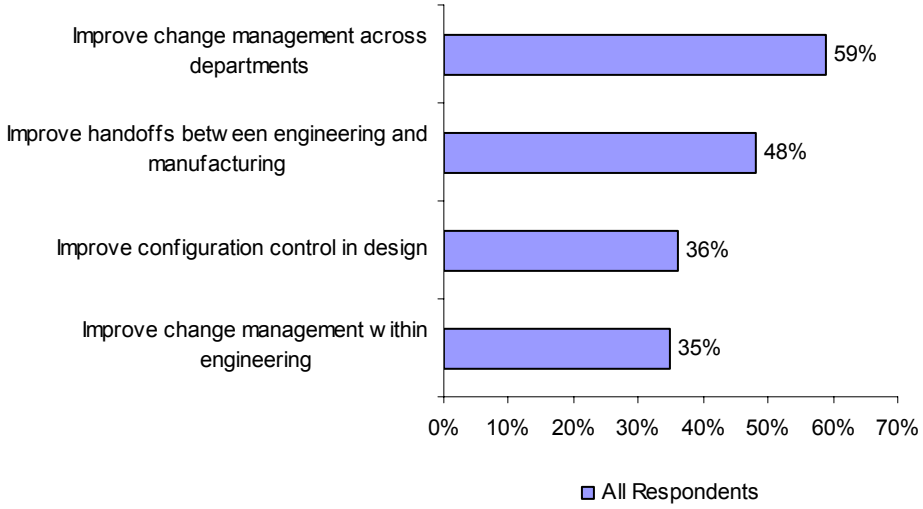
Source: Aberdeen *Group*, February 2007

First and foremost is the difficulty of maintaining the accuracy of BOMs (40%). Complex products can have thousands of components, each with its own revision and product lifecycle. A clear understanding of which items are required and which revisions are compatible is critical to preventing costly issues in manufacturing or service. Getting the configurations right the first time might be difficult, but this problem cascades when there are engineering changes. Even for simple products, frequent changes open up the possibility for miscommunication and errors that can drain profitability. Configurations can be particularly difficult to manage across multiple configurations of the same products, where BOMs represent multiple potential variants of a product in a single "super BOM" that includes configuration rules and constraints.

Taking Action across the Lifecycle

In response to these pressures and challenges, companies have been taking actions to improve configuration management processes (Figure 3). Benchmark results show that they realize that configuration management is a lifecycle issue – including, but going beyond, design and engineering through to the in-service support of the maintained asset.

Figure 3: Top Strategic Actions to Improve Configuration Management



In particular, 59% of Aberdeen survey respondents reported trying to improve change management across departments, followed by 48% who indicated that their companies are improving the handoffs between engineering and manufacturing. The coordination between different departments – and often companies – required to produce a product involves people responsible for manufacturing, procurement, planning, quality, and service. An engineering change can impact all of them, and failing to coordinate the feasibility and timing of the change can result in costly rework, scrap, or other wasted time and money. The handoff between design and manufacturing, in particular, is receiving attention. This process typically involves translating the BOM to a manufacturing view and localizing the BOM and related information to accommodate the manufacturing environment. Mistakes in this process can lead to costly errors and delays – again negatively affecting profits.

Manitowoc, Inc

"We have a formal engineering change process, where we submit the changes we want to make, which goes through departments like manufacturing, purchasing, quality, engineering, and even marketing for sign off. Depending on the effective date we set, this drives our BOM and MRP."

Michael Hollen
Design Supervisor

PACE Key — For more detailed description see Appendix A

Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows:

Pressures **—** external forces that impact an organization's market position, competitiveness, or business operations

Actions **—** the strategic approaches that an organization takes in response to industry pressures

Capabilities **—** the business process competencies required to execute corporate strategy

Enablers — the key functionality of technology solutions required to support the organization's enabling business practices

Yet questions such as what approaches to configuration management are successful remain. To better understand the approaches companies are using and which ones deliver the best results, Aberdeen surveyed benchmark participants not only on the actions they are taking, but on the capabilities – processes and organizational approaches, – and technology enablers they have put in place to actively address their challenges.

Using Aberdeen's PACE Framework (see Pace Key at left) and Competitive Framework (see below), survey respondents were classified into three levels of performance to determine which approaches are more prevalent in companies that are leading the pack in hitting their product development and lifecycle targets, including:

- Product quality
- Product launch dates
- Product development costs
- Direct product cost
- Product revenue
- Product lifecycle costs.

The following chapters highlight the results of this analysis, including the actions that companies are taking in general and the specific approaches that are delivering results.

