Aberdeen Group

The Product Lifecycle Collaboration Benchmark Report

The Product Profitability "X Factor"?

June 2006

Executive Summary

Issue at Hand

Aberdeen*Group* benchmarks indicate that companies are increasingly taking a cross-departmental, cross-functional, cross-enterprise, and cross-geographic approach to improve product development, product innovation, and engineering processes in order to increase revenues, decrease cost, and, consequently, improve profitability. Furthermore, Aberdeen*Group* has observed this "cross-" or "x" approach in different forms of collaboration across the lifecycle. These include design collaboration, value chain collaboration, project collaboration, real-time/meeting collaboration, and 3D publishing and repurposing CAD models.

With all this collaboration underway and increasing, companies need to understand whether or not it is making a difference to their corporate performance and whether collaboration is delivering on its promise. The research indicates that the answer is "yes" and further identifies how companies are successfully collaborating to gain a competitive advantage and meet their product lifecycle goals.

Key Business Value Findings

Companies are pursuing collaboration to reduce time to market and increase product innovation (including product "fit" to customer and market needs) – as part of their total strategy to achieve their corporate goals for profitable growth. In this pursuit, manufacturers are collaborating both internally (69% with internal departments, 65% with internal design/design review teams) and externally (63% with customers and suppliers, 41% with 3rd party engineering teams). They are also collaborating on a wide range of topics – with product requirements (78%) foremost.

Most collaboration comes early, before the manufacturing product launch. During the product requirements phase, design, meeting, and project collaboration are common. As companies move into design and prototyping, they begin to work more closely with the value chain on sourcing. Project and meeting collaboration are also common through product launch into maturity. Yet collaboration does not subside after launch, but plays a role in design changes and cost reduction projects.

Not surprisingly, each form of collaboration has its own goals – and appropriate approaches, including actions, capabilities, and technology enablers to achieve those goals.

- **Design collaboration**. In addition to collaborating around MCAD and other designs, this form of collaboration involves translation/visualization, digital mockup, and sharing designs with analysis tools. Prioritized goals are better matching customer/market requirements (71%), faster time to market (67%), and reducing product costs (67%). Top actions to achieve these goals include design reviews to eliminate later, expensive changes (43%); designing components in parallel (37%); and involving customers in product planning validation. Best in class companies have been collaborating during the design phase longer (more than a year), with more parties, such as suppliers and manufacturing – and with

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greater utilization of specialized tools, including product data management (PDM) systems and other PLM solutions.

- **Value chain collaboration**. Companies are collaborating with their value chains on configuration management, BOMs, compliance certifications, sourcing, and the RFP/RFQ process. Top goals for this form of collaboration include accelerating time to market (78%), reducing direct product costs (67%), and creating higher quality products (56%). To achieve these goals, companies are taking action to electronically communicate engineering changes (44%) and specifications (39%) and to increase the accuracy of BOMs (31%). Again, best in class companies have been collaborating with their value chain longer, more frequently, and with more specialized collaboration tools, such as PDM and other PLM solutions.
- **Project collaboration**. This is perhaps the most widely used form of collaboration. Over half of companies surveyed employ project collaboration from early design phases through product launch – including sharing project data, product data in a project context, and workflows. Goals include enhanced value chain teamwork (27%), better utilization of resources (23%), and faster time to market (19%). Actions to achieve these goals include improving the execution of cross-team projects (60%) and cross-enterprise projects (43%), as well as improving the visibility of the project status (41%). Top performers are 50% are more likely to be focusing on improving cross-team project execution and enforcing common project methodologies – and almost two and a half times more likely to be using PDM.
- **Real-time or meeting collaboration.** This is the most broadly used form of collaboration and includes application sharing, chat, interactive Web meetings, and polling. Top goals include accelerating time to market (67%), producing higher quality products (54%), and better meeting customer and market requirements (52%). Best in class companies, in addition to having collaborated for a longer period of time than their lower performing peers, frequently use PLM solutions in combination with real-time capabilities. In particular, they are one-third more likely to engage in real-time collaboration with digital mockup and CAD and 40% more likely to use visualization tools.
- **3D publishing and repurposing CAD models.** Used to develop manufacturing instructions, technical publications, installation manuals, maintenance procedures, and marketing collateral, this is the fastest growing form of lifecycle collaboration. Companies are implementing 3D publishing to reduce time to market (61%), lower product development costs (58%), and create higher quality product documentation (47%). Actions taken to achieve these goals include reusing design data in downstream publishing (62%), aligning creative and engineering teams (54%), and reducing the time to generate technical documentation (43%). Best in class companies are 50% more likely than other companies to be using 3D publishing to reduce time to market and communicate manufacturing instructions to the plant and to use graphics to overcome language barriers.

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What approaches are working? Best in class companies – labeled because of their ability to meet product development targets for revenue, product cost, launch date, development cost, quality, and lifecycle cost – clearly stand out for their increased usage of PDM and other PLM technologies.

Implications & Analysis

From the analysis of the different forms of collaboration, a clear picture emerges about what approaches are proving to be successful and more likely to deliver a competitive advantage. Several factors differentiate best in class companies. These include:

- **Collaborating externally**. Best in class companies collaborate externally with customers and suppliers more frequently (72% versus 62% of all other companies). However, they are also 50% more likely to collaborate with third-party engineering teams.
- **Collaborating across the lifecycle**. In addition to collaborating more with external parties, top performers are more likely to collaborate with their peers in different areas. For example, they were more than twice as likely as competitors to collaborate on systems-level design. This area has been growing, as products have become more complicated and include mechanical, electrical, and software elements. Later they collaborate more frequently on manufacturing instructions.
- **Developing a collaboration platform**. Common productivity tools – e-mail, text documents, and spreadsheets – were widely used by all companies, for all forms of communications. So these tools do not necessarily provide enhanced competitive performance. However, in all stages and types of collaboration, PDM was a key technology – and one more widely used by best in class companies than all others. In addition, these top performers were more likely to use specialty PLM tools where they were relevant to different forms of collaboration. In other words, the leaders were more likely to standardize the use of technology for at least some forms of collaboration.
- **Measuring collaboration results**. Collaboration measurement is a challenge because collaboration isn't a process in itself. However, some direct measurements, such as direct cost savings from reduced travel expenses, are possible. In addition, leading performers are more likely to measure collaboration performance, albeit indirectly, by measuring overall product innovation, product development, and engineering processes.

While it's difficult to put a direct value on collaboration, it's clear that best in class companies have been pursuing collaborative processes longer and more thoroughly, and are hitting their targets for revenue, cost, launch dates, quality, and lifecycle value more regularly. This fact indicates that product lifecycle collaboration does indeed enhance product development performance – ultimately contributing to the improved profitability enjoyed by best in class performers.

Recommendations for Action

To improve the profitability of products in the product lifecycle, companies should evaluate the use of collaborative techniques in their product innovation, product development, and engineering processes to ensure they effectively accomplish the following:

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- Support and extend internal collaboration, including both the front end and back end (with manufacturing and service) of the product development process. Look for areas in which collaboration will reduce time to market and costs as well as optimize designs for downstream functions.
- Support and extend collaboration with external parties, such as suppliers, third-party engineering teams, and contract manufacturers. By working with partners, companies can often increase innovation as well as reduce costs and time to market.
- Develop, extend, and integrate standard collaborative process – building a common collaboration infrastructure with common tools for each form of collaboration, including PLM solutions to provide differentiating capabilities.

Laggards will need to start their implementations. Industry average companies can extend their current collaborative capabilities. And best in class companies should look for ways to eliminate waste and increase innovation. However, whatever their current performance level, companies can gain value – such as lower costs, higher revenues, and greater profitability – by increasing collaboration in the product lifecycle.

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Chapter One:
Issue at Hand

Key Takeaways

- Aberdeen*Group* research shows that companies view pursuing product and project collaboration as a top priority to meet their corporate demands for profitable growth.
- Today's product innovation environment is increasing in complexity, for instance Aberdeen*Group* research indicates that 44% of manufacturers are assembling teams across geographies to pursue global design.

Collaboration was touted as the silver bullet that solves all of the problems that businesses face in working with their partners. Few would say that the promise of collaboration was not compelling, nor would they argue that it did not receive its fair attention of hype during the emergence of the Internet in business-to-business interactions. Now that time has passed, has the promise of collaboration been realized for product innovation? Has product collaboration resulted in new value for participating companies? If so, are the basic forms of product collaboration a competitive advantage or simply a competitive necessity? Finally, are there collaboration techniques and approaches that companies use in their product lifecycle that set them apart from their competition in regards to product profitability?

With these questions in mind, Aberdeen*Group* conducted a benchmark study to determine the importance of collaboration in the modern product lifecycle. *The Product Innovation Agenda Benchmark Report* determined that design and project collaboration both are among the highest product development priorities for manufacturers. Furthermore, 44% of respondents to that benchmark indicate that they were assembling teams across geographies to pursue global design. For discrete manufacturers the percentage rises to 53%, leading to an even greater need to work effectively across the product value chain.

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

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Past research also suggests that enabling product collaboration can help companies meet their product development objectives. *The Global Product Design Benchmark Report* shows that companies that are best-in-class (see Competitive Framework Key in sidebar) in meeting product development targets are 33% more likely to have formal collaboration and control of design, leveraging an automated collaboration infrastructure. How are these companies achieving enhanced value, and are there other collaboration techniques that are used in the product lifecycle to improve performance?

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

The Collaboration "X Factors"

Aberdeen*Group* benchmarks indicate that companies are increasingly approaching product innovation in cross-departmental, cross-functional, cross-enterprise, and cross-geographic fashion. To support this "cross-" or "x" approach Aberdeen*Group* has observed a number of forms of collaboration in the product lifecycle. The forms of collaboration identified include:

- Design collaboration
- Collaboration with value chain
- Project collaboration
- Real-time / meeting collaboration
- 3D publishing and repurposing CAD models

Each of these five forms of collaboration is analyzed according to Aberdeen*Group*'s PACE framework (see sidebar for more detail on PACE) to understand the objectives companies hope to achieve to address their business pressures, the actions they are putting in place to address current challenges, and the business capabilities and technical enablers they are employing to support those actions.

