Rockwell Automation

AN EVOLVED VIEW OF YIELD OPTIMIZATION

How consumer packaged goods manufacturers gain better insights from data

Product cost matters now more than ever.

Rising material and energy costs, changing consumer preferences and supply chain disruptions continue to place pressure on manufacturing operations. For CPG leaders, finding process efficiencies while maintaining quality is critical to success.

Optimizing yield is crucial to striking this balance, helping manufacturers lower unit costs, increase throughput and improve quality and consistency. There has never been a better time to **deploy digital solutions for yield optimization.**

While the cost savings and operational benefits may be obvious, sometimes the path forward is not. But what if there was a clearer view of yield, backed by data?

What if you had better insights?

From IoT sensors to connected devices, today's manufacturers have more data than ever. While many executives want to use this data for AI/ML-driven analyses that can help improve yield, the reality is that most data is underutilized.

Using data more effectively can unlock new paths to efficiency and savings. For example, you could:

- **Pinpoint loss** to the machine level
- **Use AI** to discover unseen patterns and nuanced insights
- **Maximize yield** from existing equipment
- **Train operators** on data-driven best practices

By integrating data across operations and applying analytics, these types of benefits can become reality.

*Source: Rockwell Automation, State of Smart Manufacturing Report: CPG edition, June 2024

Evaluating yield through the lens of OEE is a starting point

The first step to any yield optimization effort is discovering where production is falling short. For CPG companies, Overall Equipment Effectiveness (OEE) has been the gold standard in using data to measure actual performance against a target — helping manufacturers identify yield loss in three areas:

- **Machine availability:** Problems with breakdowns, unplanned downtime and changeovers
- **Machine performance:** Problems with equipment speed, micro-stoppages and bottlenecks
- **Quality:** Problems with consistency and variability that cause rejections, rework and scrap

OEE is simple to understand and allows organizations to determine likely culprits. But it's also limited in its ability to provide a holistic assessment of the problem. OEE largely focuses on factors at the machine level, and it doesn't consider performance disparities across different shifts, orders, products and plants. Companies can benefit from a more comprehensive approach.

Beyond OEE: How to get deeper insights across your operations

Creating a holistic view starts by enriching OEE (and other high-level measurements) with the wealth of data from equipment, devices and systems. With that visibility, you can accurately target problem areas down to the specific order or machine level and **identify the best places to focus yield optimization efforts**. These use cases provide a few examples of how new layers of contextualized data can lead to optimization opportunities throughout CPG manufacturing.

Availability	Performance			Quality	
Predictive maintenance	**Energy management**	**Batch performance**	**Improve processes with digital twins**	**Monitoring with machine vision**	**Product tracking and genealogy**
					
Deploying a computerized maintenance management system (CMMS) combines historical data with current machine condition information to help prevent equipment downtime.	Bringing in consumption data with an energy monitoring application provides additional insight into efficiency and where energy is used. It also helps define metrics for targeting energy-saving efforts.	Automating data collection, analysis and reporting with batch manage-ment and analytics software can help configure specs for an ideal batch — and identify reasons for variability across sites and lines.	Feeding real production data back to digital twins helps validate expected performance, increase accuracy over time and optimize simulated planning and real-world results.	Connecting advanced camera sensors with control systems enables in-line inspections across product dimensions, including size, shape and color. This creates continuous, data-driven quality monitoring.	Linking data from a manufacturing execution system (MES) offers insight into specific orders, batches and products. This can help reduce the scope of recalls and avoid unnecessary waste.

Better information leads to faster, more effective decision-making

CPG leaders can generate deeper insights once data has been integrated across the enterprise. With these insights in hand, it's easier to dive into issues affecting the three components of OEE and pinpoint bottlenecks, areas of loss and inefficient processes. Then, **targeted solutions can fix the root cause** of the problem. Below are examples of how manufacturers can address high-level issues identified through OEE using the data and systems from the previous use cases.