Competitive Framework Key

The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of practices and performance:

Laggards (30%) —practices that are significantly behind the average of the industry

Industry norm (50%) —practices that represent the average or norm

Best in class (20%) —practices that are the best currently being employed and significantly superior to the industry norm

Source: Aberdeen Group, February 2007

Chapter Two:
Key Business Value Findings

Key Takeaways

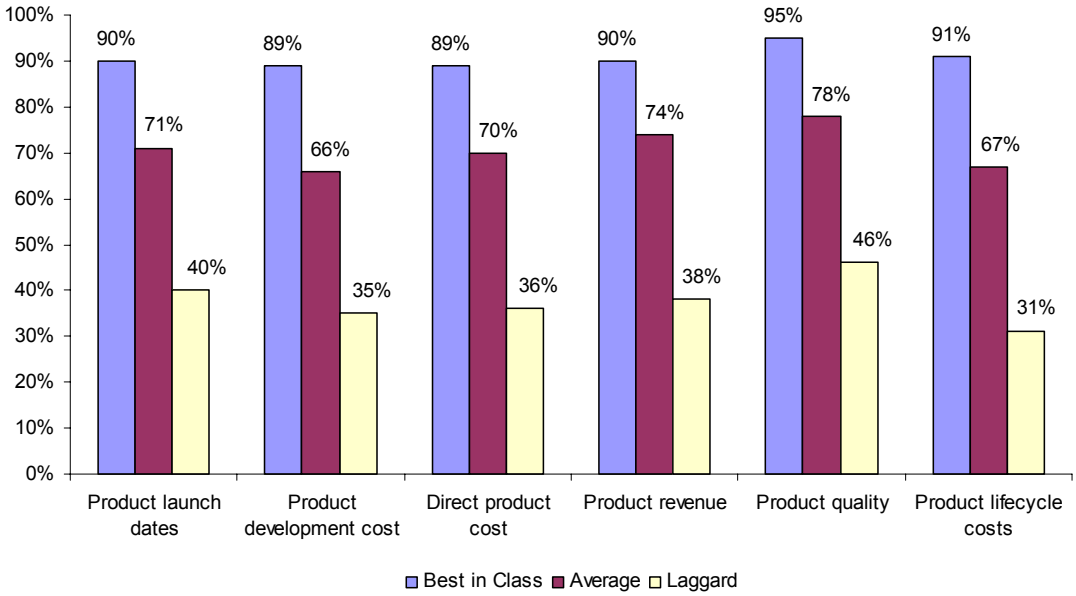
- Companies that are best in class at configuration management (CM) hit each of the product development and lifecycle cost targets that drive product profitability 89% or more of the time, on average. These targets include product quality, launch dates, product development cost, direct product cost, product revenue, and product lifecycle costs.
- Best in class companies are overcoming the challenges of configuration management by educating their organizations on the importance of CM, by providing tailored visibility to central product information by role, and by extending configuration management beyond the bill of material (BOM) to include a richer product definition.

Despite the formidable pressures and challenges of managing product configurations across the lifecycle, some companies are finding ways to succeed. As discussed in Chapter 1, to identify these companies, Aberdeen benchmarked manufacturers on six performance metrics (see Figure 4) and aggregated the resulting scores to establish their levels of performance ("best in class," "industry average"; and "laggard") in regards to their ability to manage product configurations across the lifecycle.

Best in Class Hit Lifecycle Targets on an 89% or Better Average

Aberdeen findings show a clear performance gap between best in class, average, and laggard companies (Figure 4).

Figure 4: Meeting Product Lifecycle Performance Targets



Source: Aberdeen Group, February 2007

Best in class hit their product development and product lifecycle targets significantly more often than average companies and from two to three times more often than laggards. This performance gap indicates that leading companies are enjoying significant advantages over their competition in meeting the product lifecycle metrics that drive product profitability.

Overcoming Challenges: Education, Integration, Visibility

Clearly, with their performance level in all areas near or above 90%, best in class companies are overcoming the challenges identified earlier, such as maintaining BOM accuracy. They are effectively managing configurations despite ongoing engineering changes, despite the difficulty of managing the impact of change on multiple configuration variants, and despite the resulting work of synchronizing BOMs across the value chain as engineering changes are executed.