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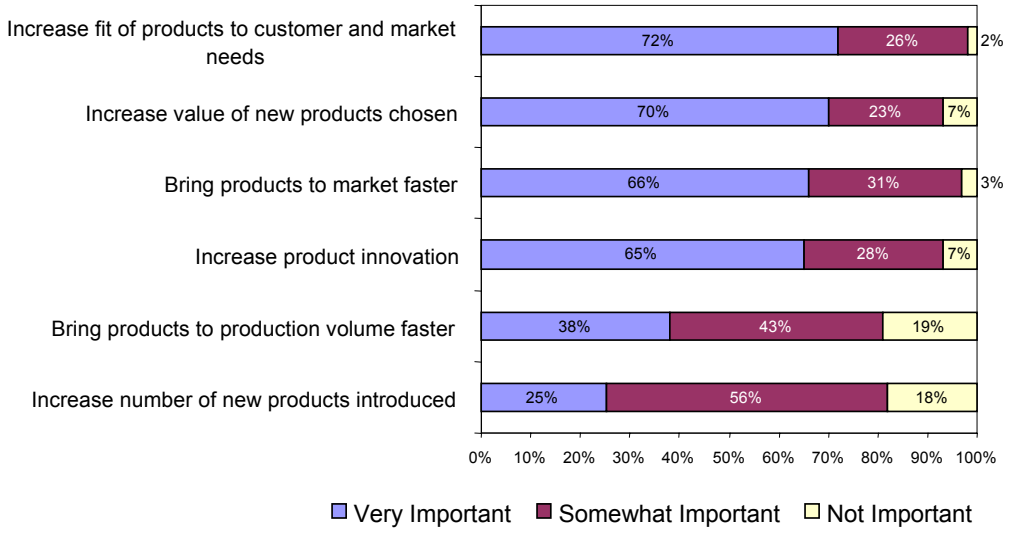
Chapter Two:
Key Business Value Findings

Key Takeaways

- Companies are collaborating both internally and externally on a wide range of topics.
- Companies have different goals for the varied types of collaboration and use different capabilities and enablers to address the unique challenges encountered in their collaborative processes.
- Companies are adopting a number of collaborative approaches to improve product innovation, product development, and engineering processes – matching specific techniques to the lifecycle phase they are trying to improve.

At the macro level, it is clear why companies pursue collaboration. Aberdeen*Group*'s *Product Innovation Agenda Benchmark* study indicates that current corporate strategies strive primarily for increased revenue, but not at the expense of increased cost – resulting in profitable growth. Further analysis indicates that companies believe the path to increased revenue is achieved by developing innovative products that meet customer needs, brought to market faster (Figure 1).

Figure 1: Product Innovation Actions to Increase Revenue



Source: Aberdeen*Group*, September 2005

Collaborative business processes are being used in order to adopt these revenue-generating techniques. Indeed, the pressures for collaboration are similar to the pressures

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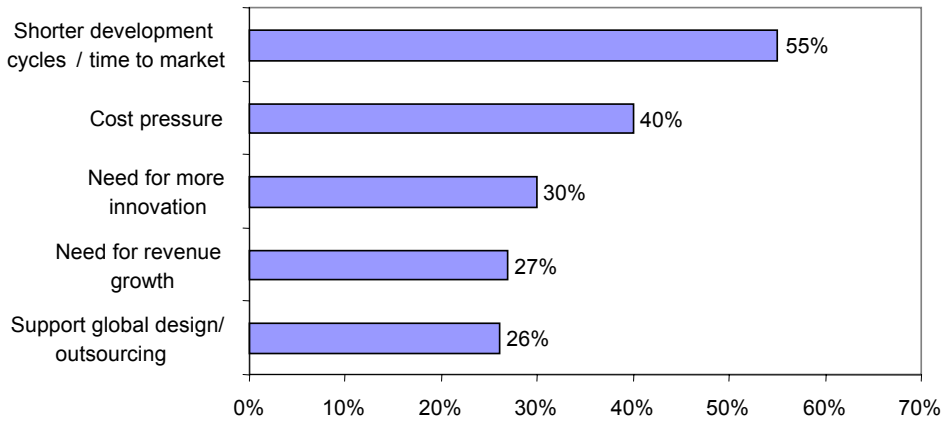
that have demanded improvements in product innovation processes. In alignment with their quest for profitable growth, over one half of companies indicate that time-to-market demands are the biggest driver of collaboration, along with the need for more innovation and a direct need for revenue growth (Figure 2). But cost is not far behind in the list of pressures (number 2 on the list) that companies face today.

Figure 2: Pressures Being Addressed by Product Lifecycle Collaboration



Source: AberdeenGroup, June 2006

Examining the Who, What, Why, and When of Collaboration

Given the potential benefit to the corporate strategy, many companies have adopted collaborative processes, both internally and externally. Working closely across multi-functional teams is indicated as the top priority, along with internal design or design review teams (Figure 3). Just slightly fewer companies have begun collaborating externally with customers and suppliers.

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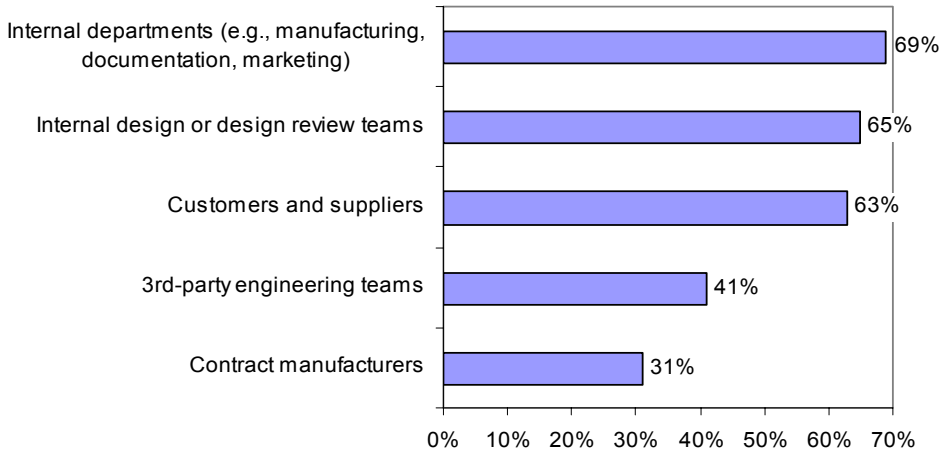
Figure 3: Most Prevalent Collaboration Partners

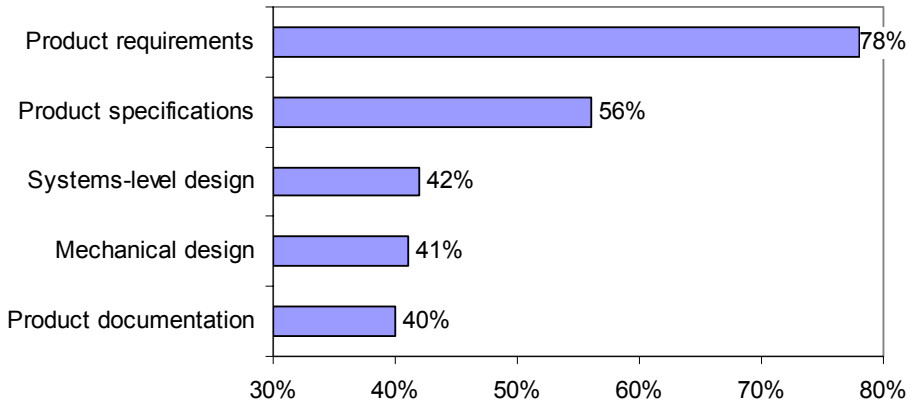


Source: AberdeenGroup, June 2006

Given the input and participation from multiple departments and individuals in the product development cycle, it is not surprising to see internal departments as the most prevalent collaboration partners. Customer or supplier participation is not far behind, due to the increasingly cross-enterprise nature of value chains today.

Understanding the nature of collaboration in today's product lifecycle entails understanding not just what parties companies are collaborating with, but on what subjects. Benchmark participants indicate that they are focusing a significant amount of emphasis on collaborating on product requirements. In fact, over three quarters indicate they are using collaborative techniques for product requirements (Figure 4).

Figure 4: Most Prevalent Collaboration Topics



Source: AberdeenGroup, June 2006

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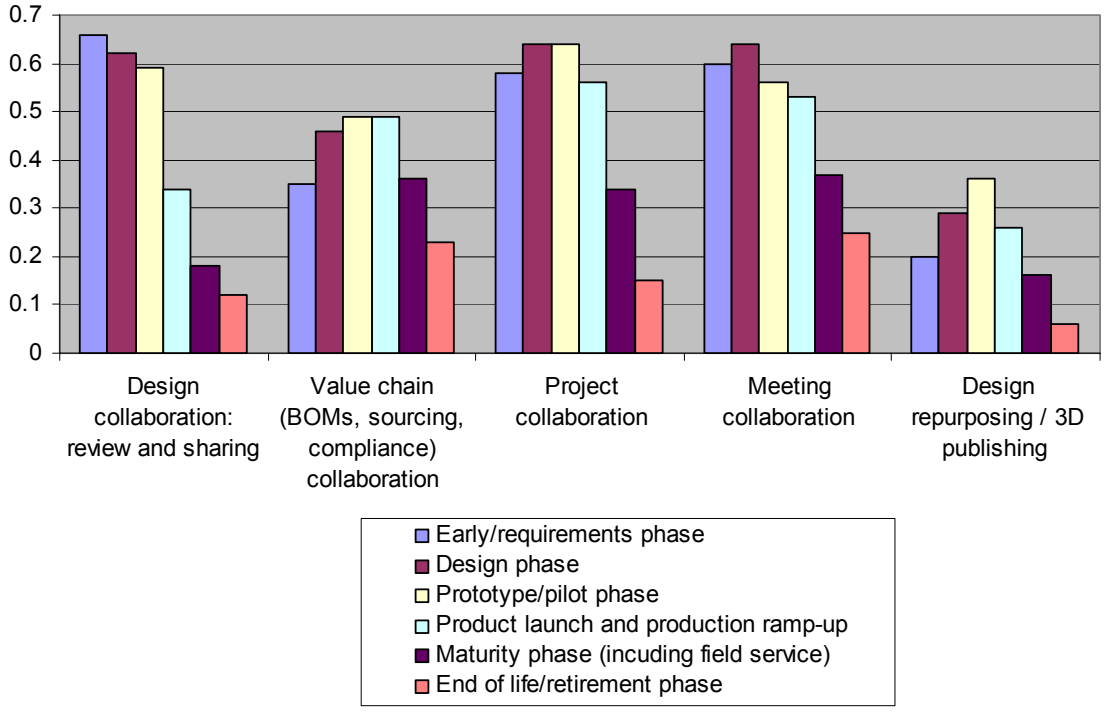
The focus on understanding and communicating product requirements maps well to corporate strategies to increase revenue and also correlates with the top action (identified in *The Product Innovation Agenda*, see Figure 1) to increase revenue – namely to increase the fit of products to customer and market needs. The next most prevalent topics for collaboration were product specifications and various forms of product design, which ideally are the result of development efforts to incorporate the requirements into the product. By identifying market needs in advance and sharing design information for review and execution, companies can ensure that designs meet the needs of their internal and external partners, including downstream departments and customers.

