THE BENEFITS OF SIMULATION-DRIVEN DESIGN

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Report Highlights

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In 2016, 87% of Best-in-Class organizations used simulation, up from 75% two years earlier.

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Best-in-Class senior management are 2.5 times more likely to support and monitor a corporate initiative for deployment of simulation to non-experts.

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Best-in-Class design engineers built 27% fewer prototypes since deploying simulation-driven design.

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Best-in-class designers that have adopted simulation-driven design improved (shortened) the length of their development time by 29%.

This report explores the benefits of simulation-driven design to create more innovative products. It shows how Best-in-Class designers are increasingly using simulation, early in the design process, to meet cost, time-to-market, and quality targets.

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Simulation-driven design (the use of simulation by design engineers early in the design process) results in more innovative products, more likely to work the first time, and less likely to require significant rework late in the design process.

Plain and simple, the number one priority of product designers is to launch innovative products to market quickly. In the past, this meant completing the initial design, and turning it over to a dedicated group of simulation experts for further design iteration and optimization. While the expertise of such groups is still highly regarded, this group has increasingly become a bottleneck in the design process.

Driven by market pressures and challenges, Best-in-Class designers are increasingly applying simulation themselves during the design phase.

This report explores simulation-driven design, the use of simulation early in the design process, and shows the significant benefits of this design philosophy in improving cost, time-to-market, and quality. Ultimately, simulation-driven design results in more innovative products, more likely to work the first time, and less likely to require significant rework late in the design process.

Pressure and Challenges Drive Simulation-Driven Design

Pressures and challenges of manufacturing today are driving designers to bring simulation into the design group and use it earlier in the design process (Figure 1, next page).

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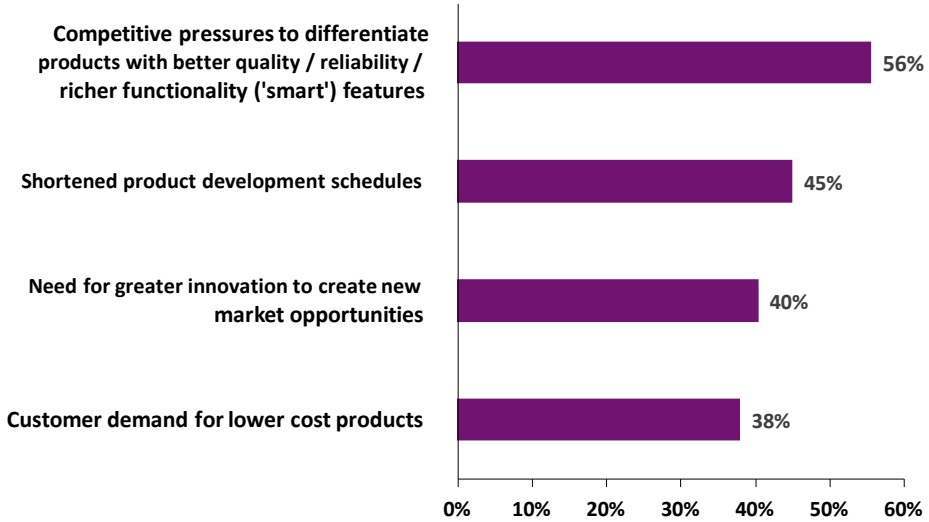
Figure 1: Business Pressures Driving the Move to Simulation-Driven Design