	Availability	Performance			Quality	
	Predictive maintenance	**Energy management**	**Batch performance**	**Improve processes with digital twins**	**Monitoring with machine vision**	**Product tracking and genealogy**
OEE issue	Machine availability is low.	Energy usage at site A is higher than similar sites.	Product X isn't being completed on time.	A previously simulated line has an unforeseen bottleneck.	Product Y has frequent anomalies.	A supplier recalls contaminated raw material that has already been used.
Data-driven approach	CMMS shows that there are consistent downtime incidents, but only during afternoon shifts. Adapting maintenance schedules could resolve the problem.	The energy monitoring app shows that the increased consumption is due to a motor running slower than normal. Fixing it restores line speed and optimizes energy use.	Batch analytics reveals cycle times are deviating from target production rates. This insight enables the team to drill down and find the root cause of the longer times.	By closing the loop with actual production data, the digital twin can virtually identify the bottleneck and suggest solutions for a quicker fix.	Instead of bad batches being finished, machine vision monitors in real time and alerts operators when product Y specs are off. Operators then shut down the line to minimize rework.	Using MES to track genealogy, the contaminated material is identified in only two of five completed batches of product Z. Three batches are saved from being scrapped.

Bringing it all together: Using data to find precise, scalable solutions

So, what does the process of using more comprehensive data to inform yield optimization solutions look like in practice?

Let's say your OEE numbers indicate a quality issue. As you dig deeper, data from the check-weighing system shows variation in the fill levels of the containers. Fill variation can lead to product giveaway, rework or even recall, so it's a prime target for optimizing yield. Implementing an AI-based filling solution can address the issue.

- The **AI solution** uses machine learning to analyze the contextualized production data and builds a model to predict the weight of product being filled in the containers. The predictions are based on current operating conditions, and the solution provides real-time alerts about deviations from the ideal fill weight.
- Integrating the prediction model with an automation system enables **closed-loop control** so that the controller can make real-time setpoint adjustments without manual intervention. Pairing it with an **intelligent edge orchestration solution** allows companies to manage devices remotely, enabling quick scaling to other fillers and facilities.

This type of filling solution provides fast, meaningful outcomes for CPG manufacturers. See how one company used it to improve yield in the upcoming collection of case studies.

Expand the effects of optimization with an industrial DataOps solution

The previous filling example uses check-weighing data as the starting point, but the **integration of all your production information** is crucial for taking a data-driven approach to yield. That's what makes AI modeling and closed-loop control possible. The best way to achieve this integration is with **a single industrial DataOps solution.** By unifying data in a centralized repository, the DataOps solution:

- Contextualizes raw information and provides a full, clearer picture of production
- Transforms disparate data points from sensors into holistic, actionable insights
- Serves as the foundation for implementing yield use cases — from predictive maintenance to energy management
- Correlates insights from solving one issue with other production data

For example, let's say the previous filling solution captured batch process data. You continue exploring the data for insights after scaling the filling solution, and batch analytics reveals that fill variation occurs at all plants every time you run raw material from supplier A. Now you have another aspect of operations to optimize.

In that way, the DataOps platform helps **take narrow solutions and expand their impact** throughout the enterprise. And the benefits are not just theoretical. Next are case studies that illustrate how CPG manufacturers are achieving better results with data-driven yield optimization solutions from Rockwell Automation

CASE STUDY

AI-based filling solution improves yield by reducing waste

OEE improvement area

- Availability
- Performance
- Quality

OBJECTIVE

A mayonnaise maker wanted **to reduce product giveaway** using the Perfect Fill solution from Rockwell Automation.

SOLUTION

The AI-based Perfect Fill solution gathered data from instruments on temperatures, tank levels and the batch process. The solution **processed that data at the edge and predicted the ideal dosed weight** of filled packets with 99%+ accuracy. Every 0.6 seconds during high-speed packaging, the AI model updated its predictions and automatically **adjusted the weight setpoint** as needed (closed-loop control).

RESULTS

- **> 50% reduction** of product giveaway
- **Less scrapped product** due to underfilling

CASE STUDY

Machine vision improves quality with automated real-time inspections

OEE improvement area

- Availability
- Performance
- Quality

OBJECTIVE

A cookie producer's goal was to maintain product quality standards by **improving inspection practices with machine vision.**

SOLUTION

Machine vision captured the passage of each cookie through the assembly line and **analyzed it against standards for color, dimension and foreign objects.** Observations were tagged for context and saved in an industrial DataOps solution. Real-time alerts were sent when deviations occurred. The model **retrained and improved detection capabilities** for optimal performance.

RESULTS

- **30% waste reduction,** plus associated cost savings
- **70% reduction of manual, paper-based quality inspections,** which led to productivity improvements

CASE STUDY

Predictive analytics and controllers fix assembly lines to reduce scrap

OEE improvement area

- Availability
- Performance
- Quality

OBJECTIVE

A producer of baby care products was **regularly scrapping thousands of units** damaged in the manufacturing process. The waste was due to problems with the application of hot glue during high-speed assembly.