The transition from gathering and communicating requirements to incorporating them in the design suggests different topics of collaboration may be more important during different phases of the product lifecycle. This hypothesis was confirmed by the survey respondents, who reported using different forms of collaboration more frequently at different times in the lifetime of the product (Figure 5).

Figure 5: Collaboration Techniques by Product Lifecycle Phase



Source: AberdeenGroup, June 2006

Most of the collaboration today is early in the product lifecycle. For most forms, more prevalent usage of collaboration occurs before manufacturing product launch. In the early lifecycle, primary forms of collaboration include design, project, and meeting collaboration. This usage maps well to the activities that most companies are pursuing at those times – primarily gathering requirements and organizing the project. Moving into the

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design and prototype phases, companies begin to work more closely with the value chain, such as identifying sources of supply and involving downstream parties. Project and meeting collaboration appear as the most prevalent forms through product launch and into maturity, with meeting collaboration taking on a more prevalent role during launch and production ramp-up, allowing companies to identify and address issues discovered in this critical phase of the product lifecycle. Collaboration tapers off during the latter phases of the product lifecycle, but does not subside completely as sustaining design changes and cost reduction projects come to the forefront. Clearly, companies are using different collaborative approaches during different product lifecycle phases.

X Factor 1: Design Collaboration

With the "who," "what," "why," and "when" of collaboration discussed, let's turn towards "how." The first of the five forms of collaboration analyzed is design collaboration. As discussed earlier, product development now crosses multiple organizational, corporate, and geographic boundaries. The value chain has expanded and become global. Aberdeen*Group*'s *Global Product Design Benchmark Report* indicates an increased adoption of global product design, with many companies now designing products in over four or five countries.

As the design team has expanded internally and externally, collaboration has been introduced as the panacea for working across boundaries. Along with the rest of the Internet hype, collaboration was identifying as the magical "x factor" that would make working across departments and companies easy and natural. Of course, technology is only one part of the equation, and while many companies today are collaborating much more frequently, it is not always "easy." Now that time has passed, has this form of collaboration survived and is it adding value?

Design collaboration is perhaps one of the most proven forms of collaborating in the product lifecycle. Many companies, large and small, are engaging in design collaboration. Design collaboration and design sharing includes:

- Collaborating around CAD (computer aided design) models, other designs
- Translation and visualization of CAD models
- Digital mockup to visualize virtual assemblies of CAD designs

Corporate goals of design collaboration are focused on both top- and bottom-line improvements and map very well to strategic goals for profitable revenue growth (Table 1). The most common goals for this form of collaboration are shown below:

Table 1: Goals of Design Collaboration

Goals for Design Collaboration	% Reported
Better match with customer / market requirements	71%
Faster time to market	67%
Product cost reduction (direct costs)	67%
Higher quality products	61%

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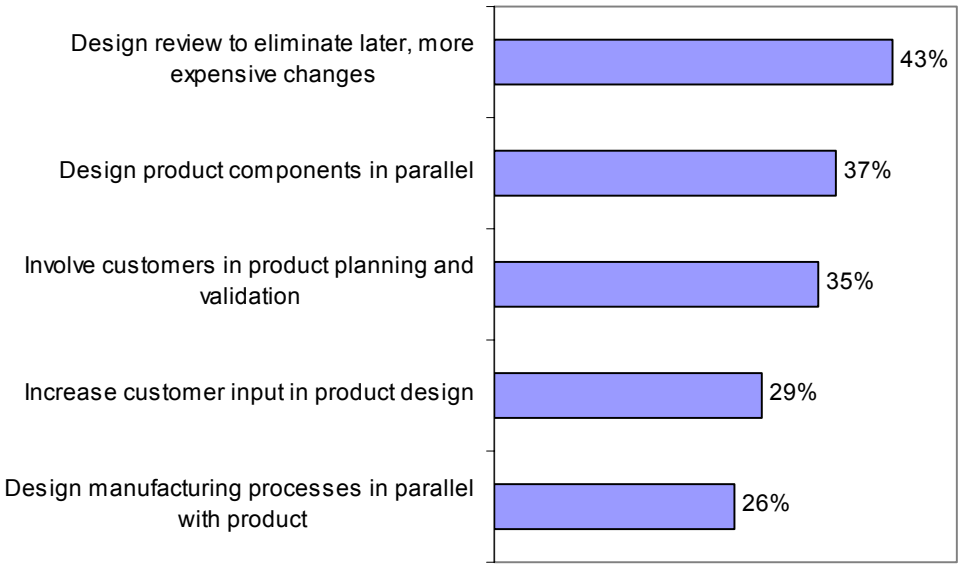
Goals for Design Collaboration	% Reported
More innovative products	59%
Design for ease of manufacturing or assembly	50%

Source: AberdeenGroup, June 2006

To achieve these goals, manufacturers are taking initiative and changing their businesses in tangible ways. Several strategic actions, including design review to eliminate late changes and parallel design of components are being pursued to improve product development with design collaboration, review, and downstream sharing.

Figure 6: Design Collaboration Actions



Source: AberdeenGroup, June 2006

These actions align well with the strategic goals, providing opportunity for reduced cost, faster time to market, cost reduction, and better product fit with market demands. Putting in place these processes and achieving the stated goals, however, do not occur without overcoming some significant obstacles (Figure 6). Survey respondents reported a number of significant challenges that they have encountered in executing design collaboration, including internal politics and struggling to work with data in multiple formats and CAD systems, frequently requiring the use of specialized viewing or translation software to interpret the various proprietary formats.

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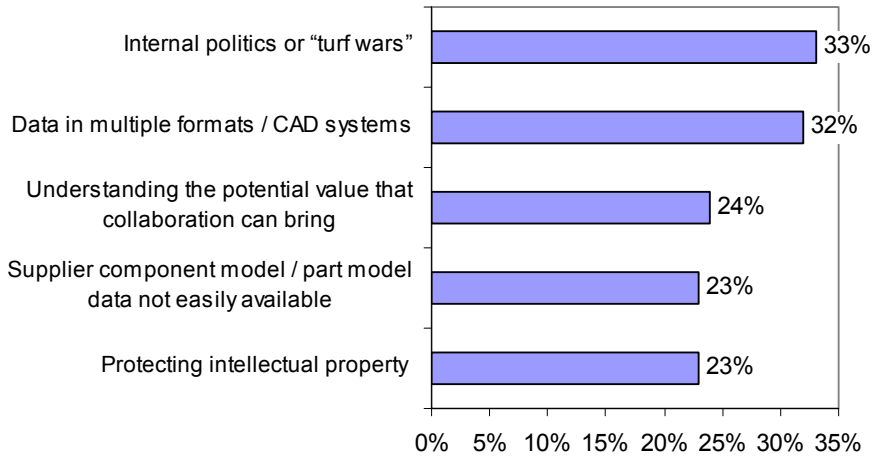
Figure 7: Design Collaboration Challenges



Source: AberdeenGroup, June 2006

These challenges fall into organizational, process, and technology categories. Process and organizational issues include internal politics. For instance, involving downstream functions might entail adding new signoffs that require engineering to get approval from downstream functions. While this process is important to overall performance, it can add short-term challenges because departmental leaders lose full control over their ability to meet deadlines and must build consensus with others. Technical issues include the struggle with multi-CAD environments, which has been reported as a challenge in past benchmark reports. Companies are using a range of technologies to overcome these obstacles and achieve their goals – ultimately with the aim of delivering profitable product revenue (Table 2). Most companies are using a combination of different forms of technology:

Table 2: Technology Enablers for Design Collaboration

Tools for Design Collaboration	Currently Use	Plan to Use (12 Months)
E-mail	95%	3%
Spreadsheets	92%	2%
Paper drawings/documents	84%	5%
Standalone document management	66%	14%
Multi-purpose screen-sharing tools	65%	18%
Visualization tools	63%	25%
Video conferencing	62%	15%
Digital mockup	49%	29%

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Tools for Design Collaboration	Currently Use	Plan to Use (12 Months)
Collaboration on designs captured in documents	48%	34%
Design translation/compression tools	48%	13%
Web portals	46%	34%
Product data management (PDM)	46%	31%

Source: Aberdeen*Group*, June 2006

These technologies include both new and old approaches. They also include specialty tools in addition to more common tools such as documents and spreadsheets.

Among these most common approaches, what appears to be working? Aberdeen*Group* analyzed the performance of benchmark participants in regards to their ability to meet their product development targets for revenue, cost, launch date, development cost, quality, and total lifecycle cost. The approaches of the top performers across these categories – the best in class – were analyzed to determine what leading companies have in common in their approach to design collaboration. This analysis revealed that, best in class performers:

- Are two times as likely to include manufacturing input in design and 50% more likely to include supplier input
- Are two times more likely to conduct interactive design sessions between engineering sites
- Are two times more likely to use product data management tools (PDM) in design collaboration
- More likely to use other product lifecycle management (PLM) tools, including: visualization, design translation, digital mockup
- Have been using design collaboration longer, 87% for over one year versus 70% for average and laggard performers

Some approaches, such as the use of spreadsheets and documents, are common to almost all companies. While these techniques are commonplace, they are not necessarily more valuable. The commonalities in the approaches of the top performers, listed above, are more likely to result in improved performance. This confirms earlier research from *The Product Innovation Agenda Benchmark* which determined that best-in-class companies are much more likely to use PLM technologies.