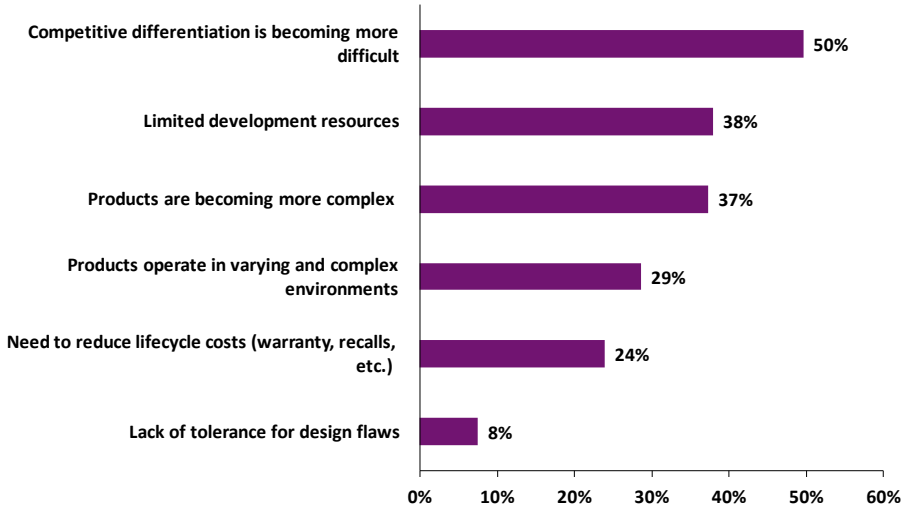
Source: Aberdeen Group, May 2017

Manufacturers are being pressured to better understand product behavior during the design phase. The need for greater innovation is critical and it is a catalyst to create new market opportunities. On top of the need to innovate, there is immense pressure to differentiate products with better quality / reliability / richer functionality.

There is less time to develop innovative products, due to shortened development schedules and the need for quicker time-to-market. There is also continuing customer demand for lower cost products, despite their concurrent cry for richer functionality and “smart” product features.

Not only do these urgent manufacturing pressures favor the use of simulation in the design group, so too do the many challenges that designers now face (Figure 2, page 4).

Figure 2: Development Challenges Leading to Simulation-Driven Design



Source: Aberdeen Group, May 2017

Products are becoming much more complex, yet there is simultaneously an understandable lack of tolerance for design flaws. And though the pressure to produce differentiated products is high, delivering on such differentiation is ever more difficult, especially when facing limited development resources. And even through products operate in varying and complex environments (think connected, IoT-based products), designers must launch products that reduce lifecycle costs (warranty, recall, etc.).

To dissipate the tension created by these pressures and challenges, Best-in-Class designers are acting. Faced with longer design time, shorter time-to-market needs, and quality issues, they have discovered a better way to product innovation: simulation-driven design.

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Simulation Usage Soars Among the Best-in-Class

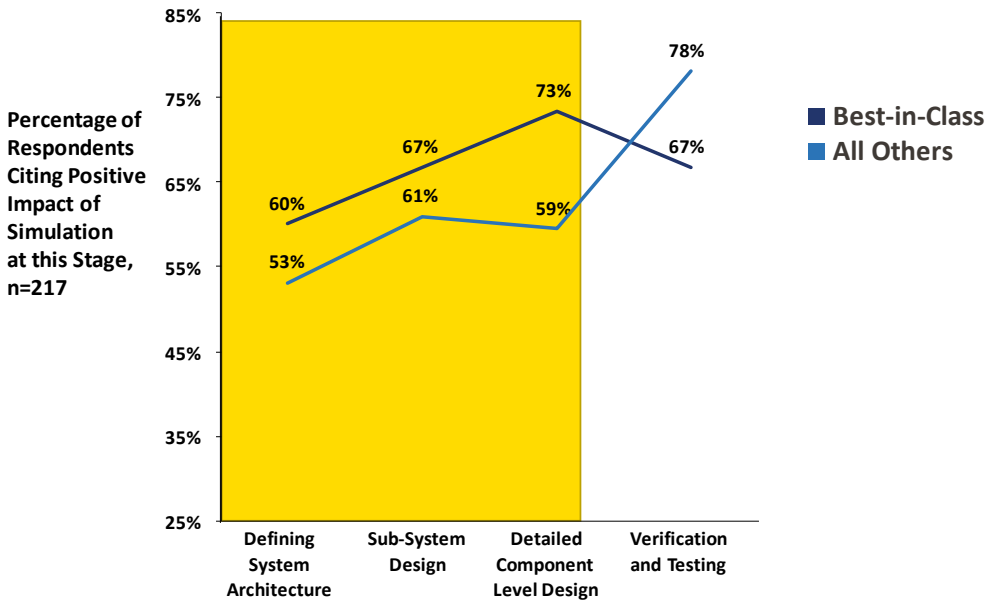
- 2014: 75% of respondents used simulation
- 2016: 87% of respondents used simulation

Best-in-Class Firms Push Simulation to Designers

The principle of simulation-driven design is simple. Because design engineers outnumber simulation experts by 5-to-1 or 10-to-1, the simulation specialist group has become a bottleneck in the design process. Best-in-class firms have thus responded by introducing simulation directly into the design environment so they can eliminate bottlenecks in specialist teams. Expressed as a proverb: "Give a person a fish and you feed them for a day; teach a person to fish and you feed them for a lifetime." In short, the simulation specialist group is better used as a leveraged resource to design engineers, advising them as they simulate for themselves, rather than doing it for them on an on-going basis.

