

PLM in Electronics

Turning Products into Profits

June 2007

Executive Summary

While electronics companies' products are becoming increasingly complex, engineers struggle to access accurate product data when they need it most. Despite this difficulty, Best in Class companies hit their business goals at an 86% average or better. This report serves as a guide for electronics companies who wish to achieve similar business performance.

Best in Class Performance

Five key performance criteria were used to identify the Best in Class electronics manufacturers. This is based on how well they met the following criteria. The Best in Class on average:

- Hit product development release dates (86%)
- Hit corporate revenue targets (88%)
- Met product development revenue costs (88%)
- Met product performance targets (96%)
- Hit product reliability targets (95%)

Competitive Maturity Assessment

Aberdeen research indicates that businesses enjoying Best in Class performance are focusing on key elements of product development, where they are:

- 2.1 times as likely as industry average companies to capture and reuse product development knowledge.
- 2.5 times as likely as industry average to integrate their product development data into their business processes.
- 2.6 times as likely as laggard companies to have centralized their product data.
- 2.8 times as likely as all others to have developed formal metrics to measure their product development process.

Required Actions

In addition to the specific recommendations that can be found in Chapter 3, electronics manufacturers aspiring to achieve Best in Class performance status must:

- Deploy design reuse technologies.
- Establish a centralized repository for storing all current design data.
- Develop formal metrics such as the ability to measure product development cycle time and departmental performance against corporate targets.

CAE Inc.

"Establishing metrics for product development across all disciplines within our company allow us the opportunity to measure ourselves against our performance and to make changes where necessary."

John Visconti
President

Analog

"The use of design reuse has allowed us to quickly develop and release new products. It has reduced our design cycle by 50% since less qualification is required to prove out the new designs."

Bob Doherty

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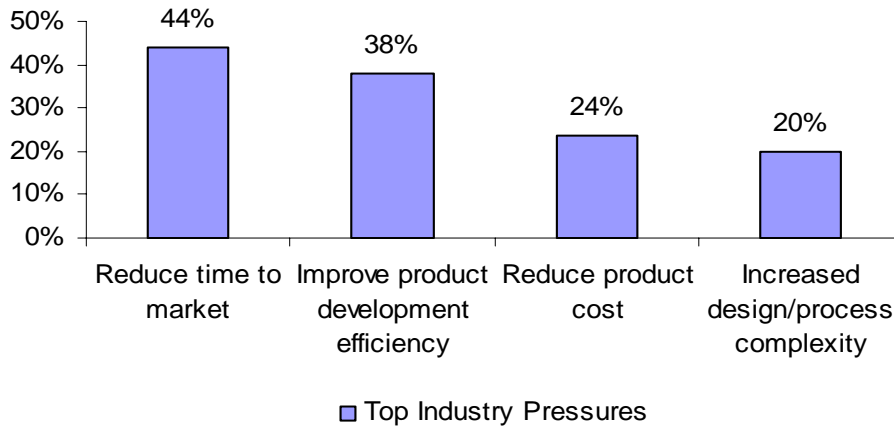
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Chapter One: Benchmarking the Best in Class

Shortened Time to Market / Top Industry Pressures

Overall, the message is clear. Electronics manufacturers must bring increasingly complex products to market on shorter time tables. In fact, 44% of electronics companies reported this as their predominant pressure. Electronics companies also realize that they need to improve their product development efficiency (38%) to decrease time to market as well as reduce product costs (Figure 1).

Figure 1: Top Industry Pressures



Source: Aberdeen Group, June 2007

Maturity Class Framework

Given today's difficult business environment, electronics manufacturers are trying a wide variety of tactics in order to differentiate themselves from their competition. However, any strategy can only be as good as the results it delivers. To understand which best impact business performance, Aberdeen determined it's Best in Class companies for this report by measuring five key performance indicators:

- Meeting product revenue targets,
- Meeting product release dates,
- Meeting product development costs,
- Meeting product performance targets, and
- Meeting product reliability targets.