X Factor 2: Collaboration with Value Chain

With the importance of design collaboration understood, it is important to recognize that not all product information is represented by the technical design. A product consists of both technical and commercial characteristics, including the information important to sourcing, producing, and delivering the product. As companies have become less vertically integrated over time, the number of companies involved in successfully bringing a product to market has increased dramatically. This can result in very long new-product

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introduction lead times, and opens up the potential for miscommunications and mistakes in product development and value chain execution processes.

Collaboration with the value chain is becoming critical in today's globally dispersed manufacturing networks. Companies of all sizes and across industries are engaging in value chain collaboration, which includes:

- Configuration management
- BOM (bill of materials) collaboration
- Collaborating on compliance, for example, on certifications
- Supplier involvement in the design phase
- RFP/RFQ

The goals of collaborating with the value chain are primarily focused on enhancing the supply chain performance of the product, with the most common goal being faster time to market (Table 3). Value chain collaboration has the potential to ensure smooth operations if conducted early in the product lifecycle, to optimize the product design for supply, manufacturing, and delivery. The most common goals for this form of collaboration encompass time to market, cost reduction, and quality:

Table 3: Goals of Collaborating with Value Chain

Goals for Collaborating with Value Chain	% Reported
Faster time to market	78%
Product cost reduction (direct costs)	67%
Higher quality products	56%
Product development cost reduction	55%
Lifecycle cost reduction (downstream costs)	44%

Source: AberdeenGroup, June 2006

These goals have some commonality with the goals for design collaboration, but add focus on lifecycle cost reduction and an even greater emphasis on improving time to market. To achieve these goals, manufacturers must adopt new processes. Several strategic actions, foremost communicating engineering changes and specifications electronically, are being pursued to improve product development by collaborating with the value chain:

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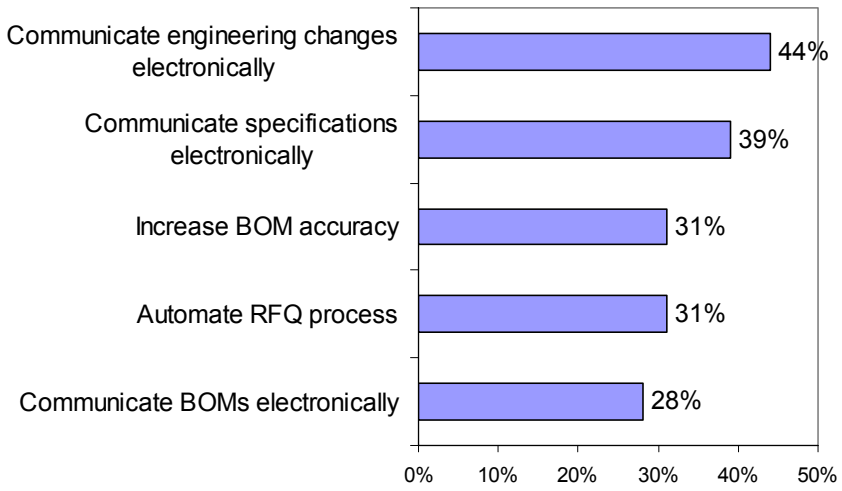
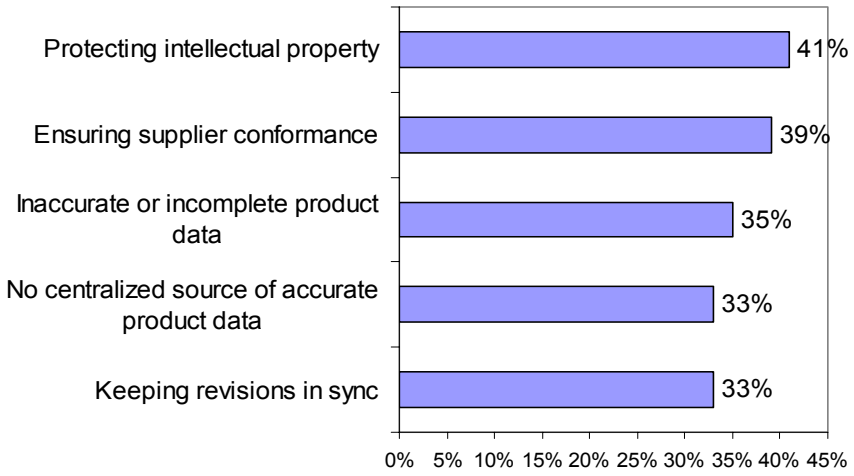
Figure 8: Actions for Collaborating with Value Chain



Source: AberdeenGroup, June 2006

These goals reflect the need for better and timelier communication of accurate product information throughout the value chain. Collaborating with the supply chain to achieve better communication, however, does not occur without overcoming some significant obstacles (Figure 9). Survey respondents reported a number of significant challenges that they have encountered in executing collaboration with the value chain

Figure 9: Challenges in Collaborating with Value Chain



Source: AberdeenGroup, June 2006

The first of these challenges, consistent with findings from *Global Product Design Benchmark Report*, is protecting intellectual property. In addition, many companies are

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struggling with supplier participation in processes and the lack of trusted product data. Companies are using a range of technologies to overcome these problems (Table 4). Most companies are using a combination of different forms of technology, including a mix of traditional and PLM tools:

Table 4: Technology Enablers for Collaborating with Value Chain

Tools for Collaborating with Value Chain	Currently Use	Plan to Use (12 Months)
E-mail	94%	4%
Text documents (e.g., MS Word)	94%	4%
Spreadsheets	94%	2%
ERP	63%	24%
Standalone document management	61%	13%
Component/part catalogs	59%	24%
Product data management (PDM)	58%	33%
Visualization tools	54%	24%
Web portals	49%	30%
Procurement solutions (collaborative)	44%	40%

Source: Aberdeen*Group*, June 2006

These technologies include both new and old approaches. They also include specialty tools in addition to more common tools such as documents and spreadsheets. Aberdeen-*Group* analyzed the performance of benchmark participants in regards to their ability to meet their product development targets for revenue, cost, launch date, development cost, quality, and total lifecycle cost. Next, the approaches of the top performers across these categories – the best-in-class – were analyzed to determine what leading companies have in common in regards to value collaboration. According to this analysis, best-in-class performers are:

- One third more likely to have been collaborating with their value chain for greater then one year
- Three times more likely to be focusing on enhancing handoff of product data to outsourced manufacturers
- 50% more likely to use product data management (PDM) to enable collaboration
- More likely to use other PLM-related tools, such as component catalogs, BOM scrubbing, and visualization technologies to collaborate

The use of readily available office productivity tools and ERP, although commonplace, did not appear to differentiate performance. Furthermore, the use of generic tools such as portals tools did not vary from the best in class to average or laggard performers. These tools, although frequently utilized and potentially a valuable part of a value chain collaboration program, do not necessarily provide a unique advantage.

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X Factor 3: Project Collaboration

The first two forms of collaboration discussed focused on the product itself, both technically and commercially. Product development, however, typically has a project orientation. Aberdeen*Group*'s *Product Innovation Agenda Benchmark* indicates that project management and project collaboration are the top-ranked technical enablers that are "very important" to driving product revenue, and that "product innovation is a team sport." Given this fact, it is no surprise that there is a lot of focus on the product in the context of its product development project. This is particularly important as shown by Aberdeen*Group*'s *Global Product Design Benchmark Report*, which indicates an increased adoption of global product design, with many companies now designing products across the major geographic boundaries.

Project collaboration is perhaps one of the most widely used forms of collaboration in the product lifecycle. Many companies collaborate on projects, with over one half of companies utilizing project collaboration from the early design phases all the way through to product launch, and with lesser use beyond that point. Project collaboration and design sharing includes:

- Sharing project data
- Sharing product data in a project context
- Shared workflows
- Task management
- Resource management

The goals of project collaboration are focused on meeting current challenges as opposed to recognizing any new, significant strategic value on its own (Table 5). The most common goals for this form of collaboration are enhanced teamwork, better use of resources, and faster time to market:

Table 5: Goals of Project Collaboration

Goals for Project Collaboration	% Reported
Enhanced teamwork across value chain	81%
Better utilization of resources	69%
Faster time to market	57%

Source: Aberdeen*Group*, June 2006

To achieve these goals, manufacturers are taking action to improve project-related processes. The following strategic actions, including improving execution in cross-team and cross-enterprise projects, are being pursued to improve product development with project collaboration:

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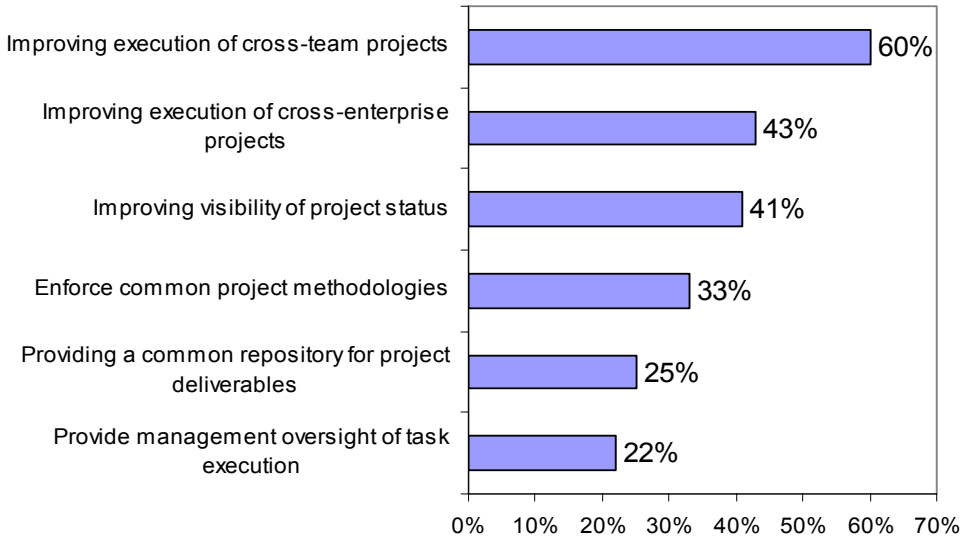
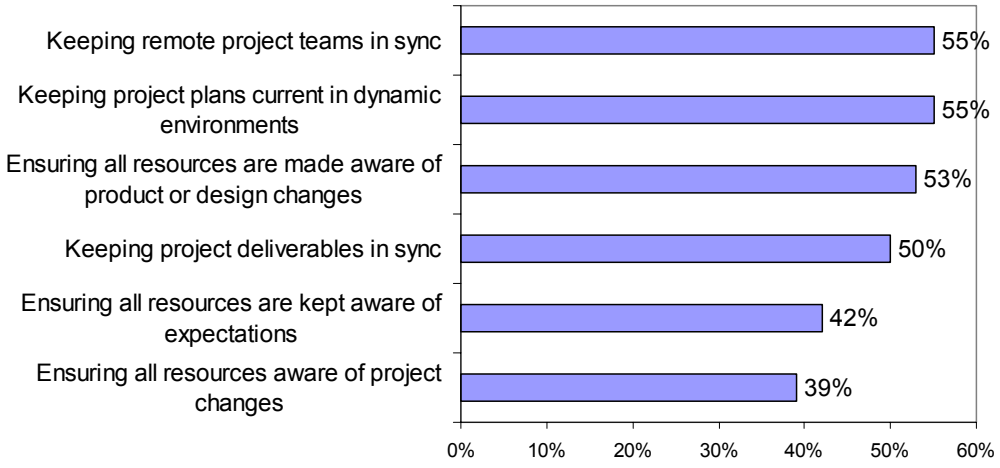
Figure 10: Project Collaboration Actions



