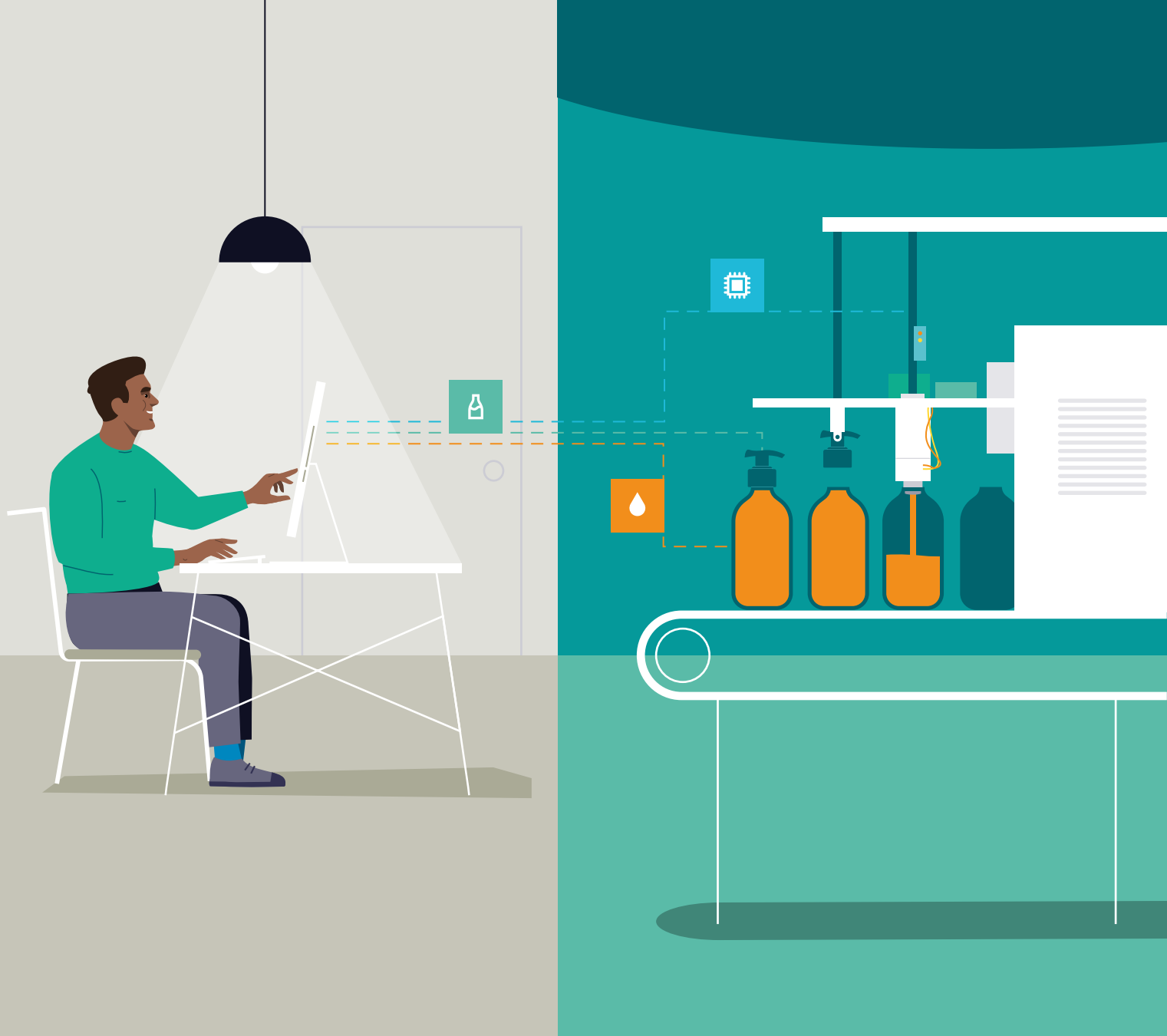




Executive Brief

How smart product and process design is transforming consumer packaged goods

A Virtual Advantage: The role of simulation
in Consumer Packaged Goods

The way a product looks, feels and behaves is at the heart of the consumer experience.

Today, customer expectations and global market shifts are ramping up the pressure on manufacturers of consumer packaged goods (CPG) and ushering in a bold new future enabled by smart technology.

Recent analysis shows that 85% of the world's top CPG companies have seen a decline in revenues, profits or both. Consumer-driven innovation, shifting trade patterns and the rise of online shopping have brought the industry to a crunch point that the pandemic has merely exacerbated.

Consumers in control

Today's consumers are more empowered than ever before. In a highly fragmented market, they have a wealth of brands (quite literally) at their fingertips, and little incentive to stay loyal to any one of them.

Increasingly, consumers expect to influence the product innovation process. Having grown up with the internet in their pockets, this generation demands unique and even personalized products and experiences – all at no extra cost. And they won't wait long for them, either: 63% of consumers say they want new products, faster. This means manufacturers must innovate continuously and rapidly.

Heightened engagement with environmental and health issues means consumers will also hold brands to their promises around sustainability and safety when it comes to product formulations and packaging.

