

Environmental concerns fuel demand for change

Moving away from unsustainable packaging

Packaging design at its best

Conclusion



Sustainable Packaging Solutions: An emerging need

How investing in innovative packaging solutions can improve adverse environmental effects.
[siemens.com/plm/cpr](https://www.siemens.com/plm/cpr)



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Global trends

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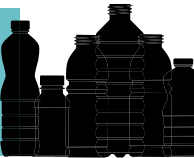
The effects of producing, packaging, and shipping consumer goods have become more complex in recent years. Government regulations and growing consumer concerns are putting significant pressures on Consumer Goods Manufacturers to make changes to how they produce and package goods.

Global manufacturers **produce 367 million tons of plastic** annually, **while only 9% gets recycled and 12% gets incinerated**, leaving over **300 million tons** of plastic waste in landfills. The major problem with dumping plastic in landfills is that they frequently leak into rivers, consequently carrying an estimated 8 million tons of plastic into the ocean. Unfortunately, most plastic-produced packages are for fast-manufactured consumer goods. While plastic packaging contributes significantly to environmental issues, it is not the only source of adverse ecological effects.

Emissions of greenhouse gases play a critical role in climate change as well. While only 1% of the world's greenhouse gas emissions come from consumer goods manufacturing, manufacturers rely heavily on the transportation sector to ship those goods, which account for 16%³ of global emissions.

3. Source: EPA (Environmental Protection Agency)

367 metric millions of plastic



Only 9% is recycled



300 million tons in landfills



Changing consumer behaviors

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Consumer behaviors have shifted dramatically in the aftermath of the Covid 19 pandemic; as a result, customers' product preferences are evolving. They are more health-conscious and prefer healthier food options, holistic and organic products. Consumers desire increased brand variety and the ability to customize their purchases. Consumers are also prioritizing having access to sustainable products. Likewise, consumers want environmentally friendly packaging in addition to environmentally friendly products. Customers expect brands to take environmental stewardship seriously, and if they do not, consumers will spend their money with those who do. Consumers also want to end the current unsustainable and linear produce, use, and discard model.

Consumer trends:



Consumers across all end-user segments indicated that they would **pay a premium for sustainable packaging.**



36% of respondents would purchase additional sustainably packaged products if they were more readily available in stores, applicable to a broader range of products, and more clearly labeled (to indicate green packaging).



1. Source: McKinsey & Company survey report 2021

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Investing in packaging solutions for the future

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The minimal cost and ease of production, durability, and versatility have always made plastic packaging the preferred choice for Consumer Goods manufacturers. The quest to create biodegradable containers can be costly, time-consuming, and easily pose several challenges for brands. However, the significant changes in consumer purchasing habits and increased regulations make it difficult for brands not to explore and invest in alternative packaging.

Adopting new ways to produce sustainable packages will create new challenges for brands.

- Durability and strength of new materials and packages.
- Meet new regulatory requirements.
- Artwork changes, recycling options and new ink types.
- Think in new package recycling options

In addition to these factors, manufacturers must examine other considerations to assure that quality and standards are not compromised.

For consumer packaging:

- Packages should be noticeable but practical to dispense
- Containers must be sturdy, light with little waste material as possible to send to recycle
- Packaging should be easy to open and free from leaking
- Closures must be tamper-proof, easy to detect any changes, and easy to open

Even though there are numerous costs to making substantial changes, with innovative solutions to mitigate the challenges that may arise, the overall benefits will justify the cost.



Changing the approach to packaging design and development

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The shift in consumer behaviors has manufacturers rethinking how they produce and package goods.

Consumer product packaging has evolved significantly in recent years. **An aesthetically pleasing package is no longer sufficient, and consumers expect packaging to inform them about its composition and environmental impact.**

In today's world, package designers must maximize the use of materials, take advantage of modern manufacturing capabilities, and give customers what they desire.

Consumer packaged goods designers can use innovative solutions to design packaging that meets consumer demands, withstands shipping stress, and is environmentally friendly.