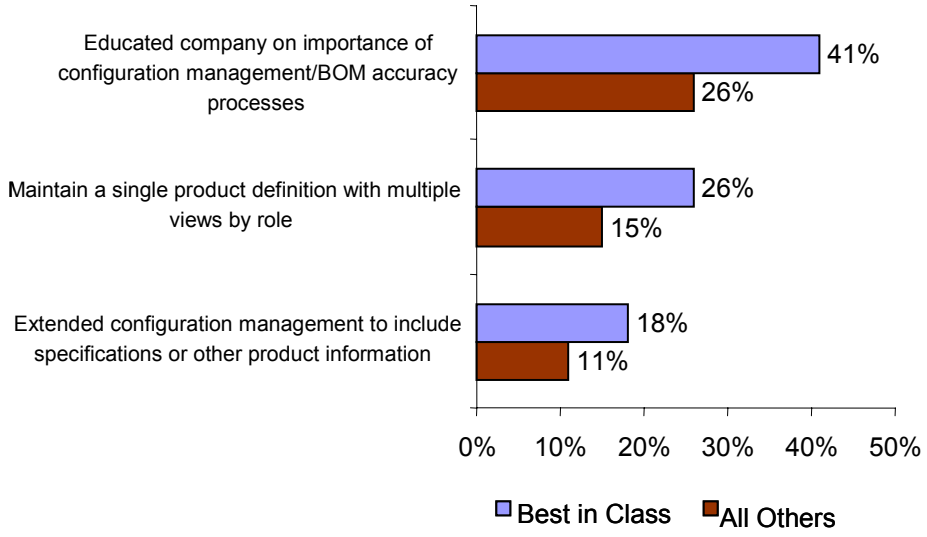
SafeNet, Inc

"Our company has a global presence, so we looked at standardizing procedures and implementing formal training. There were users outside of the US that needed to understand what the processes are so that everyone in the company will have the same view and understanding of the data and system procedures."

Bill Oxenford
Configuration Systems Manager

The key is their corporate-wide scope and focus on configuration management (Figure 5).

Figure 5: Responses to Overcome Configuration Management Challenges



Source: Aberdeen Group, February 2007

Aerospace and Defense Manufacturer

"One of our largest challenges has to be the human factor. You have to build a good skilled workforce that appreciates the importance of configured items – and when things change and the process is circumvented – bad things happen."

Almost half of best in class companies educate their companies on the importance of CM processes and BOM accuracy. This is the foundation for ensuring that these processes are adopted and incorporated into the daily routine. Best in class respondents are 73% more likely to keep a single version of their product information or BOM and to provide multiple views by role. These leading companies are also much more likely to extend the information encompassed by configuration management to include specifications and other product information.

For example, product documentation and engineering instructions – making the product definition clear across various stages of its lifecycle. This richer product definition, detailed in Chapter 3, also allows for an enhanced understanding of the impact that changing one element of a product has on other aspects of the full product.

Manitowoc, Inc

"We use a single BOM that is maintained and updated as changes occur."

Michael Hollen
Design Supervisor

Based on the successful performance of best in class companies versus all others, these actions are paying off. Chapter 3 takes a closer look at the capabilities – processes and organizational structures – as well as the technology enablers that support configuration management activities and help ensure product profitability.

Chapter Three:
Implications & Analysis

Key Takeaways

- Best-in-class companies focus on formalizing and improving configuration management (CM) processes. Compared to all other companies they are 38% more likely to have standardized processes for developing and maintaining product data (such as BOMs), 2.2 times more likely to have standardized change management processes, and 80% more likely to have standardized processes for communicating changes downstream.
- Best-in-class companies extend configuration management – to upstream and downstream stages in the product lifecycle and to more product-related information, for example, to product documentation, manufacturing instructions, electronic designs, and quality specifications.
- Best-in-class companies integrate and automate configuration management. For example, they are twice as likely as other companies to leverage centralized product data to improve control of product configurations, twice as likely to use specialty configuration management solutions, 20% more likely to use workflow, and more than 300% more likely to use service management solutions to improve CM.

Best in class companies hit each of their lifecycle performance targets near or more than 90% of the time. To achieve this, they are adopting key best practices that distinguish them from other companies. In particular, they formalize and standardize configuration management (CM) processes, extend configuration management to a broader span of control, and automate CM with key enabling technologies.

Formalizing and Controlling the Configuration Management Process

Best in class companies tend to formalize and standardize all processes relating to configuration management (Table 1) and to have put in place various controls and organizational structures to monitor and manage configuration and change processes (Tables 2, 3). These companies have gone beyond educating their companies on CM and backed it up with business processes that are designed to ensure good CM practices. They may have developed their own processes or adopted industry best practices such as CMII from the Institute of Configuration Management.

Global OEM

"The supply chain is our biggest issue because we are global and deal with thousands of suppliers and partners-and everything has to work at the end of the day. To this end we have implemented formal processes including a consistent design philosophy, and good communication throughout the supply chain."

Table 1: Implementation of Company-wide, Standardized CM-Related Processes

Formal CM Processes	Best in Class	All Others
Developing and maintaining product data (e.g., BOMs)	44%	32%
Analyzing and approving changes	47%	21%
Communicating changes downstream to affected parties	45%	25%

Source: Aberdeen Group, February 2007

In particular, the leaders in configuration management are:

- 38% more likely than all other companies to have company-wide, standardized processes for developing and maintaining product data (including BOMs). Standards for developing and defining product data are important to ensure consistency, interoperability, and reuse of information.