SOLUTION

The company implemented **a hot melt optimization solution** that combined a predictive analytics platform at the edge with programmable logic controllers and sensors on the assembly line. The solution fed data into the analytics platform to **identify errors or anomalies in glue stream temperature and pressure.** When the data showed machines were moving outside of spec, the solution automatically fixed the issue to help prevent much of the waste.

RESULTS

- **~70% reduction** in scrapped product
- **>$1 million in cost savings** per week

CASE STUDY

Model predictive control increases capacity and reduces energy costs

OEE improvement area

- ☐ Availability
- ☑ Performance
- ☐ Quality

OBJECTIVE

A food and beverage manufacturer aimed to **identify cost-saving opportunities** to justify investment in upgrading aging control infrastructure.

SOLUTION

The model predictive control (MPC) solution assessed current operational data, predicted future output and compared it to desired results. The MPC solution optimized process controls to **reduce product variability while increasing yield and lowering energy costs.**

RESULTS

- **10% reduction** in energy consumption
- **>10% improvement** in productivity
- **Only one year to achieve payback** on MPC and full control architecture upgrade

CASE STUDY

Digital twin quickly troubleshoots packaging line problems

OEE improvement area

- [x] Availability
- [ ] Performance
- [ ] Quality

OBJECTIVE

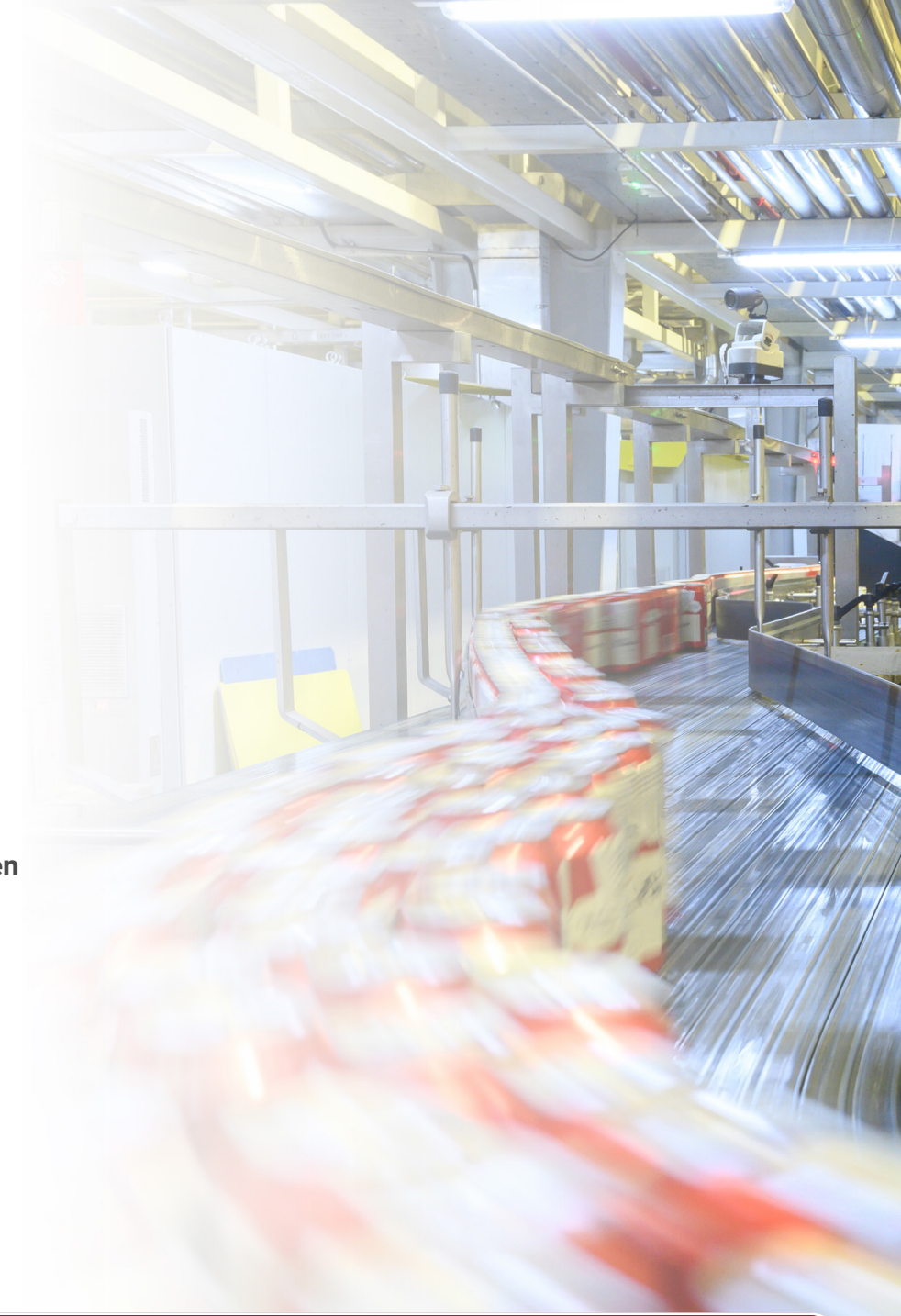
A high-speed beverage manufacturer wanted to **resolve packaging line synchronization issues** that caused constant stop-start behavior with the case and tray packers. Six months of troubleshooting on the lines in the physical environment led to negative effects on production runs without a resolution.