Source: AberdeenGroup, June 2006

These actions are predominantly focused on enhancing project execution. Companies did report some challenges in putting in place project collaboration processes to improve project-related performance (Figure 11). The most commonly reported challenges are keeping teams synchronized and project plans current, with other challenges also mentioned by at least half of respondents:

Figure 11: Project Collaboration Challenges



Source: AberdeenGroup, June 2006

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These challenges highlight the increased complexity of the current product innovation environment. The key challenge to project execution, it appears, is keeping everybody working from the same plan and on the same information. Companies are using a range of technologies to support these actions and improve project performance (Table 6). Most companies are using a combination of different forms of technology:

Table 6: Technology Enablers for Project Collaboration

Tools for Project Collaboration	Currently Use	Plan to Use (12 Months)
E-mail	97%	2%
Text documents (such as MS Word)	95%	3%
Project/program management	74%	19%
Spreadsheets	57%	18%
Product data management (PDM)	54%	27%
Workflow / business process management	52%	33%
Standalone document management	50%	20%

Source: Aberdeen*Group*, June 2006

These technologies include both generic solutions such as spreadsheets, as well as (not surprisingly) project management solutions. Among the most common approaches, what appears to be working? Aberdeen*Group* analyzed the performance of benchmark participants in regards to their ability to meet their product development targets for revenue, cost, launch date, development cost, quality, and total lifecycle cost. The approaches of the top performers across these categories – the best-in-class – were then analyzed to determine what leading companies have in common in regards to project collaboration. According to this analysis, best-in-class performers are:

- Almost 50% more likely to have been utilizing project collaboration for greater than one year
- 50% more likely to be focusing on improving execution of cross-team projects
- 50% more likely to be enforcing common project methodologies
- 2.4 times more likely to be using PDM for project collaboration

Not surprisingly, best-in-class companies are much more likely to use PLM solutions, particularly PDM, for their projects. The use of a common repository for product information, which is frequently used to house project deliverables, was a clear differentiator of performance. Project management tools were very commonly used, with a full 93% of best-in-class companies using project/program management solutions. This figure compares to about 75% of average and laggards. This comparison indicates that the use of these tools is common and, therefore, not as great a differentiator as PLM, but that the vast majority of leading companies utilize these tools.

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X Factor 4: Real-time / Meeting Collaboration

The fourth form of collaboration investigated is real-time collaboration, sometimes referred to as "meeting collaboration." Real-time collaboration is a natural consequence of the move from vertically integrated manufacturing to more networked value chains, eliminating the interaction between designers who could readily exchange ideas and work together in a common physical location. Face-to-face interaction with manufacturing and other downstream departments was also a fatality of outsourcing for many companies. Some would argue that too few took advantage of the opportunity to work closely with other departments when it was relatively easy to achieve. Regardless, the opportunity has passed for most, leading to a need for new approaches. Even compensating by having people travel is not practical given today's fast-paced product development environments and the desire to keep costs in control.

This is an area in which technology has played a transformational role in many people's workplace. The ability to conduct meetings remotely has greatly improved with the advance of communications technology, including wide availability of audio, video, and Web conferencing at affordable prices. Frequently used across the product lifecycle, real-time collaboration takes many forms. While some more advanced techniques such as co-authoring or virtual reality are still out of reach for many, companies are using online meeting and Web conferencing in combination with other design-related technologies such as CAD and visualization tools to improve product development.

Real-time collaboration is perhaps one of the most proven and broadly used forms of collaborating in the product lifecycle, frequently involving non-engineering resources. Real-time collaboration and design sharing include:

- Application sharing
- Chat
- Interactive Web meetings
- Polling

The goals of real-time collaboration place a lot of emphasis on the top line – through time to market, quality, and meeting market or customer needs. Again, these objectives are very well aligned to the strategic goals of most companies to achieve profitable revenue growth (Table 7).

Table 7: Goals of Real-time Collaboration

Goals for Real-time Collaboration	% Reported
Faster time to market	67%
Higher quality products	54%
Better meet customer / market requirements	52%
Find and correct mistakes as early as possible	52%
Product development cost reduction	48%
More innovative products	44%

Source: AberdeenGroup, June 2006

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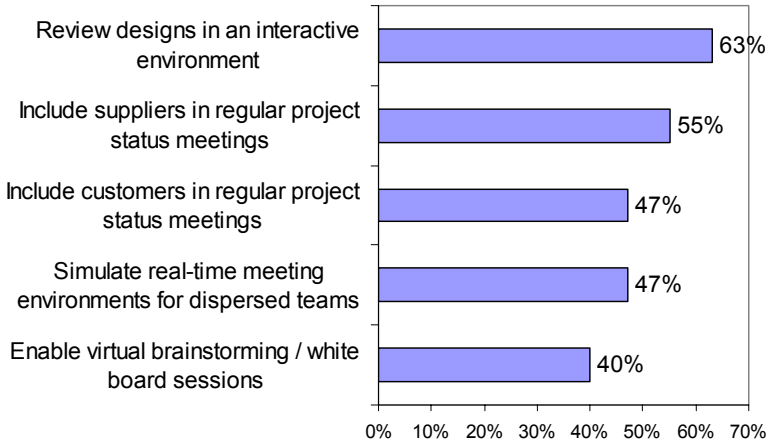
To achieve these goals, manufacturers are taking the initiative to incorporate collaborative approaches. The following strategic actions, foremost among them interactive design reviews and including suppliers in project status meetings, are being pursued to improve product development with real-time and meeting collaboration techniques:

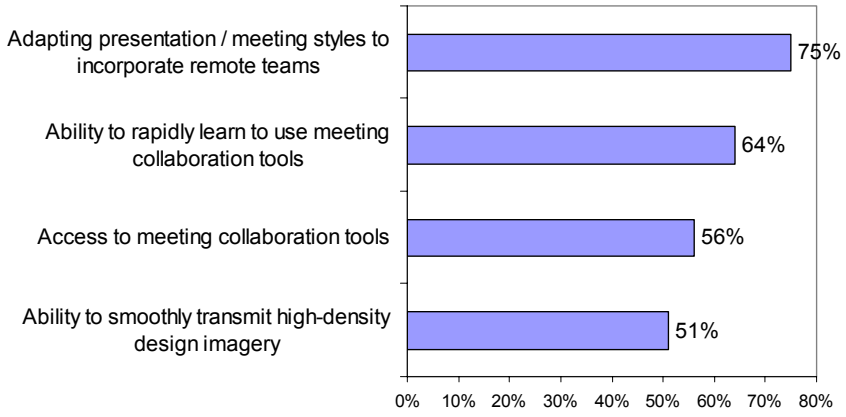
Figure 12: Real-time Collaboration Actions



Source: AberdeenGroup, June 2006

This form of collaboration, even more than others, appears to be an enabler for other processes as opposed to a process in and of itself. The actions identified above are not necessarily new activities, but activities that are being moved out of a physical location and into a virtual environment. Putting in place real-time collaboration is becoming relatively commonplace, but companies still face some obstacles in the process (Figure 13).

Figure 13: Real-time Collaboration Challenges



Source: AberdeenGroup, June 2006

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The primary challenge involves people and processes, specifically the ability to adapt to online meetings. Other challenges include usability and adoption issues. Over one half of the respondents also report that they are have difficulty sharing the rich, highly complex graphics typical in today's CAD systems, a technology issue frequently found when using generic real-time collaboration tools.

Companies are using a range of technologies to support these actions, overcome their obstacles, and achieve the goals – ultimately with the aim of delivering profitable product revenue (Table 8).

Table 8: Technology Enablers for Real-time Collaboration

Tools for Real-time Collaboration	Currently Use	Plan to Use (12 Months)
Phone/audio conference	91%	2%
Video conferencing	71%	13%
CAD	71%	5%
Web conferencing/screen-sharing tools	67%	21%
Visualization tools	58%	17%
Instant messaging/threaded discussion	57%	16%
Product mockup/simulation environments	56%	21%
Virtual/electronic whiteboard/flipchart	52%	18%
Web portals	51%	28%
Collaboration on designs captured in documents	47%	42%
Real-time design collaboration tools	45%	31%
Online training rooms	45%	23%

Source: Aberdeen*Group*, June 2006

These technologies are frequently combined with each other, such as CAD and Web conferencing. In particular, many common meeting tools used in the product lifecycle are being enhanced with PLM-specific tools such as visualization or mockup tools. This combination is frequently used to address the technology issue identified above, allowing companies to share CAD model visualizations that are much easier to transmit and receive.

Among these common approaches, what appears to be working? Aberdeen*Group* analyzed the performance of benchmark participants, that is, their ability to meet their product development targets for revenue, cost, launch date, development cost, quality, and total lifecycle cost. The approaches of the top performers across these categories – the best-in-class – were analyzed, in turn, to determine what leading companies have in common in dealing with real-time and meeting collaboration. This analysis showed that, compared to other companies, best-in-class performers are:

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- Over two times more likely to be doing real-time collaboration for greater than one year
- 50% more likely to be capturing annotations on documents
- One third more likely to be using mockup in real-time
- About 40% more likely to use visualization tools
- One third more likely to use CAD for real-time collaboration

Some approaches, such as the use of phone/audio conferences, are common to most companies. These more common forms are frequently used in combination with other forms of collaboration in addition to being used independently. Therefore, these commonplace techniques are not necessarily a differentiator. Rather, the common approaches among top performers are more likely to result in improved performance. The actions that most companies are taking for meeting collaboration, with the exception of capturing annotations and notes, are relatively common across all performance classes. This fact indicates that how companies are conducting meeting collaboration is not significantly differentiating, although perhaps valuable. The use of PLM solutions in combination with real-time collaboration does differentiate, however, confirming earlier research from *The Product Innovation Agenda Benchmark,* which determined that best-in-class companies are much more likely to use PLM technologies.