Fortune 50 Manufacturer

"Since our company is an ISO registered company we have specific work instructions we need to adhere to, and processes we need to follow."

- More than 200% more likely than all other companies to have company-wide, standardized processes for analyzing and approving changes. This ensures that the downstream parties affected by the change will have the opportunity to review it and provide feedback to minimize the disruption of the change itself and to improve their subsequent decisions about how and when changes will be implemented.
- 80% more likely than all other companies to have company-wide, standardized processes for communicating changes downstream to affected parties. This helps to ensure that BOMs stay in synch and that all affected parties know of the change, hopefully well in advance, so they can minimize disruption.

Best in class also have higher-level or stronger controls in place for the configuration and change management processes (Table 2).

Table 2: Levels of Control for Changing Released Products

Levels of CM Control (in Descending Order)	Best in Class	All Others
Central control of all configurations	35%	24%
Cross-departmental review & approval process	47%	41%
Formal communication of changes downstream (i.e., no other formal controls)	12%	23%
Ad hoc or not managed	6%	12%

Top performers are also more likely than other companies to have senior manager/vice president in charge of configuration management (Table 3)

Table 3: Managerial Control of Configuration Management

Responsibility for CM	Best in Class	All Others
Executive	3%	2%
Senior manager / vice president	28%	19%
Manager	57%	50%
Design teams	6%	14%
Individual designers	6%	7%
No designated responsibility	-	8%

Source: Aberdeen Group, February 2007

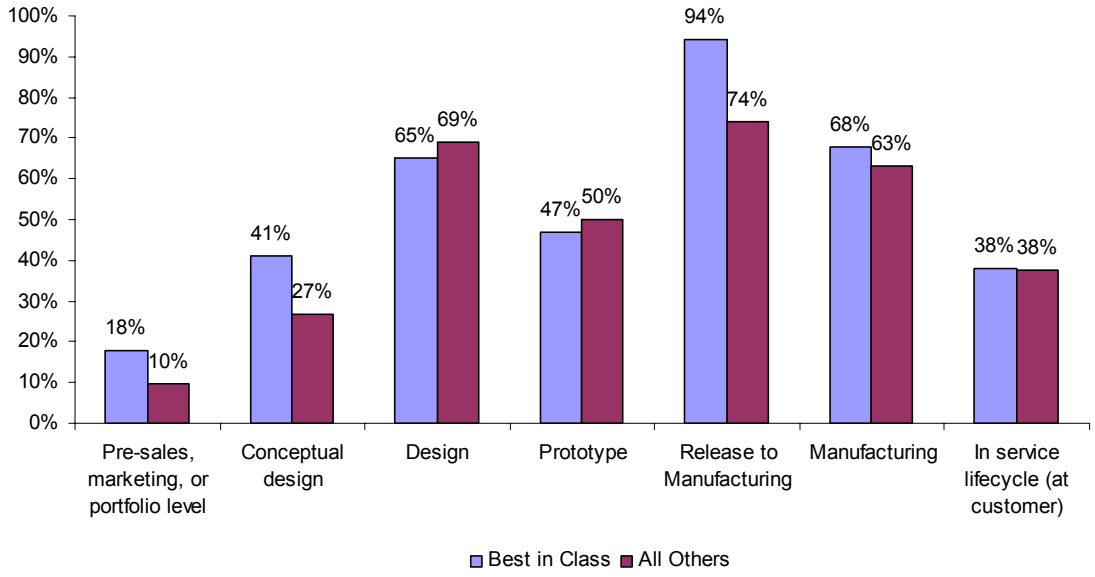
Extending Configuration Management

Best in class also extend the depth and breadth of formal configuration management efforts in a number of ways:

Extending CM throughout the Lifecycle

Best in class companies are more likely to extend formal configuration management processes both upstream before design and downstream, especially to release to manufacturing (Figure 6).

Figure 6: Use of Formal CM Processes throughout the Lifecycle



Source: Aberdeen Group, February 2007

In particular, best in class companies are 1.8 times more likely than other companies to start formal configuration management processes during the pre-sales, marketing, or portfolio planning level of product development and 1.5 times as likely to use it during conceptual design. This is significant because it means that requirements and other pivotal product data are kept under revision control, so that the impacts of changes on early assumptions about and requirements of the product are understood and addressed proactively. This is particularly important given that Aberdeen's *Product Portfolio Management Benchmark Report* indicates that unclear or continually changing product definitions is the most common reason that products fail.

Aerospace and Defense Manufacturer

"The biggest innovation over the last 10 years has been a more rigorous and granular configuration management in control of requirements."