Package design at its best:



Concept Development

- Meet regulatory package requirements
- Design brainstorming sessions
- Evaluate customer research data and past designs



Artwork Development

- Ensure brand recognition
- Maintain brand standards
- Minimize effort by efficient asset reuse.
- Automate and control artwork process



Package Design

- Easy to use, intuitive user interaction
- Rapid conceptualization of ideas
- Generate high quality surfaces without expert knowledge



Label Contents

- Use of biodegradable inks
- Traceability of materials
- Simplified process to add or change ingredients



Package Validation

- Simulation testing for package durability
- Design optimization
- Structural analysis
- Package heat transfer analysis



Virtual Shelf

- Guarantee that packaging fits on any desired shelf
- Validate how many containers can fit
- Ensure that display is pleasing to consumers



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Taking steps toward sustainable Package

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Many manufacturers of Consumer Packaged Goods are taking the necessary steps to ensure that their products' packaging is environmentally friendly.

Once brands have decided to create eco-friendly packaging, realize the intricate part that package designers play in designing the right solutions.

Equally, package designers know that design and development have many aspects, and every part is crucial to developing viable packaging. They understand that if a step is associated with developing eco-friendly packaging is missed; it can result in sub-par packaging if not appropriately addressed.

So, designers must reset, reimagine, and examine how design, development, and simulation processes are essential to solving the most challenging package design problems.

One of the critical components of creating a viable solution to construct sustainable packaging is developing all concepts concurrently. Concurrent Development makes collaboration between departments, helping to make the process of content and artwork development, simulation, and validation work together seamlessly. It also ensures that quality, regulatory compliances, and package performance standards are not compromised.



Reimagining the approach: Concurrent development

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Package Design

Sustainable package design and simulation to ensure structural integrity across the value chain.



Formula Design

The formulator receives a request from the project manager to develop a new formulation based on the project brief content. He creates several formulation candidates and performs a first regulatory check.



Concurrent Package Design:

Simulation ensures that new biodegradable packages will maintain their integrity and have adequate deformation during packaging, e-commerce, transport and consumer handling. Design can be done concurrently with formula design and lab sample testing, eliminating rework and missed steps. That's because every discipline always has access to the latest engineering data, allowing them to work concurrently.

Formulated Product Design:

Streamline your engineering processes from concept to production on a cloud solution that unifies your entire product development. Enable the Digital Twin, virtually design and validate the output of disciplines throughout the enterprise, from R&D to the shop floor.



Laboratory Quality Control

Once we know the formula and recipe, we request the lab to perform product quality checks. With Laboratory Sample testing, the formula and batch information is automatically contextualized. This procedure develops a full audit trail of how the sample was created, including the equipment and setpoints used. The assessments involved can range from microbiology all the way to physical tests.

Artwork and Labeling

Market-leading design tools integrated with engineering data-management tools to ensure accurate data for every label.



Package Design

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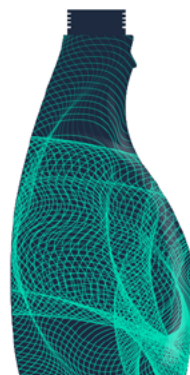
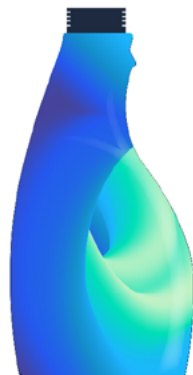
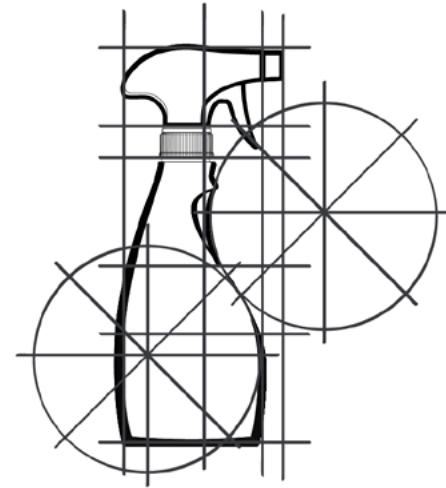
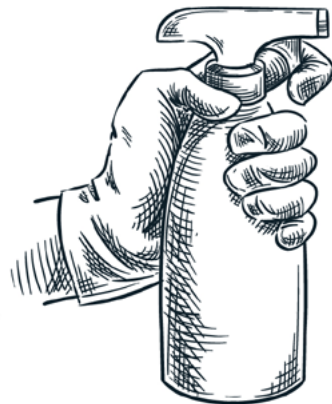
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NX, a platform for multi-disciplinary design