X Factor 5: 3D Publishing and Repurposing CAD Models

The final collaboration "x factor" might not be considered to be a form of "collaboration" by some, but, rather, a separate activity and discipline. Regardless of how the approach is classified, the publication of 3D (or 2D) graphics including the development of documentation based on the reuse of existing CAD models is perhaps one of the newest cross-departmental processes to receive attention in the product lifecycle today.

As companies look to find efficiencies beyond the early stages of the product lifecycle, extract more value, and minimize total lifecycle costs, downstream functions such as manufacturing and service have received more attention. Given today's more complex and dynamic products, it is not surprising that there is room for miscommunication of product design information to these departments. Manufacturing mistakes cost time and money, yet developing detailed instructions for production personnel is costly. The same is true for service. Aberdeen*Group* research, such as *The Emergence of the "Chief Service Officer,"* indicates that manufacturers are beginning to view service as a strategic differentiator and a source of new profits. Almost 50% of small companies surveyed reported having a senior vice president, or higher, overseeing service. Companies that have a director-level or higher position overseeing service outpaced companies lacking such a position in service revenues, raising the stakes for making service more efficient.

While internal organizations are frequently forced to go without good, easily understandable documentation, customer documentation and service manuals are often a market requirement. In some industries, they are legally mandated. These forms of documentation can be considered a part of the complete product offering, and, in fact, their preparation can delay the introduction of a product and delay time to market. Many companies, for example, wait until final designs are available due to the large effort required to recreate

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graphics, resulting in a large workload at the end of the product development cycle and the potential for slipped product introduction dates.

Publishing automation and design reuse promise to alleviate much of the duplicated effort and added time spent in recreating graphics that already exist. As a result, they decrease the cost of developing high-quality documents, allow documentation to be developed earlier in the process, and make maintenance easier by tying downstream documentation to upstream designs.

Because of the high value available, 3D publishing is perhaps one of the fastest growing forms of collaborating in the product lifecycle and includes the development of:

- Manufacturing instructions
- Technical publication
- Installation manuals
- Maintenance procedures
- Marketing collateral

The goals of 3D publishing are focused on both top- and bottom-line improvements and map very well to strategic goals for profitable revenue growth (Table 9):

Table 9: Goals of 3D Publishing

Goals for 3D Publishing	% Reported
Faster time to market	61%
Product development cost reduction	58%
Higher quality product documentation	47%
Promote reuse and efficiencies	47%
Identify and automate documentation updates based on product changes	44%
Earlier availability of documentation	39%
Provide consistent, complete documentation	36%

Source: AberdeenGroup, June 2006

The top priority identified for 3D publishing is achieving faster time to market, which contradicts a common assumption that 3D publishing only provides cost savings. There are other common goals for this form of collaboration as well, such as quality. To achieve these goals, manufacturers are taking a different approach to developing documentation (Figure 14):

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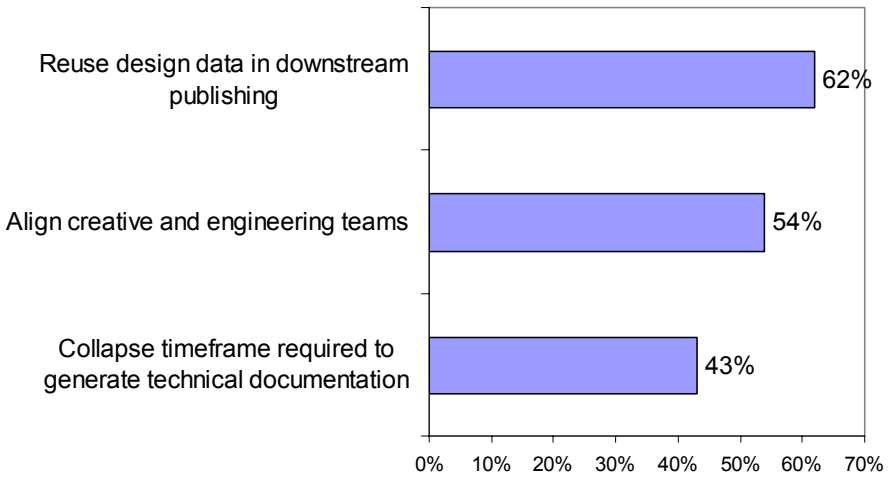
Figure 14: 3D Publishing Actions

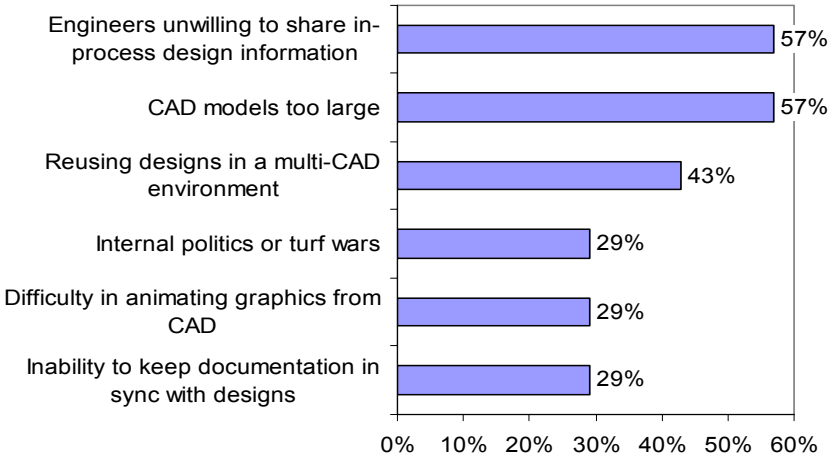


Source: AberdeenGroup, June 2006

The actions being pursued to improve product development through 3D publishing include reusing design data in publishing and aligning creative and engineering teams. These actions align well with the goals such as reducing time to market and removing unnecessary work, leading to both revenue improvement and cost savings simultaneously.

Putting in place 3D publishing is a new process for many companies, however, and does not come without overcoming some significant obstacles. The most commonly reported challenges include the unwillingness to share information and the size of CAD models:

Figure 15: 3D Publishing Challenges



Source: AberdeenGroup, June 2006

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These challenges fall into organizational, process, and technology categories. Two of the top four issues are people-related, requiring a different process and organizational outlook. Other challenges are primarily technical, as new technologies are being developed and adopted that aid in the capture and presentation of 3D graphics.

In fact, companies are using a range of technologies to support 3D publishing, overcome their obstacles, and achieve their goals – ultimately with the aim of delivering profitable product revenue (Table 10).

Table 10: Technology Enablers for 3D Publishing

Tools for 3D Publishing	Currently Use	Plan to Use (12 Months)
Spreadsheets	88%	0%
Text documents (e.g., MS Word)	87%	0%
3D publishing tools	79%	12%
Screen capture tools	79%	9%
2D publishing tools	74%	9%
Product simulation/animation	69%	13%
Design translation tools	66%	17%
Web publishing tools	66%	16%
Visualization tools	63%	20%
Standalone document management	60%	3%
Design capture tools	57%	23%

Source: Aberdeen*Group*, June 2006

These technologies include both new and old technologies. They also include specialty tools in addition to more common tools such as documents and spreadsheets, with some of the most exciting advancements in recent times including the ability to incorporate 3D models into common office productivity tools and document formats. Most companies are using a combination of technologies today to achieve their 3D publishing goals.

Among these common approaches, which ones appear to be working? Aberdeen*Group* analyzed the performance of benchmark participants, that is, their ability to meet their product development targets for revenue, cost, launch date, development cost, quality, and total lifecycle cost. Next, the approaches of the top performers across these categories – the best-in-class – were analyzed to determine what leading companies have in common in regards to 3D publishing. According to this analysis, best-in-class performers are:

- 50% more likely to be focusing on 3D publishing to reduce time to market
- 50% more likely to be focusing on overcoming language barriers using graphics
- 50% more likely to use 3D publishing for manufacturing instructions to plant

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- Three times more likely to be enhancing training and service documents with more timely illustrations

In short, best in class companies are more focused on reusing data and much more focused on using it for downstream purposes. Some approaches, such as the use of spreadsheets and documents, are common to all companies. These techniques are more commonplace, but not necessarily more valuable. The common approaches of the top performers are more likely to result in improved performance. These include the use of 3D publishing technologies, which may explain why this is one of the fastest growing forms of collaboration in the product lifecycle.

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Chapter Three:
Implications & Analysis

Key Takeaways

- Companies have met with varied levels of success depending on their approach, indicating that collaboration – when done effectively – helps companies reach their product development and profitability goals.
- Best-in-class product development companies collaborate externally more frequently.
- Best-in-class product development companies collaborate more, from the front-end to the back-end of the product development cycle.
- Best-in-class product development companies are standardizing tools – developing a collaboration platform.
- Best-in-class product development companies are measuring the results of collaboration, although indirectly.

The previous chapter identified the goals, actions, challenges, and technical enablers that are specific to the five different forms of product collaboration. In addition, the approaches taken by the top 20% of performers (based on Aberdeen*Group's* Competitive Framework – see table in Appendix A) were reviewed in order to provide insight into the practices that result in top performance. To identify the best-in-class performers, survey respondents were classified into one of three categories based on their product development performance. Aberdeen*Group*'s Competitive Framework defines these levels of enterprise performance as a way to analyze which business approaches lead to success. Survey respondents from Aberdeen*Group*'s *Product Innovation Agenda* benchmark report were asked to submit their performance in the following areas to determine baseline benchmarks for product innovation, development and engineering:

- Percent of products meeting *revenue* targets
- Percent of products meeting *product cost* targets
- Percent of products meeting *launch date* targets
- Percent of products meeting *product quality* targets
- Percent of products meeting *product development cost* targets

In addition, to cover the broader product lifecycle, this report also analyzed:

- Percent of products meeting *total product lifecycle cost* targets

In addition to the best-in-class analysis performed for each type of collaboration, Aberdeen*Group* used this framework to analyze overall approaches to collaboration to determine what commonalities can be found among top performers at a higher level.