The top 20% of companies benchmarked – the Best in Class – enjoy a significant performance gap over their competitors, hitting these targets

Fast Facts

- ✓ Electronics manufacturers identified meeting time to market as their top business pressure. (44%)
- ✓ Best in Class are hitting their product release dates 86% of the time.
- ✓ Best in Class are also meeting revenue, reliability and performance targets on an 88% average or better.
- ✓ Best in Class are 47% more likely than average companies to have improved on meeting release dates over the past 12 months.

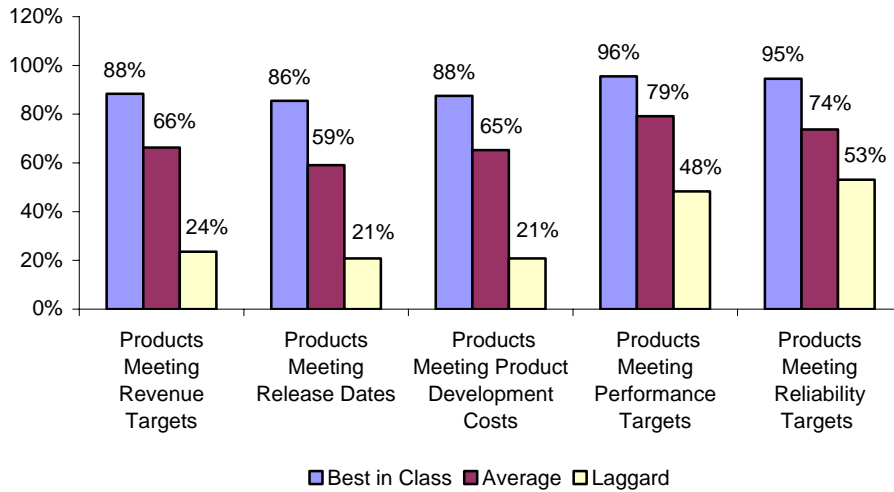
Battenfeld

"Within the time to market window, the factors that affect us most include performance, reliability, revenue and cost. Customers want their products quicker, better and at a lower cost"

Martin Sferrazza
VP Engineering

on an 86% average or better. Compare this to laggard companies who hit these targets less than 53% of the time (Figure 2).

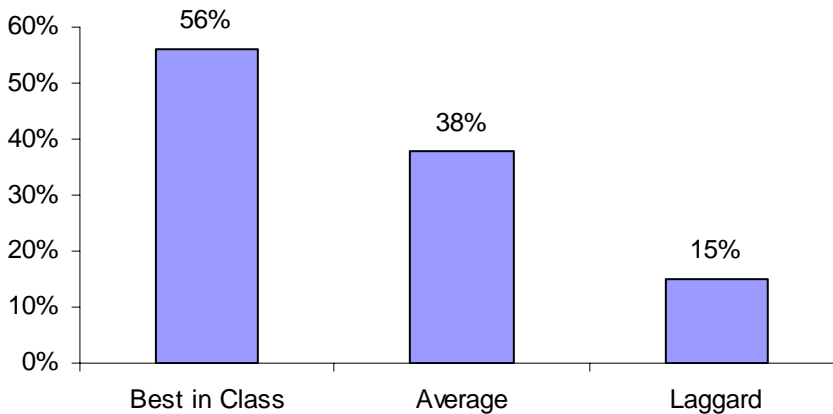
Figure 2: Best in Class Hit Targets on an 86% Average or Better



Source: Aberdeen Group, June 2007

In addition to outperforming the rest of the industry on these targets, the Best in Class have widened the gap by improving the frequency at which they have met their product release dates over the past 12 months. Delivering products to market faster than the competition translates into the ability to meet overall product revenue targets (Figure 3).