Aberdeen Group research verifies the shift to simulation-driven design among Best-in-Class designers. In 2016, 87% of Best-in-Class organizations used simulation, up from 75% two years earlier. Moreover, the value proposition of simulation has shifted into the design stages of product development (Figure 3).

Figure 3: Best-in-Class Pushes Simulation into the Design Phase

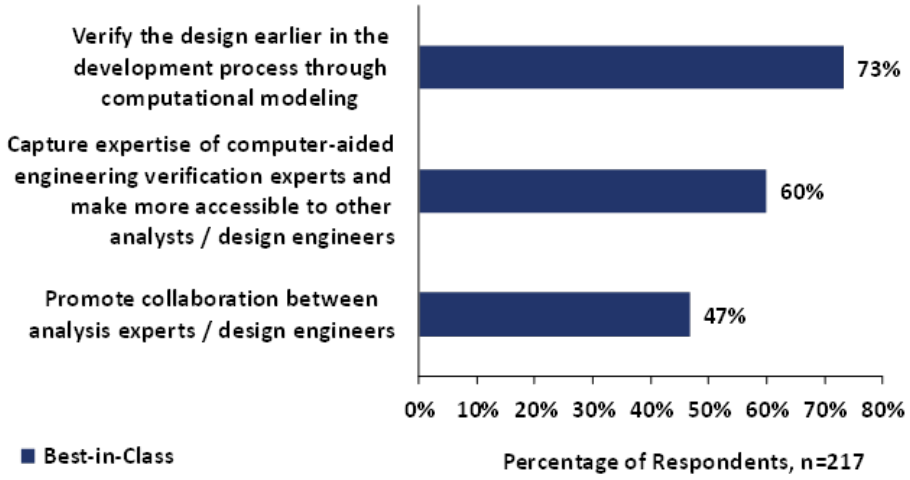


Source: Aberdeen Group, May 2017

Among Best-in-Class firms, the positive impact of simulation, expressed by the dark blue line, has shifted to the left into the *design-centric stages* of product development, expressed by the yellow square. Among the Best-in-Class, the positive impact of simulation is higher in all design-centric stages of product development, peaking (73%) at the "Detailed Component-Level Design" stage. Among All Others, the peak remains at the "Verification and Testing" stage.

Additional Aberdeen Group data supports our thesis of the ongoing shift to designer use of simulation among Best-in-Class firms (Figure 4).

Figure 4: The Shift to Simulation in Design Among the Best-in-Class

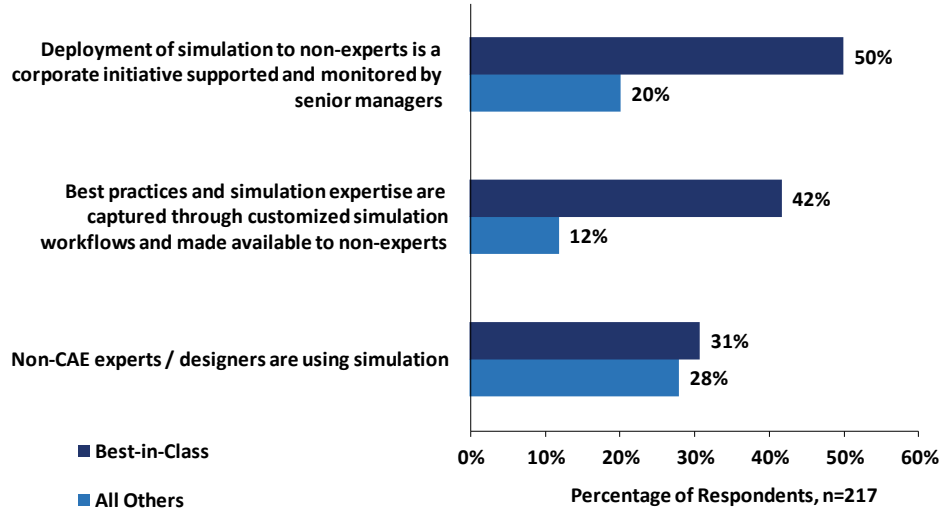


Source: Aberdeen Group, May 2017

Under simulation-driven design, the Best-in-Class ensure success in a number of ways. In this new designer-centric model, simulation experts collaborate extensively with design engineers as they simulate for themselves. In addition, Best-in-Class firms capture expertise of CAE experts and make it more accessible to design engineers. Finally, 73% of the Best-in-Class verify the product design earlier in the development process through computational modeling. This last step is critical to assuring the product's proof-of-concept works right the first time.

