Aberdeen *Group*

The Global Product Design Benchmark Report

Managing Complexity as Product Design Goes Global

December 2005

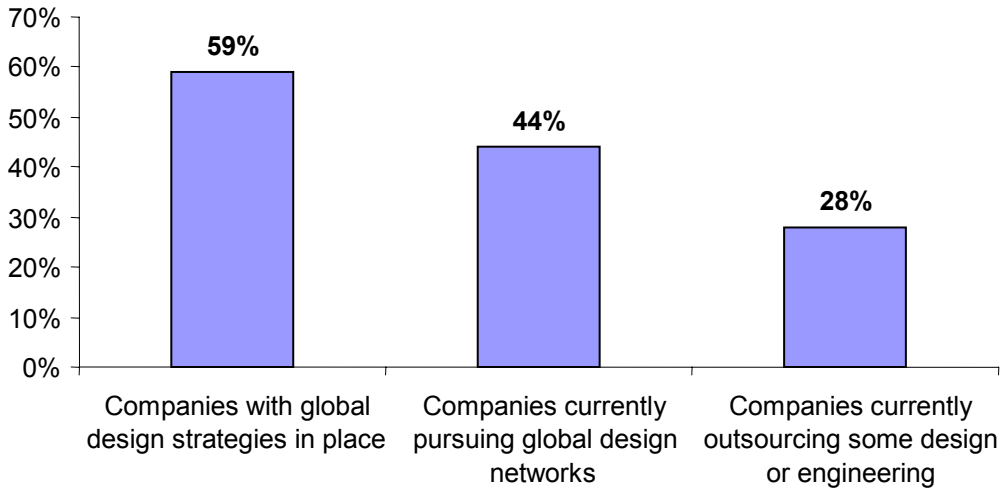
Executive Summary

The challenge of keeping an engineering team working efficiently without getting in each other's way can be difficult to manage. As products become more complex and design data more expansive, the problem of keeping everything in control grows harder. Product development projects now involve people from multiple departments trying to collapse product introduction lead times. As if this was not complex enough, many companies are distributing these resources around the globe and forming virtual teams of people from different companies. If managing the product development process was a challenge before, it is not going to get any easier as companies continue to adopt global design strategies. Global design has cost benefits that are very attractive to today's manufacturer, but adds new communication, control, and collaboration challenges and intensifies existing problem areas such as protecting intellectual property.

Issue at Hand

Forty-four percent of respondents to Aberdeen's *Product Innovation Agenda* benchmark study indicate that they are assembling teams across geographies to pursue global design (Figure 1). For discrete manufacturers the percentage raises to 53%. Respondents to Aberdeen's *Enabling Product Innovation* report indicated that one-quarter of companies are already outsourcing some design processes, which leads to increased product development and engineering complexity. Global product design is not a brand new idea; nearly one-half of manufacturers surveyed have had a global design strategy in place for longer than one year. These strategies are most frequently driven by cost reduction strategies, but are sometimes undertaken for more strategic reasons including "follow the sun" and "closer to the market" approaches that are intended to grow revenue.

Figure 1: Global Design Prevalence



Source: Aberdeen*Group*, December 2005

Key Business Value Findings

Global product design strategies often involve more than just one additional design location. Many companies are designing in four to five geographies in either outsourced or company-owned design centers. Designing products in a distributed approach makes classic control, communication, and collaboration challenges in product development even more challenging. In addition, global design adds new challenges such as protecting intellectual property, with roughly two-thirds of respondents indicating this as a top challenge and roughly one-third indicating that retaining company knowledge was a top concern.

Top actions to address global product design complexity include standardizing processes, standardizing design tools, and centralizing design data. An earlier Aberdeen benchmark study, *The Product Innovation Agenda*, identified that best-in-class companies were four times more likely to use centralized product data, have centralized organizational structures, and use automated processes while achieving their top performer status. Interestingly, these same actions appeared as the top approaches for addressing the challenges of global design. In essence, global design extends the challenges of control, communication, and collaboration that most companies are finding in their product development processes.

Technical enablers used to help in global design environments include project and program management, product data management, and collaboration tools. The most notable finding of the study was the intense usage of e-mail and office productivity tools such as Microsoft Office. These less formal collaboration tools bring along some additional challenges, including further concern about intellectual property loss.

Implications & Analysis

Companies that are best in class at meeting global product development targets follow best practice approaches to organization, performance measurement, business process, and technology. Top performers are more centrally organized and extend their management to the design network. Similarly, higher performing companies are measuring performance across the design network and more frequently than average companies. From a process perspective, companies hitting global design targets are standardizing processes more than average respondents, who also indicated standardization was the highest priority. From a technical perspective, best in class are more likely to have product data management, formal collaboration infrastructures, and standardized design tools.

There were two findings of particular interest that are evaluated in further detail. The first is the conspicuous absence of any actions that address the top concern — protecting intellectual property. Particularly when considering the frequency that e-mail is used in design collaboration, intellectual property appears to be at risk in many global design environments. PDM and other collaboration approaches can help to minimize this risk, along with other approaches such as reducing the sharing of detailed, native CAD files by leveraging lightweight design representations.

The second finding that receives additional analysis is the high number of companies that are pursuing standardized design tools. While standardizing design tools may be the path of least resistance in today's complex design environment, there are some strategic challenges to this approach that must be discussed. In the long term, standardizing design tools across the extended design network may turn out to be a limiting approach, despite that fact that best-in-class performers are adopting this approach today.

Recommendations for Action

Global design extends already challenging product innovation, product development, and engineering processes. Companies should follow best practices for organizational structure, process, technical enablers, and performance measurement and extend these to the global design network. In addition, companies should look for ways to protect intellectual property and retain product knowledge. Leading companies should look for ways to go beyond cost savings and take advantage of more strategic global design opportunities. To achieve high performance, companies should:

- Ensure a solid data and process foundation;
- Measure product development performance internally and with partners;
- Measure performance more frequently, including global design networks;
- Evaluate low fidelity approaches to sharing designs instead of sharing native CAD files, when full detail is not required;
- Look for ways to enhance lightweight forms of design collaboration;
- Look beyond standardization of design tools to take full advantage of expertise and available global design resources without the limitations of common tools;
- Continue to monitor attainment of global design objectives, and extend the value beyond cost savings.

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Chapter One:
Issue at Hand

Key Takeaways

- Global design is the reality for many companies today.
- Companies are using global networks for strategic as well as tactical design functions.
- A global approach increases standard product development challenges, and provides some new challenges of its own.