Figure 3: Best in Class Improved on Meeting Release Dates over 12 Months



Source: Aberdeen Group, June 2007

Competitive Framework Key

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

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

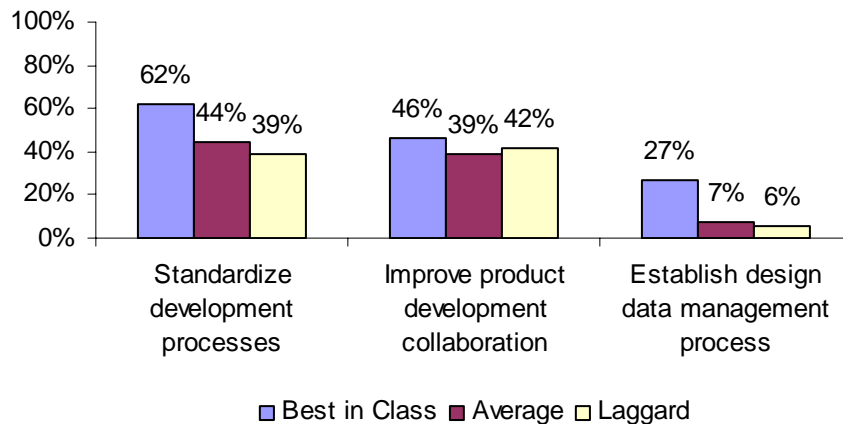
Industry norm (50%) — practices that represent the average or norm

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

Implementation of Best in Class Strategic Actions

Given the wide performance gap illustrated within Aberdeen’s maturity framework, what practices are the Best in Class successfully employing? They are pursuing specific strategies to differentiate themselves from their competition (Figure 4).

Figure 4: Top Strategies across Competitive Framework



Source: Aberdeen Group, June 2007

Many companies have recognized the need to improve communications in the design of electronic products (Figure 4). This does not mean that the utilization of collaboration technologies to design products is the only solution. Best in Class performers understand the need to communicate through collaboration solutions, but how they do this relative to product development is an essential component of their success. They are looking at ways to improve communication by establishing standard development processes, granting the ability to monitor the flow of the design and to react to design issues as they arise. By managing the design data, the team is able to collaborate by means of product data management (PDM). PDM improves design collaboration by standardizing the design process, making it easier for the product development team to access current data.

Best in Class PACE Model

Any strategy can be pursued by a variety of avenues, each with a different effect on key performance metrics. By understanding those practices used by the Best in Class, electronics manufacturers can adopt tactics that have already been employed successfully to impact business performance. Successful application of these tactics requires a combination of organizational capabilities, processes, and enabling technologies that can be summarized as follows:

Analog Co.

“We have provided more standardized tools and processes to streamline the development of new products, eliminated the delays associated with data collection for design verifications, and qualifications.”

Bob Doherty

Computer Company

“By restructuring our entire product development team, including engineering, and standardizing our development processes, we increased our productivity nearly 50% while cutting cost by 30%.”

Charlie Davies,
Principal CAE Electrical
Engineer

Table 1: Best in Class PACE Framework

Pressures	Actions	Capabilities	Enablers
<ul style="list-style-type: none"> • Reduce Time to Market 	<ul style="list-style-type: none"> • Standardize development processes • Improve product development collaboration • Establish design data management process (PDM) 	<ul style="list-style-type: none"> • Integration of data with business processes • Centralized product data • Ability to measure product performance with formal metrics • Ability to measure product development cycle time • Ability to capture and reuse product development knowledge • Product development executive to oversee all departments and partners • Program manager to oversee day to day operations • Management of engineering changes (ECOs) 	<ul style="list-style-type: none"> • Design reuse technology • Product data management (PDM) • Project management • Standardized workflow process • Product portfolio management • Knowledge Based Engineering (KBE) • Product lifecycle management

Source: Aberdeen Group, June 2007

Aberdeen Insights – Part 1

Within electronics design companies, there are a variety of teams across the globe involved in the development of the product. Designing a product 24/7 has many advantages, especially reducing the overall design cycle time. However it can also introduce data management issues. Gathering this data and using it in a productive manner is extremely complex. With most companies focusing on reducing time to market an inherent pressure they face is improving development efficiency. How are the Best in Class addressing these pressures to differentiate themselves?

