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The formula for success

How the right digital ingredients give
CP&R organizations the recipe to stay competitive

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The act of mixing ingredients based on a recipe is quite simple. The difficult part is scaling that recipe up and mass producing it where it maintains the quality and tastes the creator intended. This is the real challenge because Consumer Products and Retail (CP&R) executives must determine where to produce a new product, in what quantities and whether they should move existing ones to a new plant to accommodate the mixing and packaging. These decisions are based on various business requirements, such as proximity to market, transportation costs, regulatory compliance and meeting new demand.

Recipes are sometimes altered/adapted based on the local knowledge of a plant so oftentimes decisions are made without accurate data and little knowledge of the capacity of a different plant and its ability to manufacture the product.

Environments differ based on location so a chosen plant might not actually be ideal or efficient. For instance, factors such as mixing times and recipe formulation may have to change from the original recipe based on equipment availability.

Region-specific ingredients like corn and sugar may impact the mix, not to mention the challenging logistics of getting them to the plant in some locations around the world.

With supply chain complications and local regulations, Food & Beverage manufacturers must have the ability to manufacture anywhere and have the flexibility to move production from one existing facility to another, or to change the product mix at an existing facility to match demand.

It all starts with the recipe though, which must go from masterpiece to mass production. It's a journey that scales from teaspoons to gallons, mixed in plants that may be based in the Northwest United States or Southeast Asia.

The reality is that it can take up to six months to go from manufacturing at one plant to the next, and even then, the result may be that you can't even manufacture the product or fill the package at that plant. How can you streamline and optimize operations so that a small-batch formula can scale to the manufacturing level?

Using digitalization to scale up

About 15,000 new food products are introduced each year. Unfortunately, the failure rate can be as high as 90 percent.[1] Competition for store shelf spacing, changing consumer tastes and glocalization exacerbate the already cutthroat landscape.

On top of that, consumers' ever-changing demands involve everything from taste and quality to transparency in sourcing and manufacturing to sustainability; not to mention local government regulations or allergen/dietary considerations. When it can take anywhere from six months to five years to develop a new recipe, having the agility to make this product when and where you need to is imperative. But the scaling up process from the lab to the production line can add months after you've developed the recipe. Even then, it's not guaranteed to work.

A fast scale-up to manufacturing has been achieved in other industries, such as automotive, aerospace and consumer electronics where digitalization is revolutionizing how products are designed, manufactured and optimized. However, the food and beverage industry is trickier because it's subject to greater variability of products and larger portfolios that brings complications when scaling up for production.

Digitalization provides greater consistency, speed and efficiency when scaling up from your formula to a general recipe and ensuring it aligns with the manufacturing process.

[1] Food Product Development (k-state.edu)

Reconfigure a recipe in seconds, not months

CP&R organizations are starting to implement digitization in all stages of the recipe development process, from as early as conceptualization to product formulation. This agile approach to product deployment has been a critical maneuver to ensure product launches meet consumer demands and reduce the likelihood of brand recall.

Enterprise recipe management tackles the issues of consumer goods manufacturers having to use ingredients that differ from their original formula, using equipment that must create at scale or operate a plant that may have different equipment than initially intended. Regardless of these issues, the product results must still be consistent to protect brand equity and the ultimate promise to the consumer.

The use of manufacturing process configuration and validation tools designed to reduce errors in scaling also link product formulation, laboratory testing and recipe designers into the production execution world in zero time. That solves the challenge of the time it takes to implement a recipe change based on equipment, plant and resources modifications from months to seconds.

62.3%
CP&R organizations
consider 'product complexity' as a top challenge in production

60%
CP&R organizations
consider 'staying competitive' as the second major challenge in production

75%
CP&R executives
feel that innovation stakes in the industry have never been higher

Barriers to streamlining and optimizing manufacturing operations.

Companies constantly try to meet changing consumer expectations. Once decisions are made on the new product, there must be a method for turning the formula into a recipe and a way to streamline and optimize operations regardless of the location and equipment. Decisionmakers must identify barriers and find ways to manufacture products with efficiency and speed.

Formula Development

How can decisionmakers take a formula designed in a test kitchen or lab and execute a general recipe efficiently and on time? Designing a recipe formula requires an understanding of not just the ingredients' requirements but also the ability of a manufacturer to execute and develop recipes.

Scalability

What happens when a product must be developed in a new plant location? Employees have no clue about the equipment capabilities and tolerance levels required to create the product and maintain a global taste, flavor, and texture standard. They must have a reliable formula available.

Integrated Quality Control

Companies spend large amounts of money on creating multiple recipes that face rejection and then must be altered manually and then re-executed. How can organizations maintain quality control after the formula is approved while facing sustainability goals, increasing cost pressures and keeping their brand image in good standing?

Continuous Development Cycles

Development cycles never seem to end. How can brands maintain a competitive edge amid shorter development cycles and consumer expectations for new products?

Finding the right recipe for success

Creating a new cold brew classic

Let's take a look at how a cold brew coffee company planning to introduce a new vegan option to market would use comprehensive digital specification to create their new formula and guarantee plant production capability.