The job of bringing product innovations to market is challenging for most manufactures. Today, many companies are outsourcing some of their design to third parties, or setting up their own design centers in geographically dispersed areas. Forty-four percent of respondents to Aberdeen's *Product Innovation Agenda* benchmark study indicate that they are assembling teams across geographies to pursue global design. For discrete manufacturers the percentage raises to 53%. Responses to Aberdeen's *Enabling Product Innovation* report indicated that one-quarter of companies are already outsourcing some design processes.

Global product design is not a brand new idea, about one-half of manufacturers surveyed have had a global design strategy in place for longer than one year. As design teams become more physically dispersed, the complexity of managing the product development process has intensified. As these networks of design resources are formed, new challenges have come into play based on the relationships between the product managers and the global design centers.

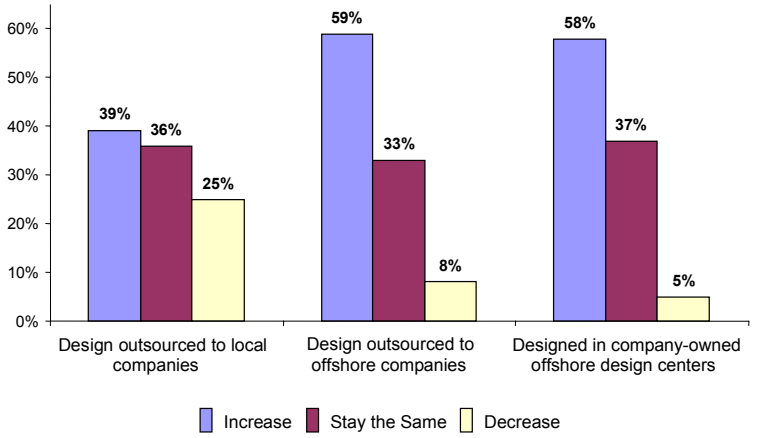
Before discussing the pressures companies face from global design, we will characterize the prevalence of global design and clear up some common misconceptions:

Global Design — Not Just "Offshore"

The first common misperception about global design is that companies are simply shipping jobs to lower cost resources. While some companies use "global design" as another term for offshore outsourcing, there are many models for global design that companies are pursuing. Global design models include outsourcing design processes to suppliers, utilizing design service providers, and developing company-owned design centers across the globe. There are other variations, including models that are hybrid of the above. One interesting finding is that companies are typically not designing in only one geographic region, with one-third of companies with global processes designing in four to five locations, and one-quarter of firms designing in more than five.

Despite differing global design approaches, the implications and challenges on the design process are relatively similar. Figure 2 below shows some common models, and reflects a clear trend for companies to increase their level of global design and move more of their design to offshore locations.

Figure 2: Global Design Plans for Next 2 Years

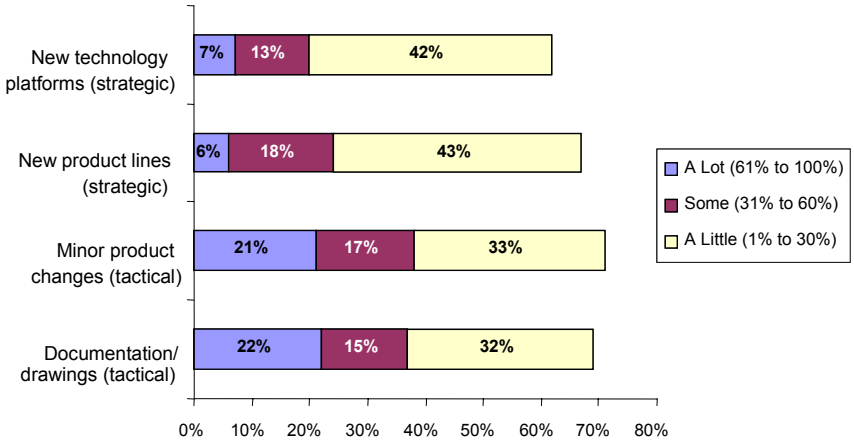


Source: AberdeenGroup, December 2005

Global Design — Not Just Tactics

Another common misconception is that global design is only being used for tactical design such as converting 2D drawings to 3D or developing design documentation. Manufacturers designing globally stated that they are performing strategic level design globally in addition to tactical design (Figure 3). The data indicates that most companies are not limiting their global strategy to simple processes, although not many have globalized a high percentage of their strategic design. Boeing is a good example of strategic globalization, with joint design efforts underway for the new 787 Dreamliner. The design efforts include suppliers on a global basis in a very strategic, parallel, and collaborative approach. Major components of the aircraft are being designed in remote centers such as Russia and then merged with other designs in large digital mockups. Boeing's goal is to avoid any physical prototypes; the first time the sections of the plane will ever be physically assembled will be on the first production plane.

Figure 3: Amount of Design Work Accomplished through Global Design



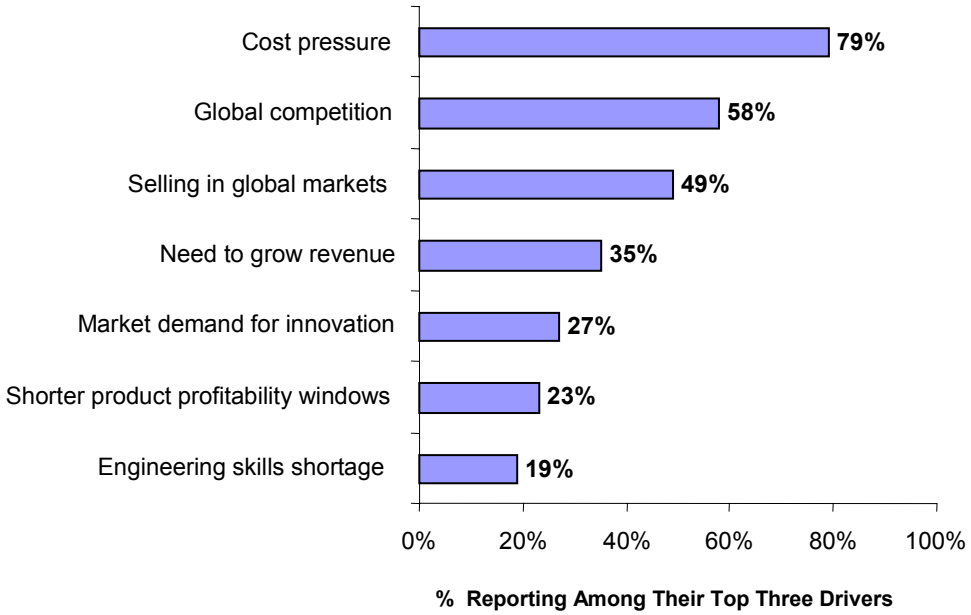
Source: AberdeenGroup, December 2005

Global Design — Driven by Cost, but Not Just Cost

The reason that most companies develop global design capabilities is to reduce cost (Figure 4). Aberdeen's recent *Low-Cost Country Sourcing Success Strategies* report determined that total costs for goods purchased from low-cost countries are 10% to 35% lower, on average, than in more mature economies such as the United States and the nations of Western Europe. The driver for low cost country sourcing is overwhelmingly based on cost savings, with more than 90% of respondents indicating cost as the greatest benefit to sourcing abroad, with no other benefits listed by more than roughly one-third of respondents. The same international dynamics that allow for low-cost country sourcing of materials apply to contracted lower-cost labor.