Electronics manufacturers knew that changes had to be made within engineering to address these pressures. The best in Class realized that standardizing the product development process was one way to improve their design efficiency. By standardizing their processes, all product development, collaboration and data management would be performed in the same manner. With this standardization, the product development team can monitor the design from concept to production.

As a result, the Best in Class are outpacing their competition by meeting their corporate performance metrics (KPIs) and releasing products to market on time. They are 1.5 times as likely as average companies and 3.7 times as likely as laggards to have improved on meeting their product release dates over the past 12 months. Being first to market with new products results in a lead time advantage over the competition which in turn can produce results that further increase the revenue stream.

Chapter Two: Benchmarking Requirements for Success

The aggregate performance of surveyed companies determines whether they are ranked as Best in Class, Industry Average or Laggard. In addition to having common performance levels, each class also shares certain process, knowledge management, and technology characteristics (Table 2).

Table 2: Competitive Framework

	Laggards	Average	Best-in-class
Process	Design data integration with business process (PLM)		
	17%	32%	82%
	Managing the engineering change process (ECO)		
	20%	21%	46%
Organization	Product development executive to oversee all departments and partners		
	36%	43%	73%
	Program manager to oversee day to day operations		
	52%	78%	69%
Knowledge	Capture and reuse product development knowledge		
	50%	43%	91%
	Centralized product data		
	24%	54%	64%
Performance	Product performance results measured with formal metrics		
	35%	32%	91%
	Ability to measure product development cycle time		
	39%	39%	91%
Technology	<ul style="list-style-type: none"> • 33% Design Reuse Technologies • 29% Product Data Management • 78% Project Management • 50% Workflow • 6% Product Portfolio Management • 17% Knowledge Based Engineering • 20% Product Lifecycle Management (PLM) 	<ul style="list-style-type: none"> • 46% Design Reuse Technologies • 63% Product Data Management • 85% Project Management • 68% Workflow • 33% Product Portfolio Management • 21% Knowledge Based Engineering • 31% Product Lifecycle Management (PLM) 	<ul style="list-style-type: none"> • 82% Design Reuse Technologies • 73% Product Data Management • 100% Project Management • 82% Workflow • 64% Product Portfolio Management • 45% Knowledge Based Engineering • 57% Product Lifecycle Management (PLM)

Fast Facts

- ✓ Best in Class performers are at least 2.5 times as likely to have integrated their design data with their business process and 2.2 times as likely to be managing the ECO process.
- ✓ They are also 70% more likely to have an experienced executive overseeing product development.
- ✓ Best in Class are 82% more likely to be capturing product development knowledge.
- ✓ They are also 78% more likely to be using design reuse technologies.

Source: Aberdeen Group, June 2007

Organizational Capabilities and Technology Enablers

Best in Class companies are hitting their overall aggregate product development targets over all five competitive framework metrics on an 86% average or better. Why? The processes, knowledge management characteristics, technology enablers and performance indicators they are pursuing form a successful strategy that translates into a competitive advantage.

- **Process and Organization: Data and Process Management** — According to Aberdeen's *Global Product Design Benchmark Report*, product development teams are no longer working under the same roof but are spread around the globe. To shorten time to market, companies are utilizing global capabilities by designing 24/7. As a consequence, managing data has become extremely challenging. Keeping the business up to date on specific projects and providing the most current data is something Best in Class companies have managed to address. They are 2.5 times as likely as average performers and 4.8 times as likely as laggards to have integrated their design data into the business process so that the entire development team is working concurrently with the most up-to-date data. Additionally, having a product development executive to oversee the new product development process is an additional method by which businesses can leverage this expertise. Best in Class businesses are 70% more likely than average companies to have appointed an executive to manage the new product development process.
- **Process: Revision Control** — Engineers are constantly changing their designs. Whether it's swapping a component or reacting to a performance issue; notification of changes needs to be made available to the product development team. Improper management of data can result in incorrect or outdated data being published to team members. Best in Class performers are 2.2 times as likely as all others to have formalized their change process within design engineering by making available to all team members the most current data through standardized notifications.
- **Knowledge: Use it again** — Design reuse makes it faster and cheaper to design a new product by vaulting current design knowledge and storing it for future use. In fact Best in Class companies are 2.1 times as likely as average companies to be capturing and reusing prior design knowledge. In fact, Best in Class are 78% more likely than average companies to have implemented solutions to capture this knowledge so it can be reused. Just capturing the data is not enough. Product development teams must be able to access it easily. To do this, companies are establishing centralized data repositories. Best in Class are 2.6 times as likely as laggard companies to be vaulting their data in a central location.