Just as important is the use of formal configuration management – by 94% of the best in class – in release to manufacturing. This is a key transition stage – from the "as designed" BOM, representing the various systems of a product, to the "as planned" BOM, representing assembly and/or production sequences and manufacturing information. This juncture is where the product is transformed from a virtual entity to something that needs to be produced in the physical world. At this point, changes become more costly because finished products, component

Manitowoc, Inc

"Once we have the determined how feasible a product is and we have our scorecards from marketing, we then formalize the BOM process and then require sign off across a number of departments."

Michael Hollen
Design Supervisor

inventory, product plans, purchase orders, and plant capabilities must be considered before a change is made.

Although Figure 6 indicates that best in class companies are at parity with all other companies in using formal CM in the service lifecycle, other benchmark findings reveal the 50% of these leaders (versus 37% of other companies) are extending formal configuration management into the service phase for "as maintained" bills of material. In fact, companies that are best in class at meeting product lifecycle costs are one third more likely than other companies to use formal CM in the service lifecycle.

Extending CM to Coordinate Cross-Disciplinary Designs

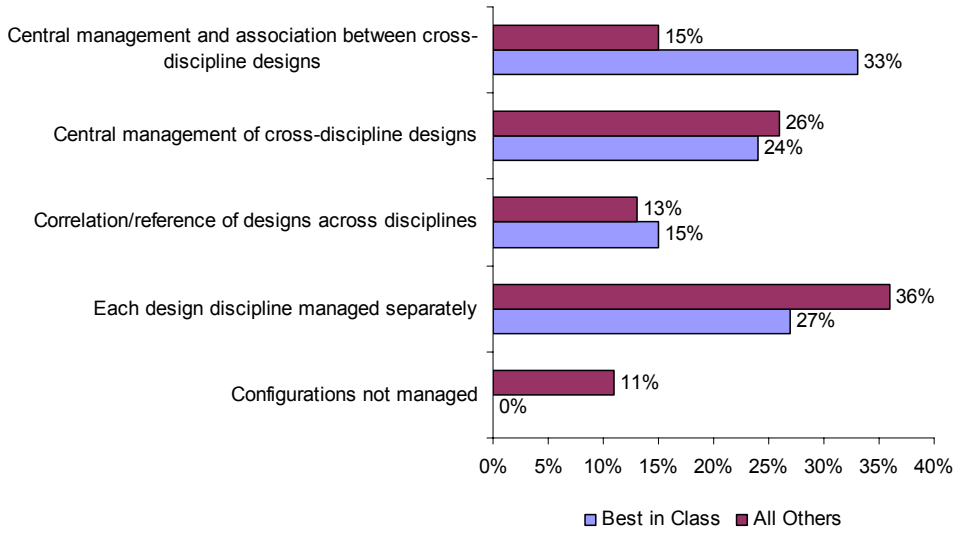
Today, more and more products involve cross-disciplinary or "mechatronic" development – that is, they incorporate electronic and embedded software systems or components as well as mechanical parts. According to Aberdeen Group's *Mechatronics System Design Benchmark Report: Coordinating Engineering Disciplines*, manufacturers (68%) of these products see synchronization of mechanical and electrical design representations as the top challenge of mechatronic development. It's also a challenge for configuration management because not only do all configurations – mechanical, electrical, and software – have to be at the correct revisions within their own domains, they must also be kept in synch with each other. This is particularly true as products integrate electronics and mechanics more tightly, and performance becomes more dependent on the way that these different elements work in concert.

Global Manufacturer

"We have a very long lifecycle product, and a given product may be retrofitted several times. We need to know what parts are, what parts are superseded, along with the service procedures."

In fact, best in class companies are more than twice as likely as others (33% versus 15%) to manage and link mechanical, electrical, and embedded software configurations (Figure 7).

Figure 7: Managing Cross-Disciplinary Configurations



Source: Aberdeen Group, February 2007

This correlates with findings from Aberdeen's *Mechatronics Systems Design Benchmark Report* indicating that seven out of ten companies that are best in class at mechatronics development plan to integrate data management across engineering disciplines, compared to half of other companies.

Extending CM to Include More Product Data

However, a commercial product – even a complex mechatronic product – is more than just its technical design. The product definition may include information such as manufacturing instructions and quality specifications, helping to ensure that it gets produced efficiently and to requirements. It also may include approved material lists (AML) and approved vendor lists (AVL), which can help reduce product costs and ensure quality. Product documentation and product graphics are also important though extrinsic components of the final product, necessary to its proper use, function, and maintenance. In fact, Aberdeen's *Next-Generation Product Documentation Benchmark Report* discloses that 60% of companies that are best in class in documentation incorporate their documentation function into engineering. This ensures the product documentation is kept up-to-date with the latest changes, so that it doesn't delay the product launch.