This shift to design engineer use of simulation is part of a larger trend of simulation deployment to non-experts (Figure 5).

Figure 5: Best-in-Class Promote Simulation by Non-Experts



Source: Aberdeen Group, May 2017

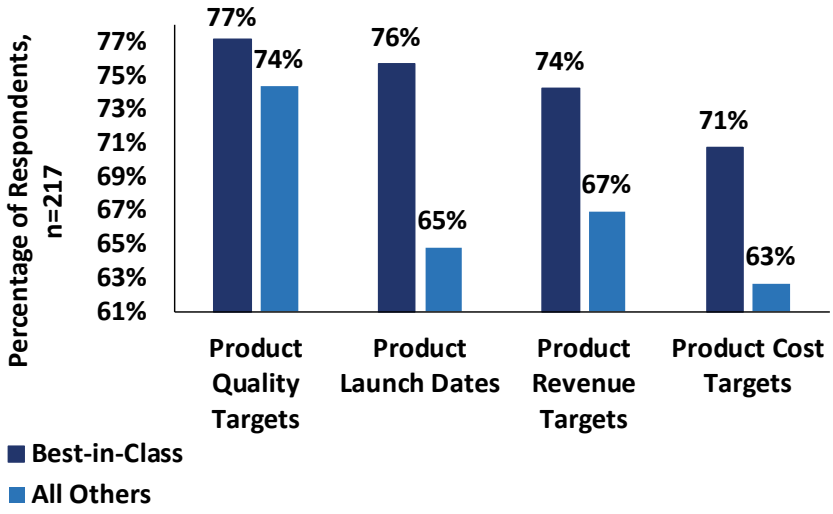
This non-expert simulation usage trend garners strong support among Best-in-Class senior management, which is 2.5 times more likely than All Others to support and monitor a corporate initiative for deployment of simulation to non-experts.

As Best-in-Class organizations move to simulation-driven design, they are also careful to capture and share simulation best practices and expertise, making it available to non-experts. This encourages and enables non-experts to get up-to-speed with modern simulation techniques.

The Benefits of Simulation-Driven Design

Does simulation-driven design pay off? Aberdeen Group evidence strongly suggests it does. Best-in-Class firms implementing simulation-driven design enjoy significant benefits in product development cost, time-to-market, and quality (Figure 6).

Figure 6: Simulation-Driven Design Users Meet Targets

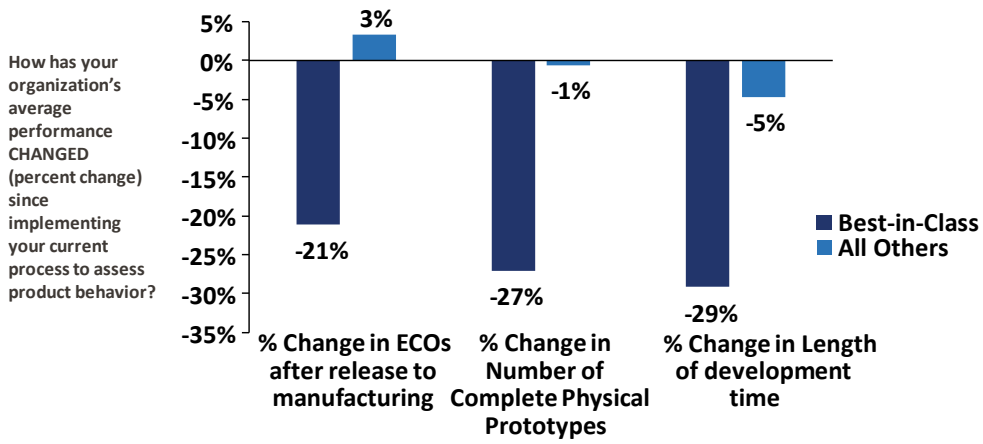


Source: Aberdeen Group, May 2017

Best-in-Class designers that deploy simulation earlier in the design process easily outperform All Others, in meeting their product cost, product launch, product revenue, and quality targets. This success is directly attributable to pushing simulation to design engineers, and allowing them to iterate and innovate themselves. This results in optimized, breakthrough product designs.