Manufacturers are moving design work to global markets for cost reduction purposes as well. Global design strategies are primarily a method to reduce product development costs, although some companies are developing global design networks for more strategic reasons. As companies reach out to sell into global markets, they require knowledge of the local requirements. Designers that are literally closer to the customer may have insights and knowledge about local regulations, preferences, and buying values that can help localize products to foreign markets. Having a presence in the local market may also be a market or legal requirement, where a percentage of the work on a product is done by local residents. Another reason to globalize design processes is to capture innovative ideas from outside of the company. Third-party designers can act as an innovation catalyst to meet the needs of customers that are demanding more innovative, fresh product ideas.

Figure 4: Drivers of Global Product Design



Source: Aberdeen*Group*, December 2005

Challenges of Global Design

The challenge to keep product development and product lifecycles in control drastically increases with outsourced manufacturing, and is increasing further as product development teams cross not only departmental boundaries, but also company, cultural, language, and time zone boundaries. Companies report synchronizing distributed designs, managing change across dispersed teams, and collaborating with partners that have limited infrastructure as challenges. These classic product innovation challenges are cited by between one-third and one-half of respondents, indicating that this is a significant challenge (Figure 5).

Beyond tactical concerns about keeping projects in control, manufacturers clearly indicated concern over protecting intellectual property, with nearly two-thirds of respondents indicating this as a top challenge. Roughly one-third indicated that retaining company knowledge was a top challenge with their global design strategy. An interesting observation is that the challenges identified with global design vary based on the length of time that the company has had a global design strategy in place. Initial strategic concerns about IP and knowledge, for example, lose priority as more tactical concerns about managing increased complexity gain in importance.

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:

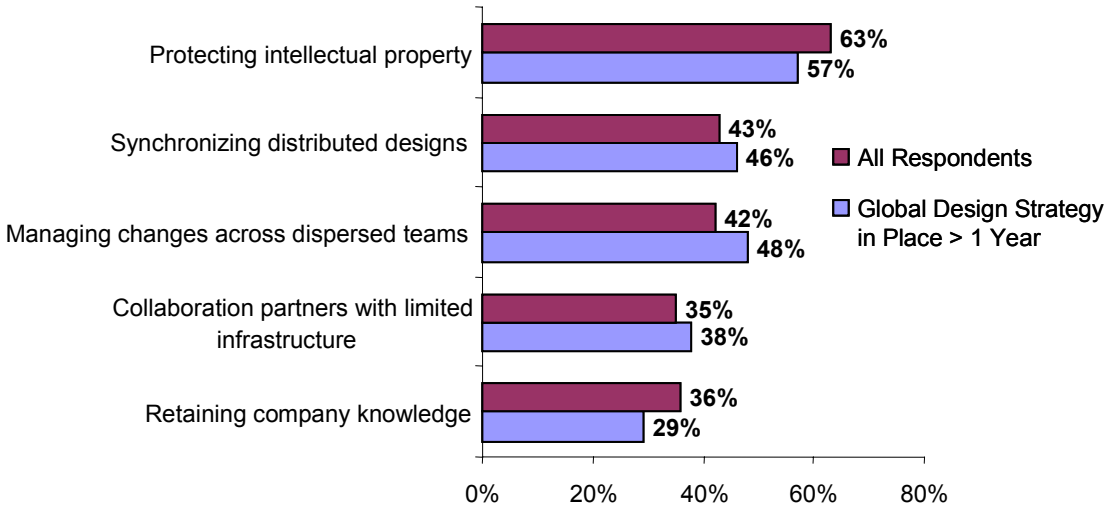
Pressures **—** external forces that impact an organization's market position, competitiveness, or business operations

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

Figure 5: Top 3 Challenges Reported in Global Design



Source: Aberdeen*Group*, December 2005

These challenges, or pressures, are further discussed in relation to the business actions companies are taking, the business capabilities companies are pursuing, and the technical enablers companies are using based on Aberdeen's PACE methodology. For more information on this research methodology, see the PACE Key in this section or a further definition of the methodology in Appendix A.

Chapter Two:
Key Business Value Findings

Key Takeaways

- Manufacturers are taking actions to develop and leverage global design networks, focusing primarily on goals to reduce cost but also on more strategic objectives.
- Companies with global design strategies must take action to address the additional complexity that global design places on their innovation, product development, and engineering processes.
- Companies are executing global design collaboration in a number of ways, and some of the current approaches may be increasing the risk of intellectual property leakage.
- Not everybody is embracing global design, inhibitors are similar to challenges identified by those pursuing global design.

Global design promises benefits that manufacturers believe will help decrease costs and provide revenue growth opportunities. The attainment of these high-level goals, however, requires companies to overcome the challenges that a global design strategy brings with it. This chapter focuses on what companies are doing to address resulting complexities from the perspectives of actions taken, capabilities pursued, and technical enablers used.