Fliptronics

"We have provided more standardized tools and processes to streamline the development of new products, which have eliminated the delays associated with data collection for design verifications and qualifications."

Philippe R.
Manager NPD

Symmetricom

"We currently have a universal product development process with defined metrics. Since implementation, we have improved our overall design process. We have just procured a PLM tool, and are at the point of final implementation."

Scott Davis,
Director, Global
Documentation
Systems

- **Performance: Know Where You Stand:** — In order to meet time to market goals, businesses need to know how their development process is performing. Establishing internal metrics to measure actual design cycle time can provide insight into areas where improvement is necessary. With Best in Class being 2.3 times as likely as average companies to meet their product release dates it's no wonder they are able to hit their product launch dates 86% of the time. They are also measuring their product development cycle time as well. Knowing what the issues are and acting on them to improve the process can lead to improved design efficiency as well as decrease time to market.
- **Technology: Is it profitable?:** — It's not just about getting products to market on time, but delivering products that increase revenue and produce profits. Knowing whether a product in development has a place in the market is essential. Product Portfolio Management (PPM) is a solution used by businesses to make product funding decisions. Best in Class companies are twice as likely as average performers and 10 times as likely as laggards to have PPM solutions in place. Based on the metrics established above, not only are the Best in Class meeting their time to market goals but are meeting revenue targets 88% of the time as compared to average at 66% and laggards at 24%. It is apparent they are releasing meaningful products to the market.
- **Technology: Managing the Project** – As with any product under development, there are multiple projects within the program that need to be managed. Each project needs to be addressed separately but managed as part of the whole. This includes developing a project plan that lays out goals and objectives, specifies tasks, and establishes resource requirements, budgets and timelines. Aberdeen found that Best in Class companies are 28% more likely than laggards to use project management solutions in new product development. With the program management team monitoring the development of the product, they are the first to know when they are falling behind and can take the appropriate steps necessary to get back on track.
- **Technology: Managing Engineering Data** – Companies are managing their engineering design process through better control of their design data. CAD files, drawings, specifications, test procedures, manufacturing and assembly data all need to be gathered and controlled within the project. Best in Class companies are doing this by implementing product data management solutions (PDM). In fact, they are 2.5 times as likely as laggard companies to be using PDM solutions in the engineering process.
- **Technology: Tying it all together** – By standardizing product development processes, incorporating design data management solutions, and supporting the new product development process (NPD) into PDM, Best in Class electronics companies are connecting relational databases and processes. Any of these solutions can be run as stand alone but at the cost of keeping the process fragmented. Tying them into PLM (product lifecycle management) provides

Ciena

"We have improved the design process by implementing PDM solutions and collaboration tools. By adding these solutions we have been able to streamline our process and improve our design efficiency."

Cornelia Rosu,
Lead Designer

Raytheon

Program Management lends itself to improvements in time to complete tasks due to experienced people managing the projects. This reorganization of program management was put in place this year and has already proven itself by improving our overall goals related to cost and development time reductions as well as overall product quality and reliability goals of the corporation."

David Scott
Principal Engineer
Test Systems
Development

electronics companies the ability to manage their products from concept to end of life while maintaining all the knowledge that went into designing the product. In fact, Best in Class companies are 84% more likely than average companies to be using PLM solutions for over a year.