SafeNet, Inc

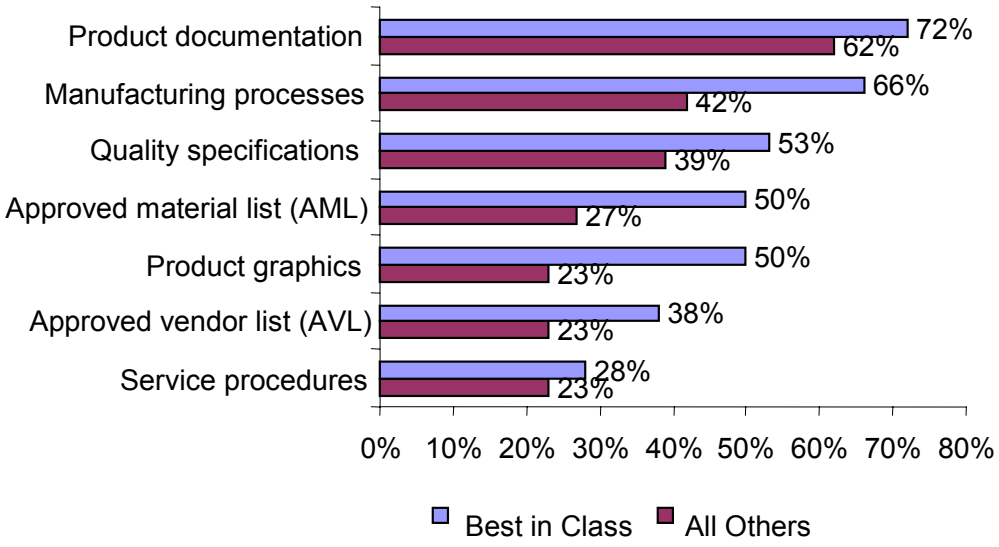
"Our company has been including declarations of conformance like Green initiative documents into our BOM in case customers have any questions. Tying our compliance initiatives into our BOM has helped us keep everything more centralized and manageable."

Bill Oxenford
Configuration Systems Manager

Given the role these kinds of data play in ensuring product quality, reducing product cost, and supporting launch dates, it's not surprising that leading companies are extending con-

figuration management beyond BOMs to cover much more richness in the product definition (Figure 8). However, by associating more information with the product, the impact of product changes is no longer limited to the component materials, but extends to the entire commercial product offering.

Figure 8: Product Data Covered by Configuration Management



Source: Aberdeen Group, February 2007

Technology Use to Enable Configuration Management

While extending configuration management to include more product information and more lifecycle phases pays off in quality, cost reduction, and time to market, it also makes the day-to-day job of managing configurations more complex. To handle the complexities, best in class companies turn to technology to manage and automate the process.

A primary technology enabler of configuration management – in fact the foundation – is centralized product data. A centralized data repository makes up-to-date BOMs in all their forms, as well as product-related data, visible – and accessible with authorization, security, and version controls – to the appropriate people involved in any lifecycle phase. In fact, best in class companies are roughly twice as likely as other companies (59% versus 30%) to leverage centralized product data to improve control of product configurations (Figure 9).

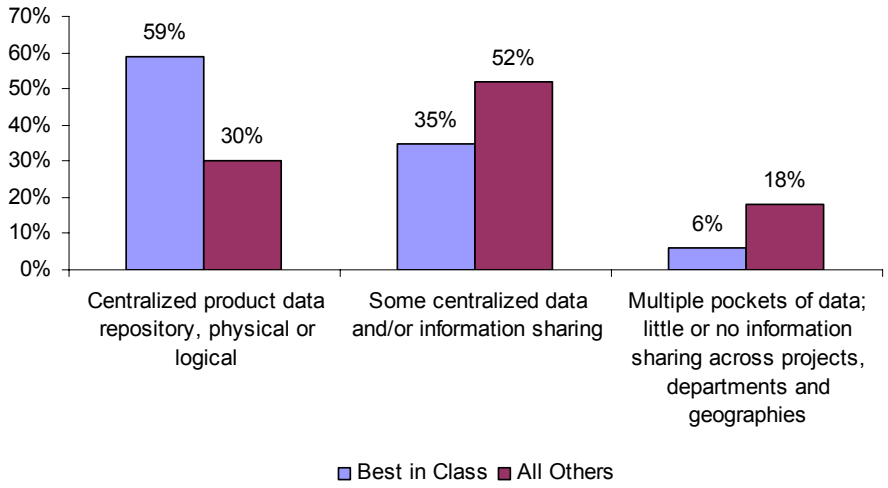
Manitowoc, Inc

"By centralizing data, everyone in the company can work on the same model at the same time. I can have a design team in the states and one in China both working off of the same data, and there is no time wasted wondering what version of the model each team is working on."

