

SIMULATION-INTEGRATED PRODUCT DEVELOPMENT: ACHIEVING MORE WITH LESS

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Report Highlights

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In the race to deliver high-functionality, complex products before competitors, companies face many challenges – both internally and externally.

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A narrow margin is what determines whether a product fails or succeeds.

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Add technology solutions that are easy to use and will integrate into your process.

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In order to properly take advantage of the benefits of simulation, companies should look for solutions that enable different design alternatives across varying environments.

The report will discuss the driving factors, challenges, and best practices for companies focusing on simulation in their product development.

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The market demand on product developers is to incorporate more functionality into their products at a fraction of the cost. Companies need a way to address these needs without eating into their profit margin.

Definition: Simulation

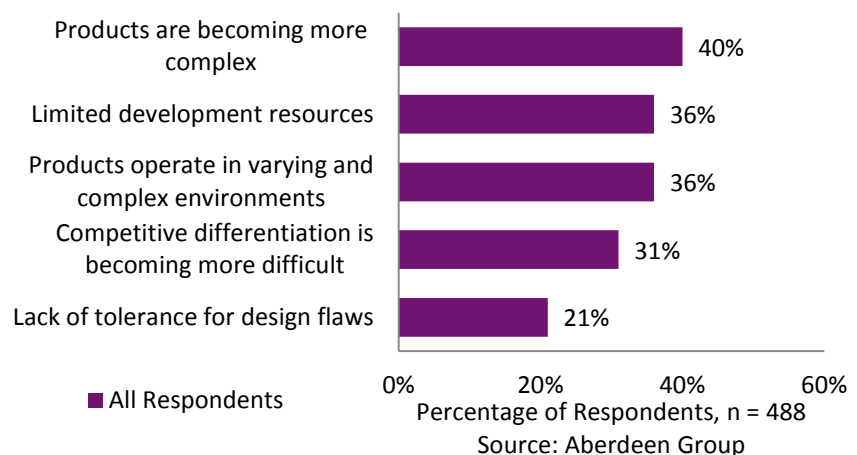
The discipline of using software to create a mathematical model that represents an actual or theoretical physical system. Once modeled, the effects are analyzed when placed under varying environments and under different scenarios.

The mantra of every product developer is “better, faster, cheaper.” A challenge in itself, but one that becomes nearly impossible depending on the level of complexity in a product. Consistently bringing high-quality products to market requires an optimized engineering workflow in product design – one that allows the developer to quickly run through tens of hundreds of different design alternatives without hindering an on-time delivery. How do companies achieve this? They use an automated simulation solution.

The Challenges of Product Development

In the race to deliver high-functionality, complex products before competitors, companies face many challenges – both internally and externally. In a recent survey by Aberdeen Group, the top challenges faced by companies were: rising complexity (40%), limited development resources (36%), and product operating environment (36%).

Figure 1: Rising Complexity in Product Development



Increasingly, successful innovation depends on a company’s ability to develop more complex products, a trend that has doubled in the past 15 years, and has seen significant increase

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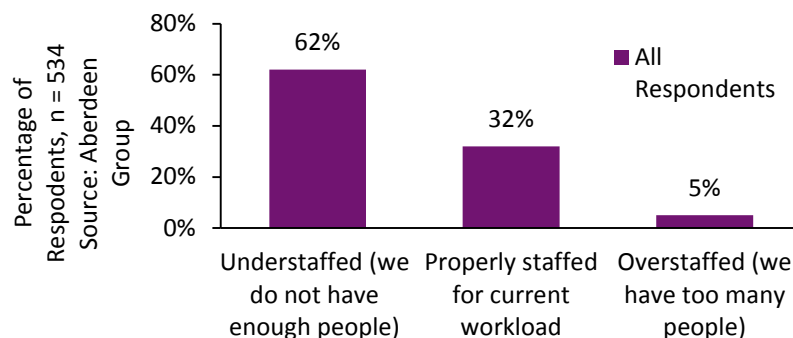
just in the past two years. Survey respondents noted an increase in components over the past two years: mechanical (13.4% increase), software (34.4% increase), and electrical (19.6%).

Once that differentiation is gained, it's equally important for the quality of the product to remain high. Flaws in the product design can, at best, mean a delay in product delivery, leaving potentially larger implications in a successful market introduction. At worst, it can mean loss of consumer loyalty and thereby market share.