Aberdeen Insights – PLM Usage within Product Development

It's clear that technology alone is not the answer. To make a meaningful change to their businesses, electronics manufacturers must look at their overall process and knowledge bases, understand where to incorporate change, and then address what technologies would be relevant to their models. Electronic design is an iterative process. Engineers are making changes that affect everything and everyone downstream. Businesses should put their processes, organization, and technology into perspective. A business cannot improve unless it knows how it is performing. In fact, Best in Class are 2.8 times as likely as average performers to be measuring their internal processes. Another roadblock to product development is access to current data. By establishing a centralized data repository, engineers as well as the entire development team can work on the current data and collaborate efficiently. In fact, 64% of Best in Class companies have this capability currently in use.

The Best in Class have taken a step forward within engineering by utilizing PLM early in the design process especially during conceptual design (91%) and prototyping (73%) phases. Best in Class are gaining the upper hand when it comes to storing and reusing data. By capturing all this early data, future designers have the ability to design by "lessons learned" from previous engineers and by seeing what worked and what didn't. This saves valuable time early in the design process and can have an impact on meeting both development cost and releasing the product on time.

Analog Co.

"We measure new product development by monitoring time to market and design times to manufacturing with internal metrics. In addition we also define a period after release (x months) to monitor the success of a design by sales volume."

Bob Doherty

Chapter Three: Required Actions

Despite the fact that most electronics manufacturers are responding to time to market pressures, Best in Class performers are employing specific tactics for competitive gains. Whether a manufacturer is trying to move its performance from “Laggard” to “Industry Average,” or “Industry Average” to “Best in Class,” the following actions can help spur the necessary performance improvements:

Laggard Steps to Success

1. **Incorporate Project Management.** Put a team in place that tracks the project against the planned schedule and resolves any issues as they arise.
2. **Deploy a Workflow Solution.** Establish a workflow within the project, to define specific tasks and assign the people required to perform them. As the project progresses, these tasks are signed off as completed. If a phase of the project misses a deliverable, it can be acted upon immediately and not delay the project. Workflow solutions automate the delivery of tasks, track their completion and notify managers when the project falls behind.
3. **Implement Centralized Product Data Management (PDM).** With designs dispersed globally, formally managing all product data is essential in maintaining a clear picture of product development. Implementing PDM solutions helps improve the flow, quality and use of engineering data. PDM also improves management of the engineering process through more precise control of engineering data, design activities, engineering changes and product configurations.

Industry Norm Steps to Success

1. **Appoint a Program Development Executive.** Use the expertise of a product development executive to manage the entire program. Being the eyes and ears of product development he or she is empowered to make changes and is the main point of contact for the entire development team. With the main focus being solely on the current program, a product development executive is able to constantly monitor all phases of the development process and address issues as they occur.
2. **Implement Design Reuse Technologies.** Capture elements of a proven design through the use of design reuse solutions. These technologies store this “knowledge” in a central location that can be accessed for future use. Using a proven design, technology or process not only saves time but cost.
3. **Establish Productivity Metrics.** Data is knowledge. Understanding the results of the data can be the key to success. Having the ability to

Fast Facts

- ✓ Centralize all product data
- ✓ Appoint a program development executive
- ✓ Leverage design reuse solutions
- ✓ Formalize departmental process metrics
- ✓ Implement PDM solutions
- ✓ Integrate processes with PLM

IKOR

“Since hiring a Director of Program Management we have the ability to focus more on our development. If issues arise, we are notified by the Director and we address them quickly. Since hiring a Director, we have improved our efficiency nearly 40%.

John Wagner,
President

Raytheon

“Metrics are being used within all areas of a product across its life-cycle. Data is collected for measuring development time and resources needed to determine effectiveness in the goal of reducing the development cycle and lowering costs.”

Davis Scott,
Principal Engineer, Test
Systems Development

understand how well you are performing within your department is a key element in bringing effective products to market on time. These measurements keep you informed on your performance and can identify potential issues before they become major problems.