Michael Hollen

Design Supervisor

Figure 9: Use Product Data Management for Configuration Management



Source: Aberdeen Group, February 2007

A number of specialty applications extend the visibility and use of centralized data by automating the processes involved in configuration management. In particular, these applications support formalizing processes and extending configuration management to include more lifecycle stages and more product related information, so it's not surprising that they are more frequently used by best in class companies (Table 4).

Best in Class Manufacturer

"A lot of improvement we have seen has come through the use of electronic data, and the ability to manipulate and interrelate more information. Now a requirement feeds 3D CAD and data management, and changes are made easily. The ability to manage traceability back to requirements and along the lifecycle has grown exponentially."

Table 4: Use of Specialty Applications for Configuration Management

Applications	Best in Class	All Others
Workflow	59%	50%
Specialty configuration management solutions	53%	26%
Service management solutions	44%	12%

Source: Aberdeen Group, February 2007

- ***Workflow software:*** These solutions can help automate configuration management process such as engineering change review and approval as well as notify users of exceptions. In addition, these business process management (BPM) solu-

tions often contain analytics that can help measure and assess process performance. Although over one half of best in class companies use these tools for CM, it is important to note that many other companies use these tools as well.

- ***Specialty configuration management applications***. These purpose-built solutions provide pre-defined CM practices – such as review-and-approval processes – providing a specialized fit to automate CM needs. These solutions may leverage existing data sources (such as product data management and ERP), or they may provide their own data repositories. Regardless of whether they provide a physical or logical approach to data, they typically integrate CM processes with the underlying data to provide a specialized solution to support CM processes.
- ***Service management solutions.*** These applications leverage or provide product data in conjunction with service management capabilities. They focus on servicing existing assets and on the "as-maintained" or "as-is" product information. They may also contain service BOMs that communicate the appropriate materials for retrofits, routine maintenance, or other common service activities.

In short, Aberdeen findings show that best in class exhibit a broader and more detailed focus on configuration management. This is manifest in standardized CM processes and a higher level of control, extensions of configuration management to cover upstream and downstream lifecycle processes, support for cross-disciplinary or mechatronic products, and the inclusion of more product-related information. These companies also more frequently support CM processes with centralized product data and specialty applications that automate CM processes. In fact, it is by adopting these practices and technologies that these companies have achieved their best-in class level of success in configuration management and, therefore, the metrics that matter to drive product profitability.

Chapter Four: Recommendations for Action

Key Takeaways

- Formalize configuration management (CM) processes, particularly for analyzing, approving, and communicating changes – and educate the company on the importance of configuration management.
- Extend configuration management practices – starting early in conceptual design and extending it to cover product-related information beyond mechanical bills of material (BOMs).
- Enable configuration management – by using centralized data management and offering differing views of product data based on roles, by leveraging workflow technology to promote standardized processes, and adopting specialty solutions that provide CM-focused business processes.

Best in class companies have adopted process, organizational, and technical practices that help them achieve higher levels of performance in managing product configurations. These strategies and actions are paying off as best in class companies are hitting their targets – for launch dates, product development costs, direct product cost, product revenue, product quality, and product lifecycle cost – 89% or more of the time.

To obtain these benefits, companies must first assess their current level of performance and then determine the path to maturing to the next level. Whether a company is trying to gradually move its configuration management from "laggard" to "industry average," or "industry average" to "best in class," the following actions will help spur the necessary performance improvements:

- *Formalize and standardize configuration management processes.*

  Educate your company on the importance of data accuracy and configuration management. Formalize and standardize processes for developing product data, analyzing changes, and communicating changes to all affected parties.

- *Elevate control of configuration management above design teams.*

  Place a manager or VP-level person in charge of configuration management, and don't rely on individual teams. Manage standardized processes at a level in the organization that can influence and enforce control of CM.

- *Extend configuration management upstream in the product lifecycle.*

  Follow the examples of leading companies and extend CM upstream to incorporate requirements and other early product definitions, to ensure that the impacts of changes to upstream information are understood downstream.

- *Extend configuration management downstream in the product lifecycle.*

Focus on extending CM downstream, particularly into release to the manufacturing process, which is prone to error. Consider extending to service management as well, to reduce total product lifecycle costs.

- *Extend configuration management beyond BOMs.*

  Incorporate richer product definitions under CM control, to ensure that the impact of changes on products are recognized and addressed across all aspects of the commercial product including documentation, quality specifications, and manufacturing instructions.

- *Extend configuration beyond mechanical components.*

  Incorporate electrical and embedded software components in the definition of the product in order to reflect the importance of interoperability and synchronization between these elements, particularly to manage the impact of change.

- *Enable configuration management with centralized product data.*

  Ensure that CM processes are supported by a foundation of accurate, readily accessible product data. The data may be centralized in a common repository or managed across multiple repositories in a logical or "federated" approach.