Goals for Global Design

In response to the business drivers identified in Figure 4, many companies have adopted global design strategies. These design strategies are often based significantly, if not exclusively, on taking advantage of lower-cost labor (Figure 6). There are other reasons to develop global design capabilities, whether they are pursued independently or in parallel with product development cost savings. About two-thirds of companies surveyed for the *Product Innovation Agenda* benchmark report indicated that bringing products to market faster was very important to increasing product revenue. Not surprisingly, more than one-half of manufacturers that responded to this study indicated they were using global design strategies to decrease development lead times. Similar numbers indicated that they were attempting to increase design capacity through global design. In many cases, these goals can be translated into gaining more capacity for the same investment, which translates to taking advantage of lower cost labor. There were some exceptions, however, where global design goals were intended to drive growth:

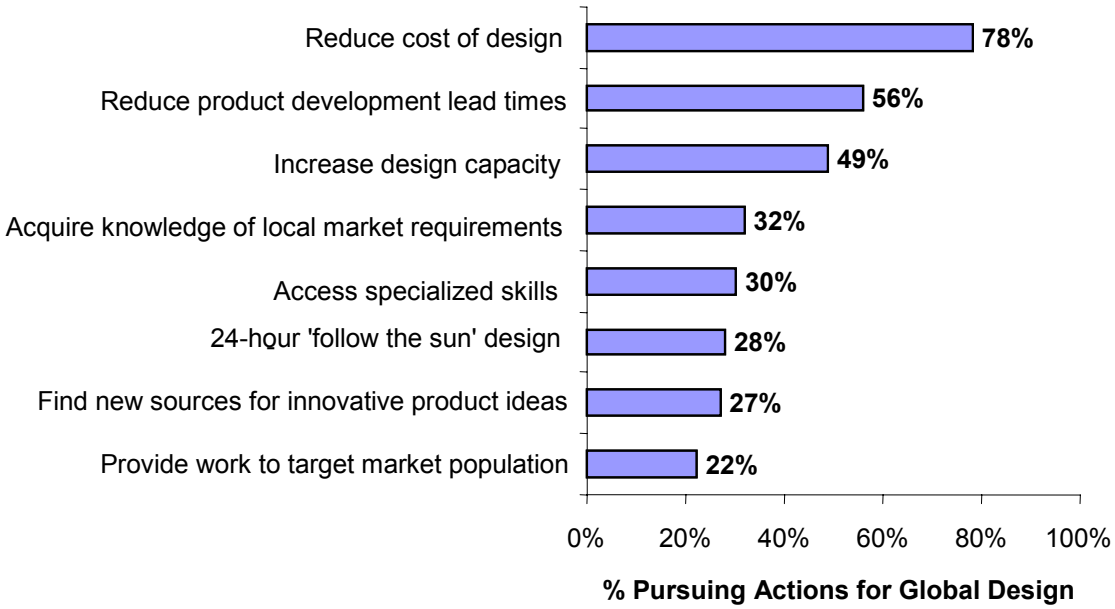
- *Local market knowledge* ─ Designing a successful product requires understanding the value that customers will perceive in it. Local resources can often provide much better insight into how a product will be perceived, often in ways that are hard to articulate and communicate across cultural boundaries. Local resources are also more likely to understand legal and regulatory needs.

- *"Follow the sun" design* ─ To collapse development schedules, some companies are targeting work in three different geographical locations to allow engineering

to continue around the clock, sometimes having three people sharing the same design and working on it during the workday in their particular time zone.

- *Specialized skills* ─ Beyond lower labor rates, global design strategies may intend to add expertise and experience in a particular industry or facet of design where resources are scarce. Examples of this are utilizing experienced Korean automotive engineers, or Russian aerospace specialists.
- *Innovation* ─ About one-quarter of respondents indicated that they were looking for new sources of innovative product ideas through global design. As market pressure for new and innovative products mounts, some companies are looking outside their organization to capture fresh, new ideas. Examples of this are consumer goods companies working with design firms to find new concepts.
- *Provide work to target market* ─ Some companies are simply providing jobs to local markets. This may be for legal, political, or marketing purposes to help companies penetrate foreign markets with a local presence. This is more common for manufacturing work where more people can be employed.

Figure 6: Goals for Global Design



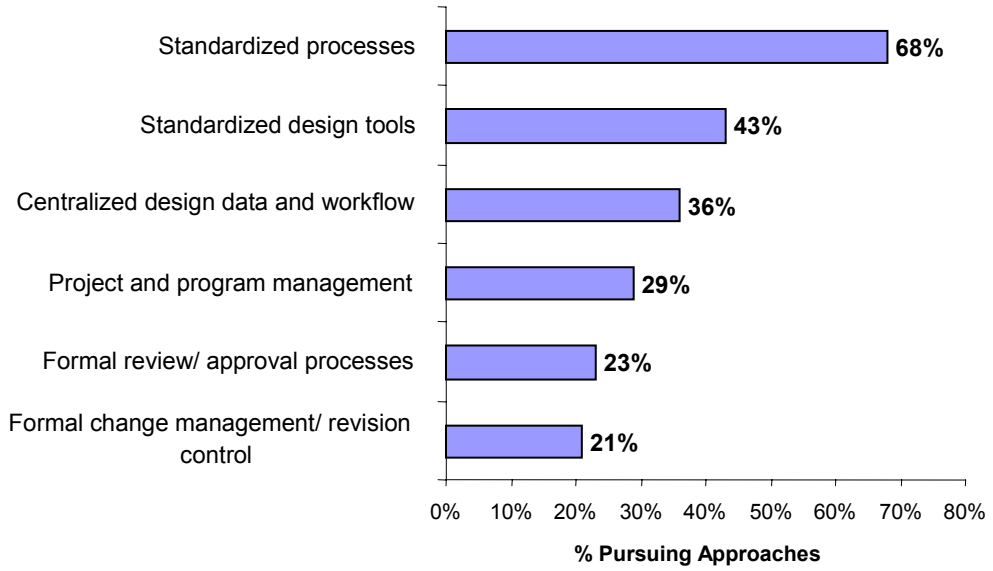
Source: Aberdeen*Group*, December 2005

Actions for Addressing Global Design Complexity

Manufacturers responding to the survey are managing the added complexity of global design in much the same way companies are managing internal design complexities. In previous benchmark studies, including the *Product Innovation Agenda* benchmark report and the *Product Development in Consumer Industries* benchmark report, companies indicated that a top priority action was to standardize processes. Past studies have also indicated that project and program management are near the top of the list in achieving product development success. The *Product Innovation Agenda* went further and identified that best-in-class companies were four times more likely to employ centralized product data and automated processes while achieving their top performer status. Interestingly, these same actions appeared as the top approaches for addressing the challenges of global design (Figure 7). In essence, global design extends the challenges of control, communication, and collaboration that most companies are already facing in their product development processes.

There are two findings of particular interest, however, that warrant special attention. The first is the conspicuous absence of any actions that address the top concern — protecting intellectual property. The second is standardizing design tools. Each of these is discussed further in Chapter 3.