The Resource Crunch

There is a narrow margin between product failure and success. The former is often a result of poor execution or lack of good management practices. But more often than not, the reason for these failures stems from one fundamental cause, a major resource deficiency. From Figure 1, we see the second highest challenge in development comes from limited resources. This assertion is further supported in Figure 2, where 62% of respondents said understaffing in engineering positions has a major impact on their business.

Figure 2: Poor Resources



A closer examination behind low quality and weak execution of project targets shows this performance has less to do with ignorance or sloppiness, but more to do with lack of time and

The Challenge in Finding Talent

Other labor resource challenges faced by companies today:

- Lack of engineers in the hiring pipeline: 62%
- Company is not willing to pay for talent: 52%
- Rapidly changing skills in engineering positions / unable to keep up with technology: 27%

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people – the consequence of which has larger implications than missed deadlines. When surveyed, respondents said lacking resources also affected their ability to meet cost, quality, and revenue targets.

Table 1: The Negative Effects of Limited Resources

Impact on Product Goals	All Respondents
Product Launch Dates	16% Decrease
Product Cost Targets	11% Decrease
Quality Targets	10% Decrease
Product Revenue Targets	11% Decrease

Source: Aberdeen Group, n = 534

When resources are lacking, corners are inevitably cut to meet timelines, essential design research is shortened, exploration of design alternatives is accelerated and reduced, and launch plans are thrown together.

The bottom line: In order for a company to stay competitive, they must overcome these challenges by doing more with less.

Successful Design Begins with Simulation

The success of a product is highly dependent on several factors; alignment to market needs, level of quality, delivery time-to-market, and cost. The issue that companies struggle with is in delivering on these objectives while maintaining profitability. As stated previously, the issue of labor resources plays a huge factor in how well a company can deliver on its promises.

Leading companies have turned to simulation solutions that enable companies to move nimbly through their product design process without overspending on overhead. The benefits of simulation far outweigh the start-up cost and setup in the long

We Need Insight

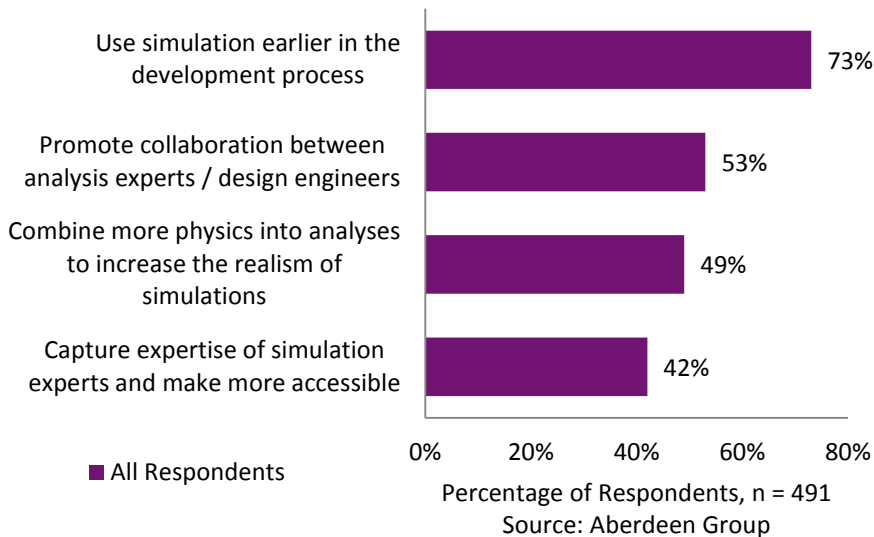
Companies were asked what their major challenges were in getting insight into product development. Here's what they said:

- Too many manual processes (spreadsheets): 39%
- No method for visibility into data to support decisions: 31%
- Lack of expertise / resources: 19%

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run, since it provides a risk-free, low-cost environment that allows designers to consider hundreds, if not thousands, of iterations of the same design.

Figure 3: Companies Turn to Simulation



Simulation as a part of product development is widespread. As shown in our survey results, 73% of respondents say their top action to improving product behavior assessment is to use simulation earlier in the development process. The use of simulation as a means of addressing the challenges of increased product complexity and improving reliability is the overriding theme, as simulation use is in three out of the four actions listed above, combine more physics into analyses (49%) and capture expertise of simulation experts (42%).