In this example, the coffee cold brew company is creating a new formula similar to the current latte cold brew they launched a few months ago. This new recipe consists of a cocoa and rice powder as a vegan alternative.

Their team must modify the formula and recipe by:

- Adding new flavors
- Reducing the percentage of sugar
- Making it suitable for vegans

Once the recipe is designed, it's sent to the lab for analysis where differences between the new and older recipe are scrutinized. It goes through several iterations before it gets to the right formula.

Now, the general recipe is generated where redundant processes are weeded out and requirements are implemented into the production plan. For instance, the previously developed process for the grinding and roasting of the coffee can remain the same.

The powdered flavors are placed in the pre-mix for the production line where pre-defined transformation rules will automatically update the process when a switch from latte to rice/cocoa is necessary. Going forward, any switching to accommodate demand is implemented quickly and automatically.

Going from manual to digital

As you can see in the cold brew example, the results are immediately realized in the initial stage of enterprise recipe management. The first stage of the solution is designed to smooth the transition between formulation and General Recipe creation – this is when you've found your perfect recipe and you're ready to move it to the manufacturing line.

°• **Recipe Formulation**

Track product material swapping when moving from design to formulation, so you know what's been added or removed. This will also develop the plant formula based on production engineering inputs.

• **Simulation**

Via simulation, the formula runs through various plant conditions to understand critical product behavior. This way, it's determined how the recipe formula reacts specifically to the conditions and how it can be modified appropriately.