- Faster concept to detailed design
- Rapid conceptualization of ideas
- Generate high quality surfaces without expert knowledge



- Quickly understand fill levels and adapt shapes to meet package demands
- Make changes to existing or imported design, size (volume) & shape
- Easy creation of screw type fastening features and 3D textures
- Simplify the creation of design variants, part families and product configurations

[Learn more from Graham Packaging](#)

Artwork and label development

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As brands adapt packaging to meet their sustainability initiatives, they determine that Artwork changes become one of the most critical deliverables for eco-friendly products. Every product will require customization for all regions and product variants. In addition, product messaging, regulatory and compliance requirements also must be considered.

It can become challenging to execute artwork and label changes because the artwork and label content are usually not adequately tracked or managed well. Hence, it becomes more complex to implement the necessary updates. Often there can be many iterations of the same label and no way of knowing which is the most current version, and rarely do art departments maintain a comprehensive library of all artwork and label changes. The effort to manage the files is substantial, and reusing artwork is so cumbersome that companies typically re-create it instead.

The Digital Twin for Artwork and Label Content can help manufacturers of Consumer Goods take control of the hundreds of thousands of artwork files they have to manage.

Designers will also benefit from having the ability to:

- Reduce time spent on searching for information
- Speed up the execution of art and label creation
- Drive mass change quickly and correctly
- Easily use biodegradable inks to create labels
- Able to track all added materials
- Simplified process to add or change ingredients
- The ability to retain brand management



Package Validation

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Simcenter integrates virtual simulation to validate package against requirements. It is about light-weighting or using minimum material while meeting functional requirements.

- Maximize reuse of design data Design optimization
- Structural analysis
- Heat transfer analysis
- Computational Fluid Dynamics

Typical tests:

- A Top Loading (stacking strength)
- B Bulge or vacuum (internal strength)
- C Denting (external impact strength)
- D Drop testing-full (external dynamic impact)
- E Closure leaking at design opening torque
- F Shelf and conveying stability (empty and full)
- G Pallet fit and stability in shipping channel (tilt and vibration stability).
- H Dispensing liquids from containers.



Before and after scenarios

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BEFORE

A typical new plastic container development project (before a digitally enhanced development process) would take the following:

- About 18 to 24 months for new shape proposed to start of ship
- About three iterations with a unit cavity mold
 - Show tests, consumer tests with handful of designs
 - Physical shelf mock-ups with customers
 - Hundreds of pallets of bottles manufactured from suppliers
 - Pilot plant runs
 - Plant line trials
 - Two to three in-trade ship tests
- Expected redesign (with new production models) for light-weighting cycle after introduction

AFTER

A typical new plastic container development project (after a fully implemented digital design and testing process) would take the following:

- About 12 to 18 months for new shape proposed to start of ship
 - Thousands of shapes evaluated for both design and functional requirements
 - The 3D printing of shapes for show and consumer tests
 - Digital shelf mock-up reviews with customers
- Unit cavity molds skipped altogether (or one for confirmation)
- First mold is production mold
 - No pilot plant runs
 - Plant trial is first production run
 - In trade ship test successful first time
- Container with minimum materials. No light-weighting cycle needed after market entry

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Virtual product design and simulation gives Consumer Goods Manufacturers the leverage they need to develop well-designed packaging that meets the demands of its customers.

Innovative solutions help brands determine if their packaging can withstand the rigors of shipping, give customers the ability to track the origins of ingredients, all while being environmentally friendly.

Imagine the time, money, and resources saved by having the ability to design a new package and create a simulation that ensures that your products are correctly mixed, filled, and packaged sustainably.

To learn more about Package design click [here](#)

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About Siemens Digital Industries Software

Siemens Digital Industries Software is driving transformation to enable a digital enterprise where engineering, manufacturing and electronics design meet tomorrow. The Xcelerator portfolio helps companies of all sizes create and leverage digital twins that provide organizations with new insights, opportunities and levels of automation to drive innovation.

For more information, visit:

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