Rigorous and responsive

Manufacturers must keep up with the latest trends, ramping up their research and development (R&D) efforts. And they must respond with speed and flexibility – in many cases, producing smaller batches of highly individualized products – while maintaining the levels of quality that attracted their customers to begin with.

With emerging markets set to grow significantly, CPG companies are under pressure to globally scale to produce localized product variants reliably and cost-effectively, at speed – or else risk losing vital revenue opportunities.

Whether they're making canned foods, bottled drinks, cosmetics or detergents, businesses know that, in order to stay competitive, they need to enhance customer experience, meet their sustainability goals and guarantee product quality. Meanwhile, today's consumers want a tailored experience from companies who are engaged socially and environmentally and who deliver more than just a product. It's a big ask.

Limited potential

CPG product and process design disciplines are complex. As many companies know from experience, adapting to new consumer and market demands can be costly, resource-intensive and risky. It's clear that traditional approaches – characterized by disconnected, manual processes, with validation and optimization taking place across locations and within silos – won't cut it.

Not only does this make it impossible to respond to consumer demands in a reasonable timeframe, it also limits the potential for rapid global expansion of products. It requires businesses to redesign the manufacturing process to accommodate each plant's capabilities and complete expensive trials to validate designs.

Without seamless collaboration between global departments, engineers must rely on trial and error: it is difficult for lessons learned in one area to be applied to a different market. And even a single mistake or miscalculation in the manufacturing process could lead to a recall and a hefty financial loss.

Closing the gap

With so many variables to consider at such speed, the design of a product must be conceived in lockstep with the manufacturing process. In order to harness great ideas and get them onto the shelf while the consumer is still interested, companies must double down on innovation and reevaluate the technology and processes they use.

Few question the need to go digital. The challenge for CPG companies now is to break down all silos to close the gap between design and manufacturing. They can do this by adopting a holistic, platform-based approach to product and process design powered by digital twins: where all processes draw from the same underlying data.

Rapid and iterative

A smarter approach to product and process design leverages simulation and concurrent design to ensure new products can be made at the speed, quality and cost today's consumers expect. It enables design, validation and optimization to happen rapidly and iteratively in a digital twin, solving problems and avoiding errors before manufacturers commit to a physical product.

Central to this is the direct alignment of R&D and manufacturing. It simplifies collaboration throughout the enterprise by using a single set of relevant data to inform every activity. This approach optimizes, as an example, the design of the formula, the recipe and the package. It also enables engineers to scale up faster by simulating the entire production process in a virtual environment. As a result, CPG brands can deliver a consistent, high-quality product in a fraction of the time it would typically take.

Virtual simulation is an increasingly important part of this process. It allows manufacturers to use digital twins, digital representations of products, packaging and manufacturing operations to evaluate the performance of each step. Using advanced engineering simulation to create a digital twin of the manufacturing process, the team can test and tweak the package design and product formulation to meet process requirements before handing it over to manufacturing sites. Filling, mixing, heating, freezing, cooking and many other processes can be simulated, each with thousands of iterations to refine them in the virtual world.



From virtual to physical

Siemens has mastered the interaction between the digital and physical product, delivering speed to market with simulation, optimization and virtual validation for clients across the food and beverage, beauty and personal care, and homecare markets.

For cosmetics brands, the need to respond to trends while providing a delightful consumer experience is paramount. Using a digital twin, manufacturers can digitally test and optimize products and processes in a fraction of the time it would take to do so manually. They can define product formulations and design packaging, and leverage computer-aided design (CAD) capabilities to create variants. They can then test the suitability of packaging for filling, storage, transport and customer handling before it reaches the market.

For food and beverage brands, there is often no shortage of innovative creations going through the lab at any one time. The challenge is how to scale them to production level while ensuring safety, quality and uniformity – and, of course, allow for design variations. Simulation can improve and expedite the scale-up process. Once a small quantity of the new product has been made in the lab, a simulation of the process can analyze the recipe and validate the model. Engineers can run any number of tests and iterations to understand how the recipe performs when produced at scale.

When it comes to homecare products, the consumer's experience of handling the product can make or break its success. When designing a detergent bottle that pours without spilling or dripping, for example, engineers would typically create and manually test numerous prototypes. But by using simulation to calculate fluid flow and determine the structural behavior of the bottle – including crush and drop tests – to tweak designs, they can reduce the development cost and time tenfold.

In pursuit of the perfect product

Simulation and the Siemens digital twin enable engineers to tap into concurrent design capabilities to make the perfect product and leverage the virtual world to design, validate and optimize the manufacturing process. It's time for consumer packaged goods businesses to recognize the power of smart product and process design as a means to reduce costs and focus on growth; innovate at the speed customers expect; drive value through sustainability; and approach quality assurance in a smarter way.

Creating value through smart product and process design

**15-35%**

faster from idea to market

**30%**

reduction in engineering time thanks to improved knowledge-sharing

**50%**

reduction in processing time because of greater operational efficiency

**\$**

millions in savings as a result of getting it right first time