Defining the Best-in-Class

To define the Best-in-Class, survey respondents were divided into two maturity classes — Best-in-Class (top 20%) and All Others (bottom 80%). This division was made by using five organizational performance metrics: quality, product launch dates met, product cost targets met, product revenue met, and

Improving Product Design

Companies were asked what external pressures drove them to improve product design. Here's what they said:

- Shortened product development schedules: 52%
- Competitive pressure to differentiate products with better quality / reliability: 39%
- Customer demand for lower cost products: 31%
- Need for greater innovation to create new market opportunities: 26%

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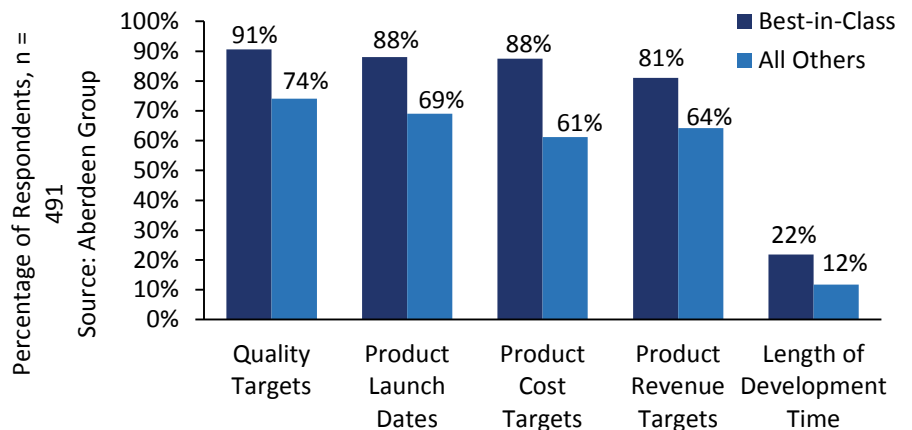
The Best-in-Class Distinguish Themselves

Other performance metrics that separate the Best-in-Class from All Others.

- Overall Product Cost Decrease
Best-in-Class: 12%
All Others: 7%
- Lifecycle Cost Targets
Best-in-Class: 83%
All Others: 66%
- Decrease in Number of Engineering Change Orders (ECOs) After Design Release
Best-in-Class: 15%
All Others: 6%

change in length of development time (increase or decrease). Respondents were asked to identify the frequency at which products met these targets in the past two years. Figure 3 highlights the performance of the two maturity groups.

Figure 3: Best-in-Class Performance



Best-in-Class companies consistently outperformed their peers. They met their targets by almost 20% in each metric of quality, launch, cost, and revenue. They were also able to decrease their length in development time by almost double that of All Others. This performance indicates the Best-in-Class are taking tangible steps to separate themselves from other companies.

Guidelines for Effective Simulating in Design

Under the constant pressure to launch truly innovative products in a rapid and reliable fashion, companies need the ability to meet consumer needs while maintaining profitability. For top companies, this means using a simulation package solution. In order to properly take advantage of the benefits of simulation, companies should look for solutions that enable the exploration of different design alternatives across varying environments. For proper implementation of simulation into product development, follow these steps:

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- **Front-load the product development process.** Make your most rigorous analysis and proofing during the first few stages. Early-stage changes are easily adapted and less costly than changes during production. The sooner design iterations are explored, the more flexibility for change is possible and the less room for error downstream. The easiest way to implement this exploration is using simulation and virtual prototyping. Best-in-Class companies are 55% more likely to perform simulation at the component level (see Figure 4).
- **Adapt technology to fit your people and processes.** Add solutions that are easy to use and will integrate into your process easily. Keep in mind that any new solution will require training, which should be considered a critical part of integration. Use simulation solutions that will aid in reducing errors during design and functionality, and fit with the existing process. Best-in-Class companies are 37% more likely to provide training of simulation solutions that include best practices relevant to internal product development processes.
- **Use solutions that help with design standardization and organizational record-keeping for “lessons learned” and downstream debugging.** Best-in-Class companies are 33% more likely to use simulation in post-manufacturing failure analysis.
- **Keep tight collaboration between testing and design teams.** Solutions that improve product performance can only be used effectively if that information is passed on to the designers. Best-in-Class companies are 11% more likely to have all R&D centers and production units collaborating closely and using simulation as a common language.