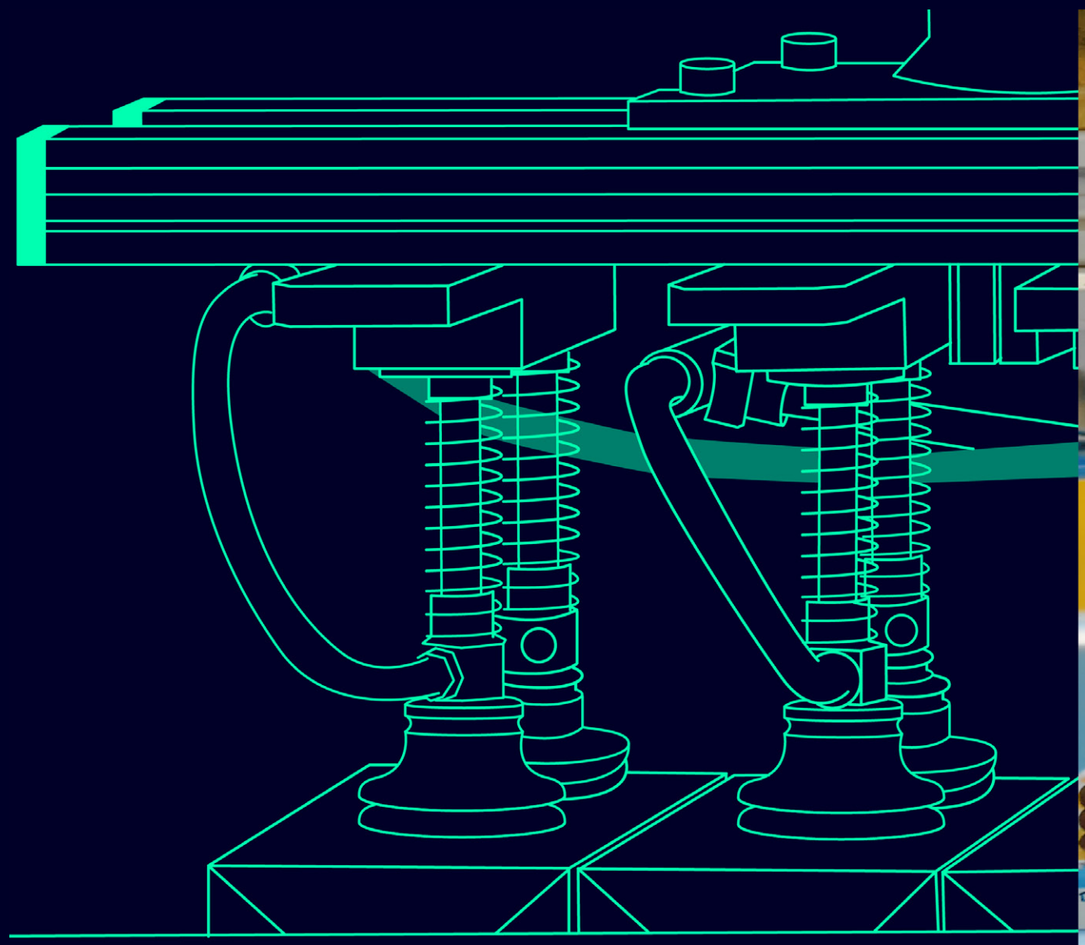
• **Machine Learning**

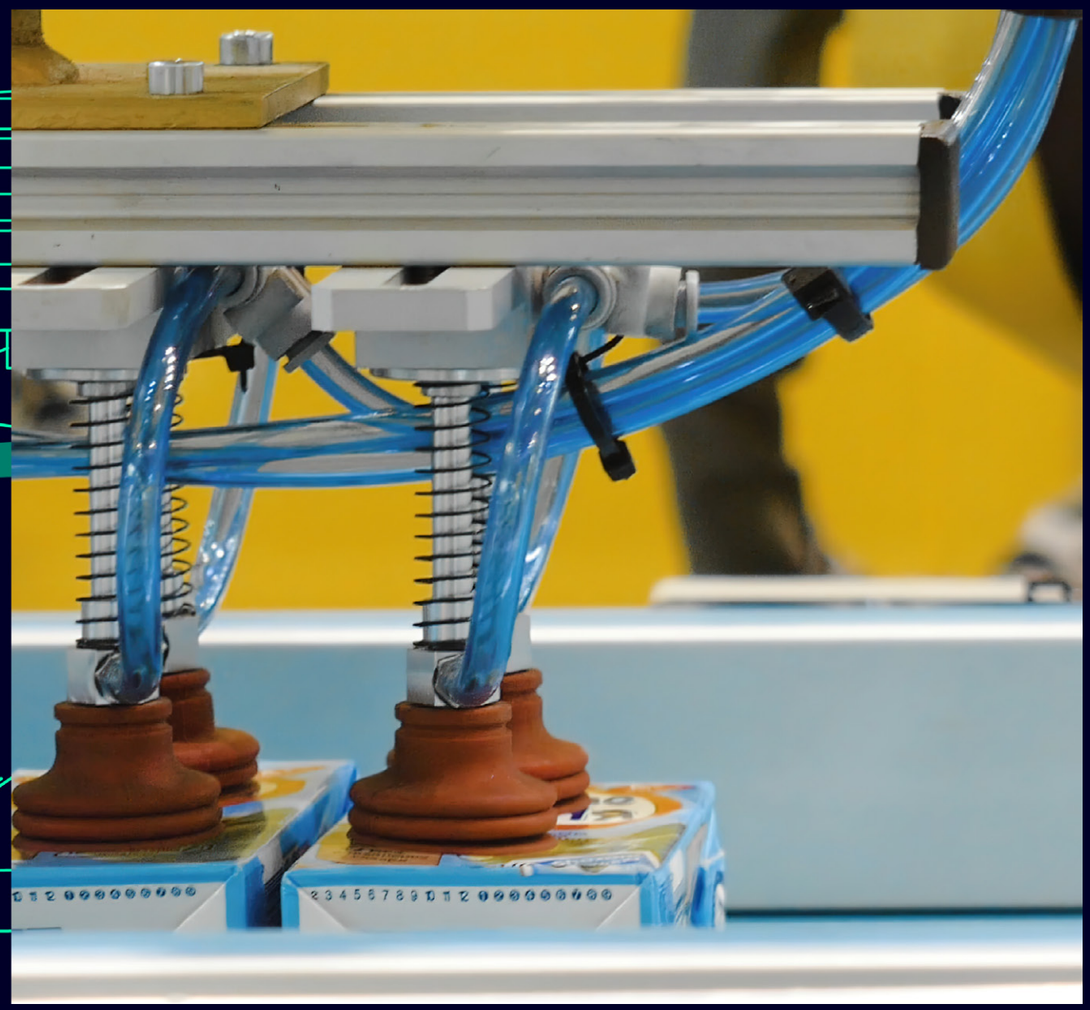
Machine learning works cohesively with simulation to provide data-driven analysis of the plant equipment performance.

• **IIoT, MES, PFC and Automation**

These advanced technologies monitor power quality and equipment usage as well as tracking equipment behavior at crucial points in the process for maximum performance and equipment efficiency.

What once took months to create a suitable formula based on several plant and equipment factors is completed in seconds. This stage automatically generates the formula required for production by accessing the production capabilities and raw materials requirements.





The art of adjusting

Sometimes, it can seem like time is wasted figuring out how to make a recipe work rather than creating the next great recipe. Fortunately, it doesn't have to be this way.

Comprehensive digital specification. This digital thread directly integrates product formulation, laboratory testing and recipe designers into the production execution world in zero time. It's a way to go from manual to digital, optimize operations, find better use of raw materials and ensure that your recipe maintains a high-quality standard wherever it's mixed.

Digitalization helps adjust recipes and formulas based on consumer demands and manufacturing capabilities and can even help shift operations to a more direct-to-consumer model. Comprehensive digital specification means:

- Nimble to react to market trends
- Fast to test new ideas, concepts, ingredients and substitutions
- Changing sourcing preferences and profitability at large scale
- Scaling up anywhere

"Cooking is the art of adjustment."

Jacques Pepin

When every country has its own set of procedures and rules, when consumer demands seem to evolve by the second, and when ingredients differ from region to region, it will take the right mix of digital tools to remain competitive in an ever-changing world.

About Siemens Digital Industries Software

Siemens Digital Industries Software helps organizations of all sizes digitally transform using software, hardware, and services from the Siemens Xcelerator business platform. Siemens' software and the comprehensive digital twin enable companies to optimize their design, engineering, and manufacturing processes to turn today's ideas into the sustainable products of the future. From chips to entire systems, from product to process, across all industries, Siemens Digital Industries Software is where today meets tomorrow.

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