Best-in-Class firms have also enjoyed improved product metrics since adopting simulation-driven design, saving product rework time, reducing prototype development, and decreasing development time (Figure 7).

Figure 7: Simulation-Driven Design Boosts Performance



Source: Aberdeen Group, May 2017

As all design engineers know, the cost of a design misstep is great. The later a design problem surfaces, the more it costs to fix or rework the issue. Simulation-driven design remedies this issue by pushing simulation into the earlier stages of product design. This pays off big, resulting in a 21% improvement in the number of engineering change orders (ECOs) issued after release to manufacturing. All Others, who have not implemented simulation-driven design, experienced 3% more ECOs. As a result of increased virtual prototyping, Best-in-Class design engineers built 27% fewer physical prototypes. Lastly, the Best-in-Class improved their length of development time by 29%.

Key Takeaways and Recommendations

For designers pressed to produce innovative new products, the addition of simulation, within the design group, couldn't come at a better time. The pressures and challenges of manufacturing today are driving Best-in-Class firms to push simulation directly to the desktops of designers. Simulation-driven design overcomes the unfortunate reality of outsourced simulation: because design engineers outnumber simulation experts by 5-to-1 or 10-to-1, the

simulation specialist group has become a bottleneck in the design process.

The benefits of simulation-driven design are compelling, resulting in more innovative products developed faster, meeting time-to-market, quality, and cost targets.

To capture these benefits, and dissipate mounting manufacturing pressures and challenges, Aberdeen Group recommends that design engineers meet their goals through simulation-driven design:

- **Deploy Simulation-driven Design for Product Innovation.** The reason the Best-in-Class decreased their physical prototypes by 27 percent, is because they switched to virtual prototypes and virtual testing. This allowed them to explore hundreds of design iterations (or more), freeing them up to identify and concentrate on the most innovative designs with the highest breakthrough potential.

- **Deploy Simulation-driven Design for Improved Time-to-Market.** Best-in-Class designers improved their length of development time by 29% – six times the rate of improvement by All Others. Best-in-Class organizations also met their time-to-market targets 76% of the time, a 17% higher rate than All Others.

- **Deploy Simulation-driven Design for Higher Quality.** Seventy-seven percent of Best-in-Class firms met their product quality targets. Plus, Best-in-Class products were more likely to work right the first time and less likely to

require rework, as the Best-in-Class improved their ECOs, after release to manufacturing, by 21%

➔ **Deploy Simulation-driven Design to Reduce Costs.** Seventy-one percent of Best-in-Class designers met their product costs targets, versus 63 percent of All Others.

Innovation begins with accepting that the world has changed, and is becoming open to new ways of doing things. The Best-in-Class have made the leap to simulation-driven design, and others should consider doing the same.

Thomas Edison once said that genius was "One percent inspiration and 99 percent perspiration." Simulation-driven design updates Edison's maxim for design genius, allowing design engineers to innovate through iteration via virtual prototyping and virtual testing. This new way of doing things eliminates the "perspiration" of physical prototyping. And designers are now free to test hundreds (or thousands) of design alternatives until they are "inspired" by the most innovative product design choice.

Edison tried over 1,000 physical prototypes of the incandescent light bulb, before discovering that the lowly bamboo-based carbon filament yielded a bulb that lasted over 1,200 hours. In choosing simulation-driven design, engineers get the best of both worlds: innovative product that also meets time-to-market, cost, and quality targets.

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Related Research

Maximizing Product Design in a Complex Manufacturing Environment; August 2016

Simulation-Integrated Product Development: Achieving More with Less; June2016

Accelerating Development with Virtual Prototyping; November 2016

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Since 1988, Aberdeen Group has published research that helps businesses worldwide improve their performance. Our analysts derive fact-based, vendor-agnostic insights from a proprietary analytical framework, which identifies Best-in-Class organizations from primary research conducted with industry practitioners. The resulting research content is used by hundreds of thousands of business professionals to drive smarter decision-making and improve business strategy. Aberdeen Group is headquartered in Waltham, MA.

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