Figure 7: Addressing the Challenges of Global Design



Source: Aberdeen*Group*, December 2005

Case Study

Electronics manufacturing services (EMS) company, **Solectron** operates on five continents and 20 countries across the globe. The company offers a range of services on a global basis, including manufacturing, service, and design. For Solectron, effective management of global design processes with its customers, typically OEMs, is critical to business success. Roland Goyette, VP of Engineering and Technology for Solectron, shared some insight on global design:

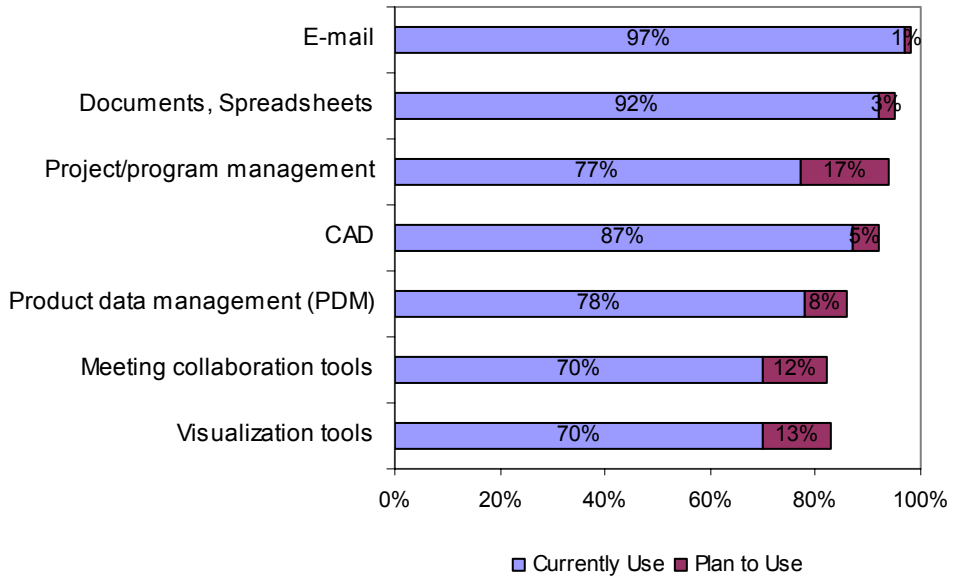
"It is not unusual for us to design on three continents," Mr. Goyette explained, "where one senior designer leads the project and distributes work across sites." In this way, Solectron is able to work three shifts per day on their design work. To keep the project in control, the project lead has checkpoints in the morning and the night. "The key is keeping the work well managed since the projects are very complex from a program management perspective," Mr. Goyette described. "We make sure that day to day, shift to shift, everything stays in check."

Mr. Goyette also pointed out the need for standardization. "To be successful, we have to standardize processes and tools," he explained. "Without this, we can't even start." By keeping projects in control and standardizing process and technology, Solectron is able to use their global workforce around the clock to meet customer demands.

Technical Enablers for Addressing Global Design Complexity

From a capabilities perspective, global design extends the need for collaboration, communication, and control across enterprise and geographic boundaries. Not surprisingly, the technical enablers being used to help in global design environments include project and program management, product data management, and collaboration tools. The most notable finding of the study was the intense usage of e-mail and office productivity tools such as Microsoft Office (Figure 8). Many companies are sharing design and project information with global partners using these less formal, less controlled, and less secure methods. This appears to be a disconnect when the top challenge companies face in global design is protecting intellectual property. Interviews with companies big and small confirm that significant amounts of product development and engineering data are being shared with global partners via e-mail. The impact on intellectual property will be discussed further in Chapter 3.

Figure 8: Technical Enablers used to Address Global Design Complexity



Source: Aberdeen*Group*, December 2005

The companies surveyed indicated significant use of technology to address global design. Respondents indicated using the tools identified in the chart above among a host of technical solutions. Other tools companies are using to help with global design include:

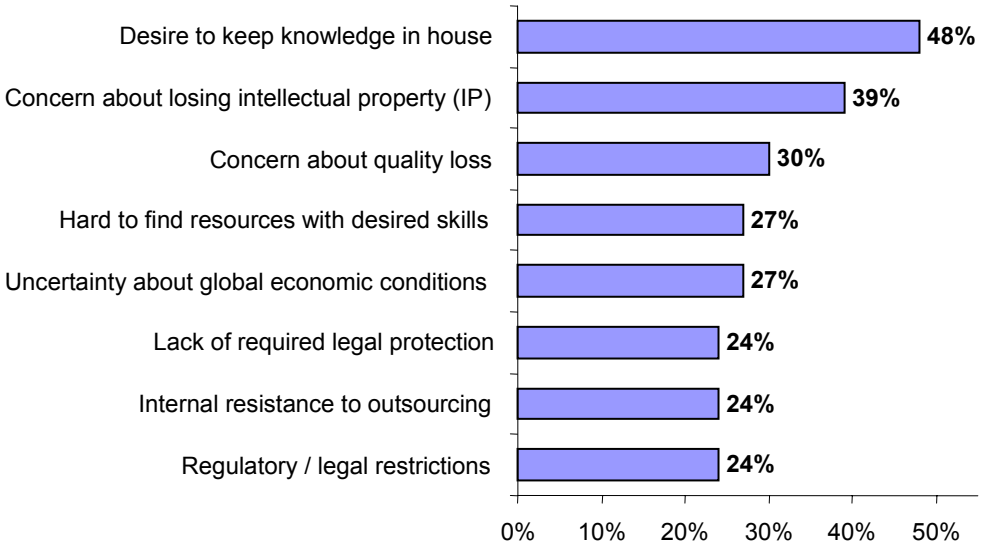
- Workflow
- ERP
- Project collaboration tools
- Web portals
- Collaboration on designs captured in documents
- Design translation tools
- Product simulation tools
- Digital mockup
- Online design collaboration tools
- Digital manufacturing/manufacturing process planning

Clearly companies are focusing significant technical resources on achieving and enabling global design.

Inhibitors to Global Design

Not everybody is pursuing global design. About one-third of survey respondents indicated that they do not plan to pursue global design strategies. These companies identified very similar reasons to the strategic challenges identified by those pursuing global design (Figure 9). For these companies, perhaps the challenges seem insurmountable. In addition to these challenges, however, companies also mentioned concerns about quality loss from global design, as well as a discomfort about the state of the global economy. Finally, just under one-quarter of participants indicated that they face legal or regulatory restrictions that prevent them from taking advantage of global design.

Figure 9: Inhibitors to Global Design



Source: AberdeenGroup, December 2005

Clearly, there is more work to do to decrease the complexity of global design in order for some companies to take advantage of it. While some of the intellectual property concerns can be alleviated with good processes and technology, some companies have stated that these challenges are nonnegotiable and that they will not consider global outsourcing under any circumstances.