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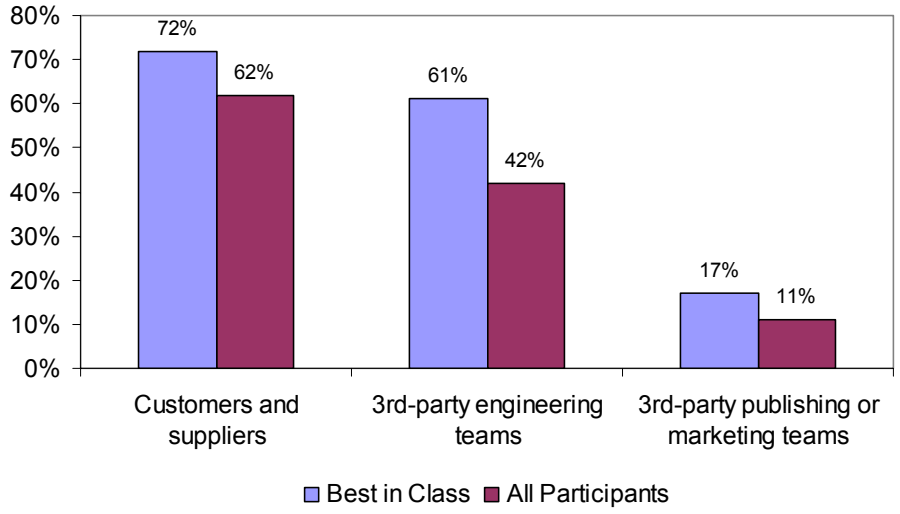
Collaborating Externally

The first commonality identified among top performers is external collaboration. All companies analyzed are collaborating with multiple parties, to some extent. The correlation between company performance and the occurrence of company collaboration with internal partners was not remarkable. About two thirds of the companies surveyed collaborate internally, and best-in-class companies were not identified as collaborating more.

A notable difference was identified, however, in the use of collaboration with customers and suppliers. Best-in-class companies collaborate externally with customers and suppliers more frequently (Figure 16). This is not to say that other manufacturers do not, and, in fact, the difference between top performers and total participants was not identified as a large gap. On the other hand, top performers were about 50% more likely to collaborate with third-party engineering teams. Based on these results, external collaboration appears to be a contributing factor to enhanced performance, although many companies have begun collaborating with customers and suppliers, indicating this form of collaboration may now be less of a competitive advantage and more of a competitive necessity.

Figure 16: Best in Class Collaboration Partners



Source: AberdeenGroup, June 2006

Collaborating across the Lifecycle

In addition to collaborating more with external parties, top performers are simply more likely to collaborate than their peers (Figure 17). This was particularly true for systems-level design, where best-in-class manufacturers are almost twice as likely as their competitors to collaborate. Systems-level engineering has been receiving a lot of attention because products have become more complicated and now include elements of mechanical, electrical, and software design. During the design phase, best-in-class companies also indicate they are more likely to collaborate on both mechanical and electrical design.

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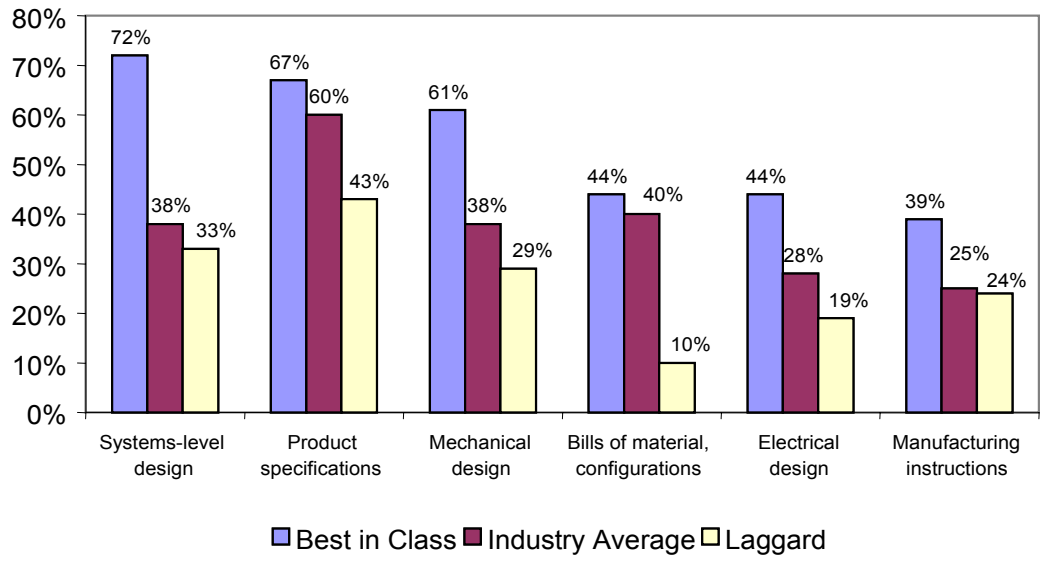
Later in the lifecycle, the leaders indicate that they collaborate more frequently on manufacturing instructions. These findings identify collaboration in early design and further into the lifecycle as a key contributor to product innovation performance – which, in turn, should lead to enhanced product profitability.

Figure 17: Best in Class Collaborate across the Lifecycle



Source: AberdeenGroup, June 2006

Developing a Collaboration Platform

Enabling technology plays a key role in product lifecycle collaboration. The most commonly identified tools for collaboration are office productivity tools, such as e-mail, text documents, and spreadsheets. This is a relatively consistent finding across all forms of collaboration. The use of these tools is common to companies of all performance classifications, including laggards, indicating that this usage did not necessarily lead to enhanced performance. Another commonly identified technology in collaboration was product data management (PDM). Product data management is identified in several forms of collaboration as being more prevalent in best-in-class companies, including during design collaboration, project collaboration, and value chain collaboration. This is likely because PDM can serve as a common backbone for collaborative processes and provides a secure environment in which to share information. These findings support earlier Aberdeen*Group* findings that indicate that best in class manufacturers are much more likely to use PLM solutions.

The benchmarks indicate that PDM and office productivity tools are commonly used across many forms of collaboration. Beyond these, visualization tools were utilized by the best-in-class more frequently than by lesser performers. In addition to the general-purpose tools, many companies are using specific tools for the task at hand. These were detailed in the individual sections in Chapter 2. What is notable is that although compa-

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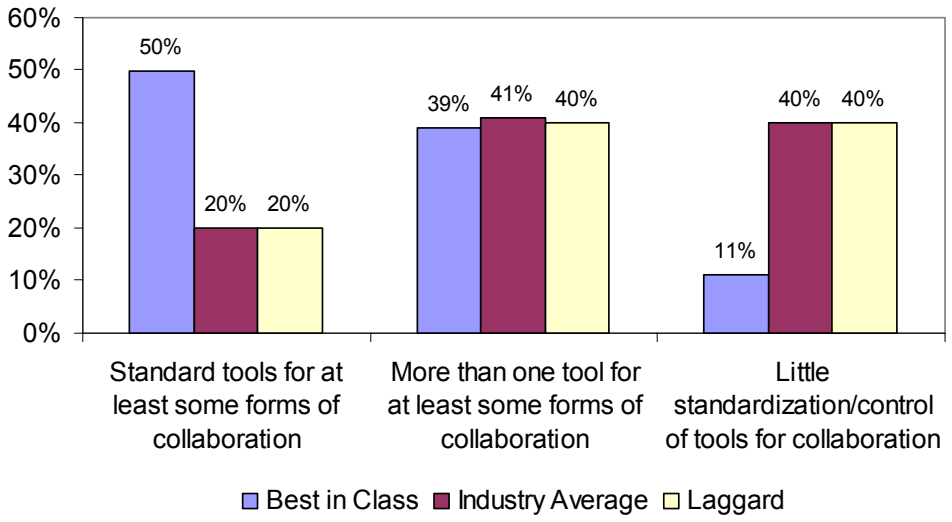
nies can't necessarily use one tool for every form of collaboration, leaders are more likely to standardize the use of their technology for at least some forms of collaboration (Figure 18).

Figure 18: Best in Class Employ Collaboration Platforms



Source: Aberdeen*Group*, June 2006

Measuring Collaboration Results

Aberdeen*Group* benchmarks on product innovation, product development, and engineering indicate that best-in-class companies are much more likely to measure their performance than the norm, and that laggards frequently measure their performance on an ad-hoc basis if at all. Collaboration presents a special challenge for performance measurement, however, because collaboration is not necessarily a process by itself. It is more an approach used to execute a process. As a result, measuring direct results of collaboration may be difficult. There are some direct measurements that can be used. For example, some companies measure direct cost savings such as reduced travel expenses from online collaboration. Most companies, however, have difficulty measuring the direct results of collaboration. Perhaps this is why some have lingering questions about the value of collaboration as a whole.

What is clear from the findings, however, is that companies that are performing at higher levels in their product innovation processes are measuring the results of collaboration, although indirectly (Figure 19). The leading performers are measuring the overall product innovation, product development, and engineering processes, if not the direct benefits of collaboration.

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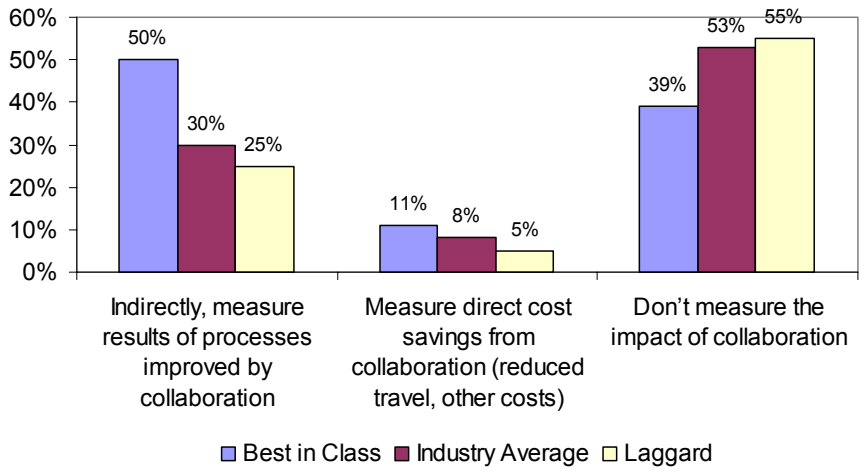
Figure 19: Best in Class Measuring Collaboration Results



Source: AberdeenGroup, June 2006

Concluding Observations on Collaboration Value

Due to the fact that collaboration is frequently measured indirectly, it is difficult to place a direct value on employing collaboration in the product lifecycle. What is clear, however, is that best-in-class companies – those that most frequently hit their product development targets for revenue, cost, and quality – are actively pursuing collaboration in all five forms identified in this benchmark. Furthermore, while some aspects of collaboration have become commonplace and so may no longer provide unique competitive advantage, the leading performers indicate more significant use of collaboration than their peers. Furthermore, they have more frequently automated their collaboration processes with PLM tools that incorporate or enable collaboration across the product lifecycle.