SOLUTION

Simulations of the line with a digital twin enabled **troubleshooting to happen 10 times faster.**

RESULTS

- **<2 weeks** to achieve performance improvements
- **52% reduction** in downtime
- **14% improvement** in OEE



Rockwell Automation can help

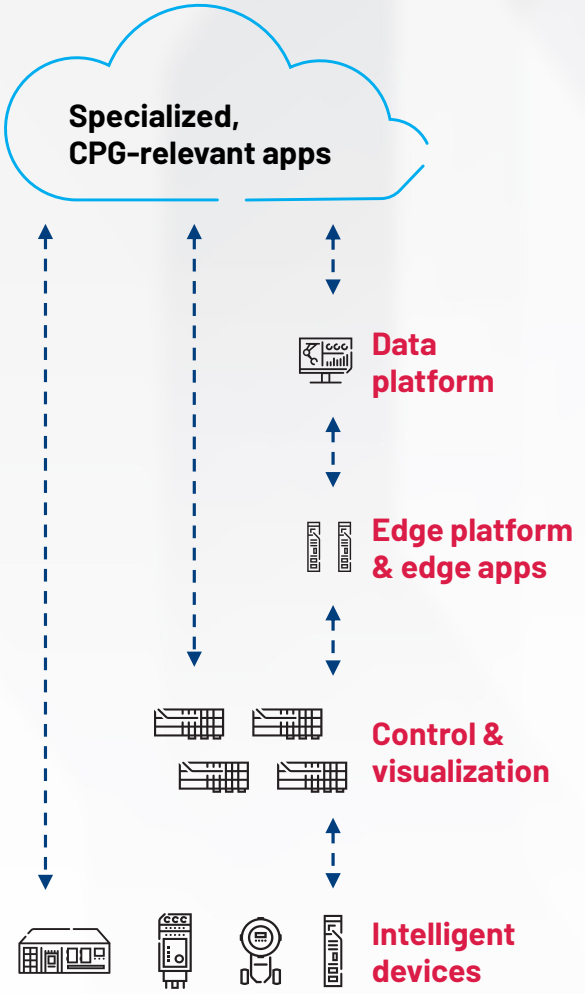
Rockwell Automation has the breadth of technological expertise, the industry experience and the strategic approach to support your yield optimization efforts. Our offerings and services span the entire optimization journey, from identifying areas of loss through deploying solutions that deliver operational efficiency and ROI.

Portfolio of CPG-relevant optimization solutions: From batch quality and packaging to DataOps, Rockwell Automation and our partners have a range of solutions for every facet of operations. We also enable autonomous production with solutions that provide closed-loop control and eliminate manual intervention.

Integrated Architecture® system: Our solutions link together to create one enterprise-wide architecture that's easier to install, operate and maintain. This architecture extends from OT devices all the way to IT software in the cloud, providing widespread access to the contextualized data that fuels better decision-making. Our portfolio is also adaptable and effective in heterogeneous environments.

A differentiated approach: With vast OT expertise, we take a consultative approach to understanding and optimizing your processes. We help you prioritize use cases with the easiest implementation, highest value and best scalability, and we aim to deliver value within 12 weeks. Our Digital Services team also supports organizational change management and provides value-based readouts to communicate quarterly progress toward KPIs.

Rockwell Automation solutions extend from sensor to cloud



Learn more about yield optimization and digital solutions from Rockwell Automation.

In today's highly competitive CPG landscape, an experienced technology partner makes all the difference.
Learn how our digital solutions for yield optimization can help you reduce waste, lower costs, increase efficiencies and improve consistency.
Wherever you are in your journey, we're here to help.

Visit these resources to learn more:

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