Chapter Three:
Implications & Analysis

Key Takeaways

- Best-in-class companies are more centrally organized and measure performance more regularly.
- Best-in-class companies utilize structured collaboration platforms.
- Current approaches are addressing many of the challenges of global design, but IP protection requires more attention.
- The variety of design tools in use today leads to the need for significant rework and translation between partners and steps in the product development cycle. Today, companies are standardizing design tools in order to compensate for these challenges. Although standardization of tools is the path of least resistance, it has strategic limitations.

As shown in the Competitive Framework Key below, survey respondents were classified into one of three categories based on their product development performance. Aberdeen's Competitive Framework defines these levels of enterprise performance as a way to analyze which business approaches lead to success. Survey respondents from Aberdeen's *Product Innovation Agenda* benchmark report were asked to submit their performance in the following characteristics 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 development cost targets

Based on the goals identified for global product design, respondents to the current study were asked to characterize their performance in regard to meeting product design cost and product design date targets. Based on the responses to these questions, respondents were classified by performance. The performance benchmarks were then compared in order to classify respondents as "Laggards," "Industry Norm," or "Best in Class" companies in regard to global product design.

(For more information on the Competitive Framework, see Appendix A.)

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

Process, Organization, and Measurement

The *Product Innovation Agenda* identified that best-in-class companies in product innovation are much more likely to have standardized processes, centralized organizational structures, and measure performance more frequently. The results from this research not only confirm those findings, they also indicate that top performers are extending their standardization and centralization to their global design networks. Some key findings of this report with regard to process, organization, and measurement include:

- *Standardizing processes* — Overall, more companies across the three performance categories identified standardizing processes as a top approach to addressing global design complexity. Best-in-class were far more likely to pursue this (91%), although on average the approach was still relatively pervasive (67%).
- *Centralized control* — Best-in-class are more likely to have centralized management of internal and external design resources (45%) than the average company (35%) across performance categories.
- *Measuring performance* — Best-in-class performers were twice as likely (36%) to measure key performance indicators on at least a monthly basis than their poorer performing counterparts (17%)
- *Measuring performance across global design network* — Twenty percent of best-in-class companies measure performance enterprise - and partner-wide to encapsulate the extended design network, as opposed to 13% for average companies

Case Study

Tata Consultancy Services Limited (TCS) offers product engineering to manufacturers among their service offerings. As frequent participants in global design projects, TCS has unique insight into ensuring successful design relationships. TCS has established formal processes for managing outsourced design based on significant experience in global design. In addition to formalizing design processes, TCS points out that there are additional business processes required to manage the global design relationship itself. Global design projects can be broken into logical portions of work, or work packages, that can be handed off to remote designers. Care must be taken, according to TCS, to plan time to transfer design intent to the global designers and to transfer the finished design back to the contracting company. These processes can frequently be overlooked or ignored, which can result in inefficiency, frustration, and ineffective global design relationships.

To manage projects effectively, performance must be measured. From a metrics perspective, TCS engagements are typically measuring schedule slippage, defect density, and designer idle time. These key performance indicators measure the project in the areas of design lead times, design quality, and designer utilization. In addition to these, TCS has frequently been asked to measure another metric that helps to gauge the overall effectiveness of the extended global design team. "First time right" is defined as the percent of designs that are delivered correctly on the first try, and do not require rework. Without strong performance in this metric, all design work needs to be rechecked by the contracting company, which can quickly erode any savings generated by the global design relationship. By managing and measuring the global design relationship in addition to the design work itself, companies with global design networks are more likely to achieve successful global design operations.

Technology Usage

In addition to standardizing practices, best-in-class companies are also standardizing design tools. In fact, the top two approaches to address global design complexity are standardization of processes and tools. In addition, best-in-class performers are also utilizing PLM technologies to help address complexity.

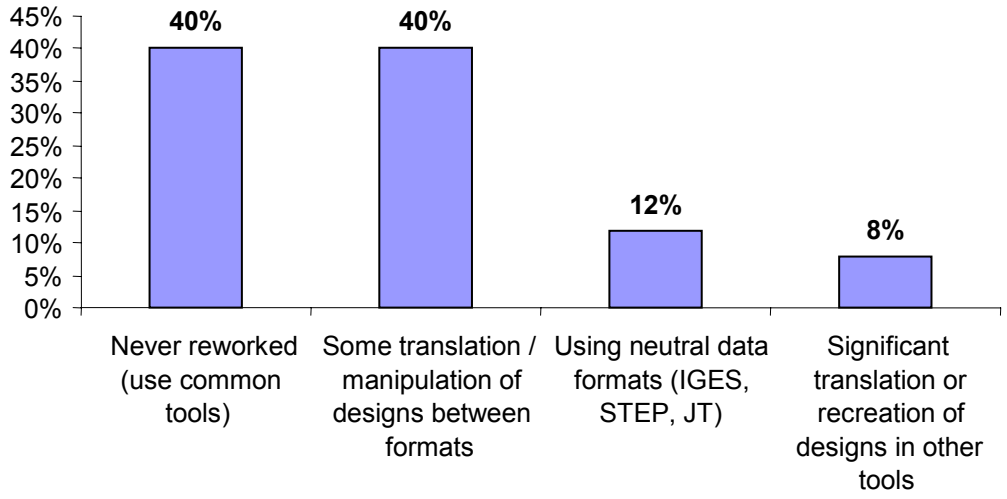
- *Standardizing design tools* ─ Many companies are standardizing design tools inside and out of their companies. More than one-third of all companies, and almost two-thirds of best-in-class companies, are forcing all designs to be delivered in the format of a specified tool. Standardization helps companies incorporate delivered designs into parent assemblies and into downstream processes, although it comes with some inherent challenges (see "Standardizing Design Tools – a Strategic Approach?" section below).
- *Product data management* ─ More than 90% of best-in-class companies, and 81% of companies overall, are using product data management (PDM) solutions to help manage the complexity of global design. PDM solutions help manage designs, revisions, change control, and often process workflows, to keep the dispersed organization in control and working on the right set of data. These solutions also help to offer a secure mechanism to share product designs.
- *Collaboration infrastructure* ─ Best-in-class companies are more likely (81% vs. 65% for all respondents) to have formal collaboration and control, whether leveraging an automated collaboration infrastructure or document-based collaboration.

Standardizing Design Tools — a Strategic Approach?