Which Features Do You Look for in a Simulation Solution?

- Accuracy: 76%
- Reliability: 76%
- Integration with CAD: 70%
- Depth of Capabilities: 67%
- Cost: 61%
- Ease-of-use for Non-Experts: 50%

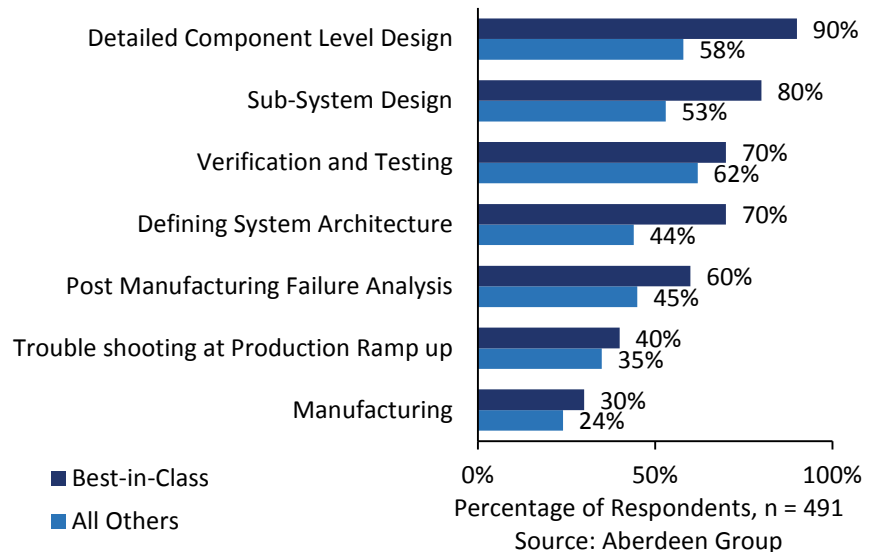
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Design Products Correctly – The First Time

Company performances were measured over a span of two years. The goal was to see how performance metrics changed with the incorporation of a simulation solution versus those who used none at all (i.e. manual or hand calculations). Here's where they stood:

- Change in overall product cost**
 Simulation Users: 13% decrease
 Manual Calculation Users: 2% increase
- Change in number of change orders after release to manufacturing**
 Simulation Users: 10% decrease
 Manual Calculation Users: 8% increase
- Change in number of partial physical prototypes**
 Simulation Users: 12% decrease
 Manual Calculation Users: 3% increase

Figure 4: Best-in-Class Companies Use Simulation at All Stages of Development



Companies who streamline their most complex processes enable themselves to develop, launch, and manage products more effectively.

Key Takeaways

For Best-in-Class companies, simulation-driven development is a key part of the processes for designing products in the era of the Internet of Things. What distinguishes them from their peers? They use simulation at all stages of development, and use it as a common language of communication between functional groups. Some key steps to keep in mind are:

- Integrate existing infrastructure into new simulation strategies.** Easily achieve this through an automated simulation solution, which will provide standardized processes for designing.
- Redefine your workflow.** Getting the most out of simulation means creating a process that uses simulation

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in the early design phase, as well as in troubleshooting or post-production.

- **Find a solution that helps optimize for complex, high-speed electronics.** Connected products will require a high-speed processor to transmit data quickly and without lagging or downtime.

Companies can significantly reduce their production costs, decrease delays to market, and minimize compromised quality by taking the right steps to effective implementation of simulation in their product development. This requires a systematic approach across the entire enterprise, by deploying simulation solution capabilities to equip users to work efficiently and productively.

For more information on this or other research topics, please visit www.aberdeen.com.

Related Research

[*Optimizing Efficiency and Cost by Using Simulation in Aerospace and Defense*](#); March 2016

[*Utilizing Simulation to Drive Innovation and Top-Line Growth*](#); January 2016

[*Eliminating Simulation Bottlenecks with Best-in-Class Meshing*](#); June 2015

[*From the Internet of Things to Service and Machine Transformation*](#); December 2015

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