- *Enable configuration management with CM-focused applications.*

  Implement solutions that provide and support best-practice CM processes. Look to adopt these processes to jump-start a CM implementation with specialized capabilities and built-in CM workflows.

- *Enable configuration management with service applications.*

  Extend CM further into the service lifecycle, and take advantage of service management solutions that can help control configurations and reduce total product lifecycle costs.

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Appendix A:
Research Methodology

Between January and February 2007, Aberdeen Group examined the product configuration management procedures of more than 200 enterprises in aerospace and defense (A&D), automotive, high-tech, industrial products, and other manufacturing industries.

Responding executives completed an online survey that included questions designed to determine the following:

- The current challenges to managing product configurations effectively
- The effectiveness of a variety of existing configuration management procedures and infrastructures
- The use of automation to support and promote configuration management processes and information visibility
- The results and benefits of successful technology, process, and organizational approaches aimed at improving product configuration management.

Aberdeen supplemented this online survey effort with telephone and e-mail interviews with select survey respondents, gathering additional information on configuration management strategies, experiences, and results.

The study aimed to identify emerging best practices for configuration management and provide a framework by which readers could assess their own configuration management capabilities.

Responding enterprises included the following:

- ***Functional area of responsibility:*** The research sample included respondents with the following functional areas of responsibility: engineering (35%), information technology (24%), business process management (11%), manufacturing (9%), logistics/supply chain (6%), documentation (6%), quality (5%), procurement (3%), marketing (1%), and finance (1%).
- ***Industry:*** The research sample included respondents predominantly from manufacturing industries. Aerospace and defense manufacturers represented 15% of the sample, followed closely by industrial equipment at 13%, high-technology/software at 12%, and automotive at 11% of respondents. Computer equipment and peripherals and medical devices each accounted for 5% of the sample. Other sectors responding included consumer electronics, telecommunications equipment, and consumer durables.
- ***Geography:*** A majority of respondents – 69% – were from North America. Remaining respondents were from EMEA – Europe, the Middle East and Africa – (23%), Asia-Pacific (7%), and South/Central America and the Caribbean (1%).
- ***Company size:*** About 36% of respondents were from large enterprises (annual revenues above US$1 billion); 37% were from midsize enterprises (annual reve-

nues between $50 million and $1 billion); and 27% of respondents were from small businesses (annual revenues of $50 million or less).

Solution providers recognized as sponsors of this report were solicited after the fact and had no substantive influence on the direction of the *Configuration Management Benchmark Report*. Their sponsorship has made it possible for Aberdeen Group to make these findings available to readers at no charge.

Table 5: PACE Framework

PACE Key
Aberdeen applies a methodology to benchmark research that evaluates the business pressures, actions, capabilities, and enablers (PACE) that indicate corporate behavior in specific business processes. These terms are defined as follows: *Pressures* — external forces that impact an organization's market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive) *Actions* — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product/service strategy, target markets, financial strategy, go-to-market, and sales strategy) *Capabilities* — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing) *Enablers* — the key functionality of technology solutions required to support the organization's enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)

Source: Aberdeen Group, February 2007

Table 6: Relationship between PACE and Competitive Framework

PACE and Competitive Framework How They Interact
Aberdeen research indicates that companies that identify the most impactful pressures and take the most transformational and effective actions are most likely to achieve superior performance. The level of competitive performance that a company achieves is strongly determined by the PACE choices that they make and how well they execute.

Source: Aberdeen Group, February 2007

Table 7: Competitive Framework

Competitive Framework Key
The Aberdeen Competitive Framework defines enterprises as falling into one of the three following levels of configuration management practices and performance: *Laggards (30%)* — configuration management practices that are significantly behind the average of the industry, and result in below average performance *Industry norm (50%)* — configuration management practices that represent the average or norm, and result in average industry performance. *Best in class (20%)* — configuration management practices that are the best currently being employed and significantly superior to the industry norm, and result in the top industry performance.

Source: Aberdeen Group, February 2007

Appendix B:
Related Aberdeen Research & Tools

Related Aberdeen research that forms a companion or reference to this report includes:

- *The Mechatronics System Design Benchmark Report: Coordinating Engineering Disciplines* (August 2006)
- *The Next-Generation Product Documentation Report: Getting Past the "Throw It Over the Wall" Approach* (December 2006)
- *The Product Portfolio Management Benchmark Report: Achieving Maximum Product Value* (August 2006)
- *Enabling Product Innovation: The Roles of ERP and PLM in the Product Lifecycle* (December 2005)
- *Managing Risk and Reward in the Performance-Drive Service Chain Report (February 2007)*

Information on these and any other Aberdeen publications can be found at www.Aberdeen.com.

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