A significant percentage (38%) of companies and a larger percentage of companies that are best in class at meeting global design targets (64%) are standardizing design tools. On the surface, this appears to be a world class approach. Standardization reduces variability and promotes continuous improvement. From an information technology perspective, it can also provide cost savings due to economies of scale in software licensing, implementation, and training. Given the complexity of today's design environment, it is not surprising to see companies trying to standardize their design infrastructure both internally and throughout their design network. Particularly for those that can dictate to their suppliers, such as the large automotive OEMs and the US Department of Defense (DoD), this is an appealing approach. Standardization has inherent drawbacks, however, that should be considered.

The first drawback is that although it reduces internal complexity, standardization often drives cost and complexity down the supply chain. Frequently suppliers or design service providers use different design tools. If they are demanded to provide designs in one specific format, this simply pushes the burden back on them. If all of their customers were asking them to standardize on the same platform this would be a smaller issue. Of course most customers have their own specific CAD tool, PDM tool, and even specific versions of these that must be used. This requires suppliers to either design in multiple environments or to rework or translate designs between formats (Figure 10). This is the approach most are taking, but it has limits and inefficiencies that are eventually passed on to the customer.

Figure 10: Companies Reworking/Translating Designs during Design Lifecycle



Source: Aberdeen*Group*, December 2005

Another challenge is that standardization can only go so far. There is not one, integrated solution that can meet the varied needs of engineers in complex industries today. Tools for mechanical design, electrical design, styling, and a myriad of specialty applications, including engineering analysis tools, are not standardized or well integrated. In addition, many companies have developed custom solutions. The choices available today include translating designs between steps in the process, developing custom integration, or using tools that are developed under a single vendor's architecture. The use of standards such as IGES and STEP, or newer approaches such as JT or 3DXML, may also help to solve this problem by providing a common data format that design tools can read and write. More than one-third of companies translate or manipulate files to some level, and 8% require significant massaging of design data during their design process (Figure 10). Given the reality of the design tools market today, however, many companies will likely continue down the tool standardization path for the near future. And as this research shows, the companies that are best in class at meeting product design date and design cost targets are using this approach today.

What about Protecting IP?

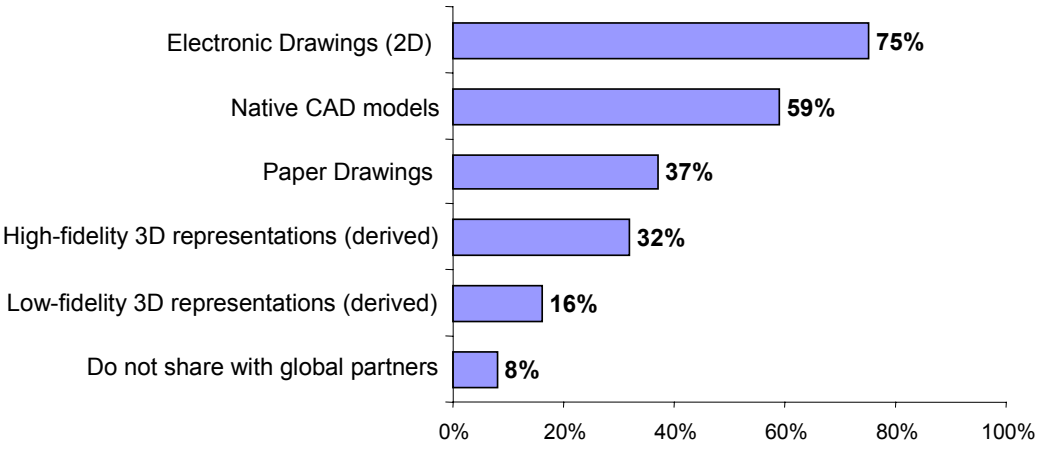
Survey respondents clearly indicated that protecting intellectual property was a top concern with global design. Are companies doing enough to protect their investment in innovation and engineering? Many manufacturers are already faced with competitors that can quickly reverse engineer their products or replicate features to neutralize or shorten the competitive advantages of innovation. With global design strategies, companies are now sharing their critical design data outside of their organization and environment.

The use of secure PDM environments and formal collaboration infrastructures can help to ensure that those accessing design data are authenticated. With proper IT security procedures, these tools can help reduce the ability for others to access sensitive information.

By selectively sharing design information with only those that need access and have been granted permission, companies have begun to lock down their important data from unwanted eyes.

As Figure 8 above indicated, the two most prevalent technology enablers for global design are e-mail and office automation tools. The reality is that product design information is frequently shared outside of the secure, vaulted PDM environment in order to allow for rapid, more ad-hoc collaboration. Engineers e-mailing design data is not uncommon, even if it is not the intended process. Companies can either choose to try to close this potential security threat, or formalize collaboration in a document-based environment. Advances in digital rights management in office documents and PDF files can greatly enhance a company's ability to share design data via e-mail, but also provide some IP protection in the process. Recent technology advances by Adobe and Microsoft, along with their alliances with CAD and PLM vendors, promise to allow more structured, protected design sharing via documents and e-mail.

Figure 11: Company's Design Sharing Approach with Global Partners



Source: Aberdeen*Group*, December 2005

Whether designs are shared less formally via e-mail or in a structured PDM environment, the type of data that is shared is also important. Some companies have adopted modular design strategies to split subcontracted work into multiple segments where only the controlling company can see the big picture. Other companies are sharing representations of the data instead of native CAD files. This can not only help bridge the gap of collaborating with partners that have different or limited design infrastructures, but can also limit the value of the data shared with the partners. Many partners do not need the full details of a design in order to design a complementary item or quote a manufacturing price. In these instances, a lower fidelity model that does not describe the item in enough accuracy to produce it may be sufficient. In this way, the amount of native CAD data that is being shared can be reduced, limiting the opportunities for others to take advantage of the un-

derlying intellectual property of the design. As Figure 11 above shows, many companies are sharing native CAD models that could in some cases be used to produce the part illegally.

Chapter Four: Recommendations for Action

Key Takeaways

- All firms should ensure that their actions include efforts to protect intellectual property and retain product knowledge.
- Laggards should standardize processes and ensure that they have the necessary data management and collaboration infrastructure to succeed in global design environments.
- Companies in the industry norm should extend their processes, performance measurements, and tools to their global design network. These companies should investigate ways to reduce the amount of native CAD that is being shared by replacing CAD files with lightweight design representation when full accuracy is not needed.
- Best-in-class companies should look for ways to extend their global design strategies to target revenue growth in addition to cost savings. These leaders should look for opportunities to move beyond the need for standardizing CAD tools by investigating the use of standard formats when possible.

Global design is the reality for many companies today. Projections from companies in all performance classes – laggard, norm, and best in class – indicate that the level of global product design will increase over the next two years. Given this reality, manufacturers must look for ways to address the added complexity in their product design environment in order to meet product development targets.