Best in Class Steps to Success

1. **Implement Product Portfolio Management (PPM).** Know what you are designing and understand how it fits into the market. Develop a strategy team that investigates the market and understands how the product will be received and will it be profitable. Senior management should implement PPM solutions to mitigate risk.
2. **Deploy Knowledge Based Engineering (KBE).** Continue to capture and reuse product and process knowledge. Use KBE solutions to do this in an integrated way by capturing the design intent or rules as well as knowledge from all phases of the product lifecycle. The ultimate goal of a KBE solution is to capture the best design practices and engineering expertise into a corporate knowledge base.
3. **Formalize the engineering change process (ECO).** Phase out the use of email and paper as the formal sign-off or notification process for ECOs. Continue to expand the use of collaboration and visualization solutions within the ECO process. The ability to view and discuss the change in real time improves efficiency and provides instantaneous feedback.

Aerospace Company

"With the help of PLM we have gained control of our ECO and change management processes. With data readily available, all team members can act on the change with simultaneous notification to downstream members and our global partners."

R.S.
Director, Program
Management

Aberdeen Insights – PLM Summary

PLM is not a single software solution but a tool to manage people, processes and technologies from a central location. Whether you have niche solutions or a multitude of products, they can be managed using PLM. With PLM as the central core for all relative information and data regarding a product, anyone within an organization, as well as outsourcing partners, know where to go to obtain what they need. Engineers, managers, procurement specialists or manufacturing personnel all will have the ability to search for the knowledge they need to assist them in deciding how to move forward on a design.

Whether you're Best in Class, Industry Average, or Laggard, there are many opportunities to improve overall performance. Leading businesses enjoy significant performance advantages in their overall product development targets – including revenue, release dates, development costs, performance targets and reliability targets, by adopting unique approaches. While many solutions are available to improve immediate performance, it all starts with managing processes. Best in Class have an advantage over the competition by formalizing their processes and managing them "under one roof". The gap is widening.

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Appendix A: Research Methodology

In May and June 2007, Aberdeen Group examined the electronics design industry and the experiences, intentions, and internal processes of more than 160 enterprises.

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

Responding enterprises included the following:

- **Job title/function:** The research sample included respondents with the following job titles: 34% Manager, 26% Engineer, 17% Director, 12% CEO, 5% VP and the remaining 6% falling into Staff, Consultant and Designer.
- **Industry:** The research sample included respondents exclusively from the electronic design industries and the industries they service. 23% came from High Tech, 22% from consumer electronics, 17% from Aerospace, 15% from Automotive, 14% Medical Devices and 6% from Telecom with the remaining 3% from various industries.
- **Geography:** The majority of respondents, 67%, were from North America, 17% from Europe, 11% from Asia and the remaining 5% from the Middle East and South America.
- **Company size:** 34% of respondents were from small businesses (annual revenues of \$50 million or less). Another 47% were from midsize companies (annual revenues between \$50 million and \$1 billion); 19% of respondents were from large companies (annual revenues above \$1 billion). (Amounts are based on \$US)

Table 3: 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: <i>Pressures</i> — external forces that impact an organization’s market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive) <i>Actions</i> — 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) <i>Capabilities</i> — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing) <i>Enablers</i> — 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, 2007

Table 4: Competitive Framework

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

Source: Aberdeen Group, 2007

Table 5: 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, 2007

Appendix B: Related Aberdeen Research

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

[Printed Circuit Board Design Integrity Benchmark Report](#), April 2007

[Electronics – Correct by Design Benchmark Report](#), January 2007

[The Design Reuse Benchmark Report](#), March 2007

[Get to Market Faster – Implement PLM into the Electronic Design Process](#), March 2007

[New Product Development: Profiting from Innovation](#), January 2006

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

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Founded in 1988, Aberdeen is a leading provider of fact-based research and market intelligence that delivers demonstrable results. With a research panel of over 175,000, and an extended opt-in user base of 2.2 million, Aberdeen has benchmarked more than 30,000 companies in the past two years. With facts in hand Aberdeen is uniquely positioned to educate users to action: driving market awareness, creating demand, enabling sales, and delivering meaningful return-on-investment analysis. As the trusted advisor to the global technology markets, corporations turn to Aberdeen™ for insights that drive decisions. As a Harte-Hanks Company (NYSE:HHS), Aberdeen plays a key role of putting content in context for the global direct and targeted marketing company.

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