Some forms of collaboration may have become commoditized because they are now so common that they can no longer provide an advantage, but will likely provide a disadvantage if not used. Other forms, such as reuse of 3D data for publishing, are on the rise. Despite any hard benefits figures, which this benchmark did not intend to identify, this benchmark clearly indicates the value of product lifecycle collaboration in terms of enhancing performance in product innovation, product development, and engineering processes – ultimately leading to enhanced profitability.

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Chapter Four: Recommendations for Action

Key Takeaways

- Companies should review existing processes for the opportunity to improve performance by including customers and suppliers in their product lifecycle processes.
- Businesses should review their approaches to each of the five collaboration "x factors" to determine where the opportunity for the greatest improvement lies for their company.
- Manufacturers should consider standardizing tools for each form of collaboration and developing a collaboration infrastructure that combines the best elements of each.
- Companies developing a manufacturing platform can leverage general-purpose collaboration tools, but to differentiate themselves, they should incorporate PLM-specific tools and capabilities into their collaboration infrastructure.

Collaboration helps companies leverage the power of their organizations and their supply chains to bring more innovative, profitable products to market in less time. The five collaboration "x factors" can help companies to achieve their product development targets for product revenue, product launch dates, product costs of all kinds, and product quality. The following recommendations are intended to help companies learn from those organizations that are achieving success in their product lifecycle through the use of collaborative techniques.

Whether a company is trying to gradually move its product development performance from "laggard" to "industry average," or "industry average" to "best in class," the following actions will help spur the necessary performance improvements:

Laggard – Steps to Success

1. *Increase internal collaboration.*

   Look for opportunities to increase collaboration between internal departments to reduce the potential for miscommunication and design products that are better optimized for downstream functions.

2. *Adopt collaboration within the value chain.*

   Laggards should close the gap in supply chain collaboration, finding opportunities to better share product information with partners in their value chain in order to reduce time to market, decrease costs, or improve product innovation.

3. *Develop collaborative capabilities by beginning to implement common tools for each form of collaboration, at a minimum.*

   Evaluate the five forms of collaboration to identify the best opportunities to add collaborative processes, focusing on areas that can address current product development challenges. Look for technologies that can meet current needs and

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also lay the foundation to advance future collaborative efforts, preparing for a common collaboration infrastructure when implementing new collaborative processes. PLM tools should strongly be considered as a foundation for this infrastructure.

Industry Norm – Steps to Success

1. *Increase collaboration among third parties.*

   Look for opportunities to include customers and suppliers in product innovation, product development, and engineering processes. Evaluate the ability to better capture customer needs and to find new forms of innovation in the early phases of the product lifecycle and include customers and suppliers throughout the lifecycle to provide review and feedback and keep product profitability on track.

2. *Extend collaboration to the front and back ends of the product development process.*

   Consider collaborating on systems-level designs or implementing systems-level design if not yet incorporated internally. Share design information with downstream functions such as manufacturing and service, ideally through the reuse of existing design data such as CAD models.

3. *Further develop collaborative capabilities, seeking to standardize on common tools for each form of collaboration, at a minimum.*

   Evaluate the five forms of collaboration to identify the best opportunities to add or extend collaborative processes, focusing on areas that can address current product development challenges. Consolidate collaboration technologies, with a goal to designate one standard tool for each form of collaboration, at a minimum. Look to extend existing technologies to meet current needs, if possible, preparing for a common collaboration infrastructure when implementing new collaborative processes. PLM tools should strongly be considered as a foundation for this infrastructure.

Best in Class – Next Steps

1. *Look for ways to further extend collaboration both internally and externally.*

   Top performers should look for ways to extend their lead by eliminating waste and miscommunication in their product innovation, product development, and engineering processes. Consider the ability to "lean out" product development processes and look for new sources of product and process innovation by working more strategically with partners.

2. *Integrate collaborative processes across the product development process, developing a common collaboration infrastructure.*

   Manufacturers that are already operating at high levels of performance should look for opportunities to combine collaboration technologies, such as incorporating collaborative processes directly into PLM solutions and incorporating more PLM capabilities, providing the opportunity to collaborate directly in the context of the product.

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Author Profile

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Jim Brown leads Aberdeen*Group*'s Global Product Innovation and Engineering research. Its goal is to provide fact-based research and experienced analysis that advises executives on how to achieve maximum product profitability and corporate value by using the right approaches and enabling technology to identify, specify, engineer, develop, and continuously improve innovative, high-value products.

Jim founded research and consulting firm Tech-Clarity, acquired by Aberdeen*Group* in May 2005. Tech-Clarity focused on making the value of PLM and enterprise software solutions clear to manufacturing business leaders. Jim began his professional experience with roles in manufacturing engineering and software systems at General Electric before joining Andersen Consulting (Accenture), where he focused on enterprise software applications. He has also served as an executive at several software companies and as the PLM analyst for Technology Evaluation Centers and The PLM Evaluation Center. Jim is a frequent author and speaker on applying software technology to achieve tangible business benefits.

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Appendix A: Research Methodology

Between May and June 2006, Aberdeen*Group* examined the approaches, strategies, and processes around conducting different forms of collaboration across the product lifecycle of approximately 100 enterprises in various manufacturing industries. The forms of collaboration examined included design collaboration, value chain collaboration, project collaboration, meeting collaboration, and 3D publishing / reusing 3D CAD models.

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

- Key pressures driving companies to implement collaboration in general and each specific form of collaboration.
- The topics, parties, and lifecycle phases involved in active, regular collaboration
- The goals of companies in each form of collaboration and the approaches – strategies, actions, processes, organizational structures, and enabling technologies – companies are implementing to achieve those goals
- The benefits that have been derived from collaboration and how often they are measured.

Aberdeen*Group* supplemented this original online survey effort with additional emailed questions, gathering more in-depth information on late lifecycle collaboration. Aberdeen*Group* also drew on data collected in July and August of 2005 for Aberdeen*Group*'s *Product Innovation Agenda Benchmark Report* and in November and December 2005 for *The Global Product Design Benchmark Report*.

The study aimed to identify emerging best practices for product lifecycle collaboration and provide a framework by which readers could assess their own current collaborative initiatives as well as future plans for collaboration.

Responding enterprises included the following:

- ***Job title:*** The research sample included respondents with the following job titles: manager (25%), senior management (CEO, CFO, COO) (22%), director (16%), engineer (11%), staff (10%), internal consultant (9%), senior vice president (3%), CIO/IT leader (1%), and other (2%).
- ***Job function:*** The research sample included respondents from the following functional areas of responsibilities: engineering (20%), information technology (19%), marketing (10%), business process management (10%). logistics/supply chain (6%), customer service (6%), manufacturing (5%), manufacturing engineering (5%), procurement (3%), sales (2%), and other (14%).
- ***Industry:*** The research sample included respondents predominantly from manufacturing industries. At a high level, the respondents represented discrete manufacturing (65%), consumer products (23%), and process manufacturing (11%). From a more detailed perspective, the industries represented were widely varied.

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Industries that were more highly represented included high technology (16%), industrial equipment (14%), automotive (13%), and aerospace (12%).

- ***Geography**:* The majority of study respondents were from North America (59%), with other representation from Europe (27%), and Asia/Pacific (9%). The remaining respondents were from either Central/South America or the Middle East.
- ***Company size**:* About 40% of respondents were from large enterprises (annual revenues of more than US$1 billion); 25% were from midsize enterprises (annual revenues between $50 million and $1 billion); and 39% were from small companies (with annual revenues of less than $50 million).

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

Table 11: PACE Framework

PACE Key

Aberdeen*Group* 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*, June 2006

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Table 12: Relationship between PACE and Competitive Framework

PACE and Competitive Framework How They Interact
AberdeenGroup 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: AberdeenGroup, June 2006

Table 13: Competitive Framework

Competitive Framework Key
The AberdeeGroup Competitive Framework defines enterprises as falling into one of the three following levels of FIELD SERVICES practices and performance: *Laggards (30%)* — Product development performance that is significantly behind the average of the industry. *Industry norm (50%)* — Product development performance that represent the average or norm. *Best in class (20%)* — Product development performance that is at the highest level, indicating the best practices are currently being employed with significantly superior results to the industry norm.

Source: AberdeenGroup, June 2006

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Appendix B:
Related Aberdeen Research & Tools

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

- *The Product Innovation Benchmark Report* (September 2005)
- *The Global Product Design Benchmark Report* (December 2005)
- *The Product Lifecycle Management for Small to Medium-Size Manufacturers Benchmark Report* (March 2006)

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

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About AberdeenGroup

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To be the trusted advisor and business value research destination of choice for the Global Business Executive.

Our Approach

Aberdeen delivers unbiased, primary research that helps enterprises derive tangible business value from technology-enabled solutions. Through continuous benchmarking and analysis of value chain practices, Aberdeen offers a unique mix of research, tools, and services to help Global Business Executives accomplish the following:

- IMPROVE the financial and competitive position of their business now
- PRIORITIZE operational improvement areas to drive immediate, tangible value to their business
- LEVERAGE information technology for tangible business value.

Aberdeen also offers selected solution providers fact-based tools and services to empower and equip them to accomplish the following:

- CREATE DEMAND, by reaching the right level of executives in companies where their solutions can deliver differentiated results
- ACCELERATE SALES, by accessing executive decision-makers who need a solution and arming the sales team with fact-based differentiation around business impact
- EXPAND CUSTOMERS, by fortifying their value proposition with independent fact-based research and demonstrating installed base proof points

Our History of Integrity

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