To be successful in global design, companies need to extend the same capabilities that help them control, communicate, and collaborate around product innovation, product development, and engineering internally. As companies mature in their global design processes, they can begin to explore revenue generating global strategies in addition to taking advantage of cost savings. All firms should concentrate their actions around protection of intellectual property and look for ways to retain product knowledge in house.

Whether a company is trying to gradually move its field service organization from "Laggard" to "Industry Norm," or "Industry Norm" to "Best in Class," the following actions should help spur the necessary performance improvements:

Laggard Steps to Success

1. *Standardize product development processes.*

   In order to improve product development performance internally and in a global design environment, companies should formalize and standardize processes. Standardization increases efficiencies, but more importantly provides an opportunity for companies to improve their processes — leading to improved performance.

2. *Ensure a solid data and process foundation.*

   In order to synchronize efforts, eliminate errors, and protect intellectual property, manufacturers should implement centralized, secure access to product and project information. Successful product development and design requires companies to keep data and processes in control.

3. *Measure product development performance.*

   In order to analyze current performance and identify improvement opportunities, companies need to measure performance against key performance indicators. What is not being measured can not be improved.

Industry Norm Steps to Success

1. *Extend standardization of product development processes to global design networks.*

   To increase efficiency and decrease the opportunity for errors, companies should incorporate global design partners into standard processes. Standard processes should be reevaluated and extended to take advantage of global design, and to manage the added complexities that it brings with it.

2. *Measure metrics more frequently, including global design network performance.*

   To understand and improve performance of the extended design network, key performance indicators should be measured across internal and external resources. Additional measurements to examine the effectiveness of the global design relationship should be developed and incorporated into service level agreements with internal or external design resources.

3. *Evaluate low fidelity approaches to sharing designs.*

   To help protect intellectual property, manufacturers should evaluate opportunities to replace CAD drawings that incorporate rich design content with lightweight, derived models. These models are easier to view by those with limited infrastructure, and expose less product design intent and intellectual property.

Best in Class Next Steps

1. *Look for ways to enhance lightweight forms of design collaboration.*

   To control lightweight forms of collaboration in addition to more formal collaboration, manufacturers should either eliminate this process, or more likely accept that design information will be shared via e-mail with some partners, and identify ways to protect the design content. Investigate advanced capabilities in common tools such as Adobe Acrobat and Microsoft Office to add structure and security to document-based collaboration efforts.

2. *Look beyond standardization of design tools.*

   To increase efficiency and expand the base of potential designers, consider allowing designers the advantage of working in their preferred design tools and share information in standardized formats. Push vendors and standards organizations to enhance the capabilities of standards so that design tool standardization

is no longer necessary and design data can easily be shared across design tools and other engineering and product development applications.

3. *Continue to monitor attainment of global design objectives, and extend the value beyond cost savings.*

   In order to identify new areas for improvement and retain the lead in global product design, leaders should keep a careful eye on performance. The global design environment is not static, and what works today may not work in coming years. Look for opportunities to extend the value of global design beyond cost savings. Adopt strategies for market expansion, faster design cycles, access to local requirements, tapping new sources of innovation, and targeting global design strategies towards growth.

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Jim Brown leads AberdeenGroup'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 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.

Appendix A:
Research Methodology

In November 2005, Aberdeen*Group* examined the global design strategies, challenges, and approaches of more than 125 enterprises across multiple manufacturing industries.

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

- Characterize the current and upcoming use of global design strategies, including the type of design being globalized and the approaches manufacturers are taking.
- The resulting complexity that global design places on organizations, and the ways that companies are overcoming that challenge.
- The structure and effectiveness of existing global design processes.
- The performance measurements being used to manage global design networks.
- Current and planned use of automation to address global design challenges.

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

Responding enterprises included the following:

- ***Job title:*** The research sample included respondents with the following job titles: director or manager (42%); senior management (14%); staff (14%); engineer (12%); internal consultant (9%); vice president (5%); and CIO/IT leader (4%).
- ***Job function:*** The research sample included respondents from the following functional areas of responsibility: design engineering (27%); information technology (13%); business process management (13%); manufacturing (9%); manufacturing engineering (9%); logistics/supply chain (8%); marketing (7%); sales (5%); procurement (4%); customer service (3%); and finance (1%).
- ***Industry:*** The research sample included respondents predominantly from manufacturing industries. At a high level, the respondents represented discrete manufacturing (61%); consumer products (31%); process manufacturing (10%);, and others (8%). From a more detailed perspective, industries that were more highly represented included industrial equipment manufacturing (15%); computer equipment and peripherals (14%); high technology/software (8%); automotive (7%), and medical devices (7%).
- ***Geography:*** The majority of study respondents were from North America (68%), with other representation from Europe (20%), and Asia Pacific (Asia, Australia) (7%). The remaining respondents were from South America (3%) Africa/Middle East (2%).

Company size: About 27% of respondents were from large enterprises (annual revenues of more than $1 billion U.S.); 31% were from mid-size enterprises (annual revenues between $50 million and $1 billion); and 42% were from small businesses (annual revenues of $50 million or less).Solution providers recognized as sponsors of this report were solicited after the fact and had no substantive influence on the direction of the *Global Product Design Benchmark Report*. Their sponsorship has made it possible for AberdeenGroup to make these findings available to readers at no charge.

Table 1: PACE Framework

PACE Key

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

Pressures — external forces that impact an organization's market position, competitiveness, or business operations (e.g., economic, political and regulatory, technology, changing customer preferences, competitive)

→ *Actions* — the strategic approaches that an organization takes in response to industry pressures (e.g., align the corporate business model to leverage industry opportunities, such as product/service strategy, target markets, financial strategy, go-to-market, and sales strategy)

→ *Capabilities* — the business process competencies required to execute corporate strategy (e.g., skilled people, brand, market positioning, viable products/services, ecosystem partners, financing)

→ *Enablers* — the key functionality of technology solutions required to support the organization's enabling business practices (e.g., development platform, applications, network connectivity, user interface, training and support, partner interfaces, data cleansing, and management)

Source: AberdeenGroup, December 2005

Table 2: Competitive Framework

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

Source: Aberdeen*Group*, December 2005

Appendix B:
Related Aberdeen Research & Tools

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

- *The Product Innovation Agenda Benchmark* (September 2005)
- *Enabling Product Innovation: Roles of ERP and PLM* (November 2005)
- *The Design for Compliance Benchmark Report* (November 2004)
- *Product Development in Consumer Industries Benchmark* (June 2004)

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

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