Optimizing F&B Production: Data-Driven Strategies to Maximize Yields

ROCKWELL AUTOMATION WORKS WITH

100% of global Fortune 500 CPG companies

Proven success helping Consumer Packaged Goods customers achieve significant results

Reduced development time by[1] **100%**

Safety integration[2] **100%**

Reduced changeover time by[3] **50%**

1- Yuhan-Kimberly case study
2- Encore Tissue case study
3- Optima case study

Industry expertise through acquisitions, investments and partnerships

Investments to enhance our CPG capabilities

More than **$3B**

Doubled our delivery capacity

Increased by **100%**

Co-innovation with industry-leading technology companies

ACQUISITIONS

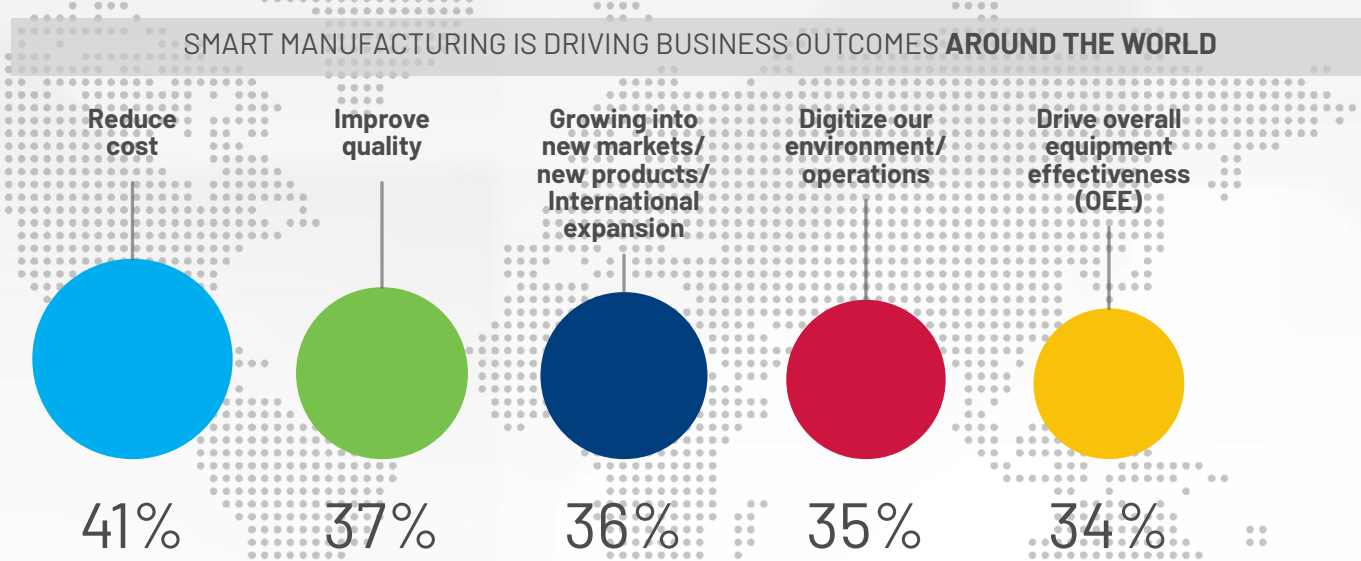
PLEX, Fiix, KALYPSO, ASEM, AVNET, EMULATE3D, MESTECH, oylo Trust Engineering, AVATA, MagneMotion, odos imaging, CUBIC, Knowledge Lens, CLEARPATH ROBOTICS, VERVE

PARTNERSHIPS

Microsoft, aws, cisco, accenture, Ansys, ptc, CLAROTY, KEZZLER, COGNITE, FANUC

CPG companies are implementing smart manufacturing technology to address top operational challenges

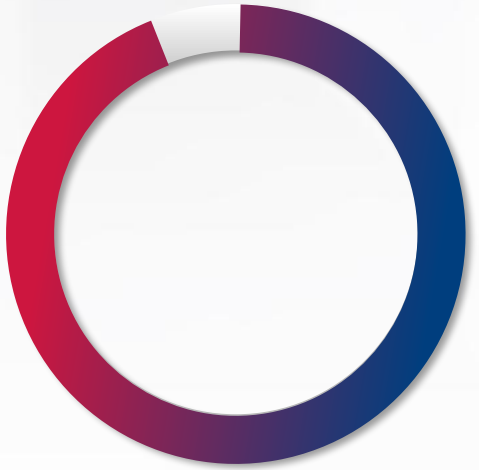
86% of CPG manufacturers are using or evaluating smart manufacturing technology and most believe it will help them to reduce costs. This is in contrast to our overall survey, where quality improvement topped the table of expected outcomes.



Q. What positive business outcomes are you looking to achieve from your smart manufacturing technology? Select all that apply.
Base: 1567

However, cost is also seen as the main barrier to adoption of smart manufacturing in the CPG sector, followed by workforce-related issues; namely a lack of necessary skills to implement and use the technology.

86% of CPG manufacturers are using or evaluating **smart manufacturing technology**



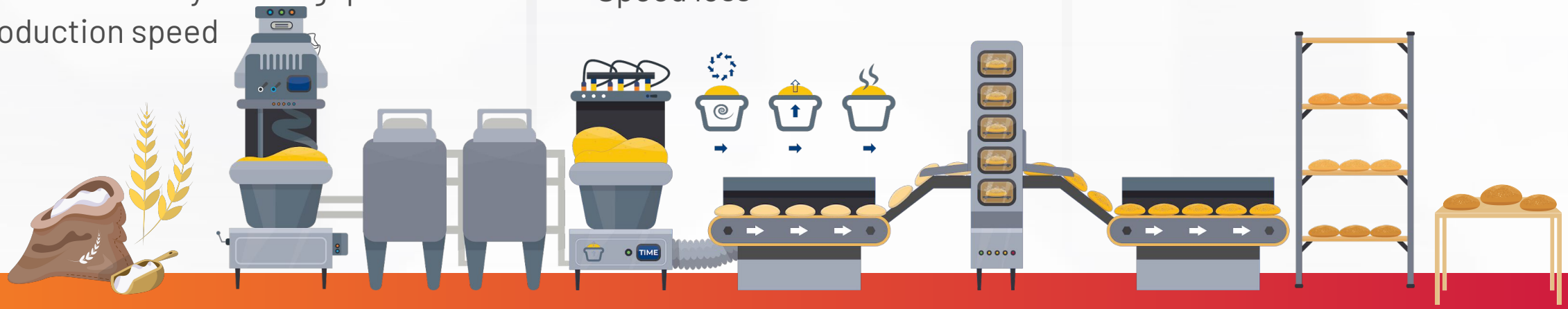
What is yield?

Expected output from given inputs → Process loss → Actual output

- Raw materials
- Labor
- Energy
- Asset availability / throughput
- Production speed

- Rework
- Scrap
- Unplanned downtime
- Speed loss

- Finished goods
- Approved quality
- Salable product



EXAMPLE: **100** units **10** units **90** units

$$\text{Yield Loss} = 1 - \frac{\text{Actual Output}}{\text{Expected Output}} = 1 - \frac{90 \text{ units}}{100 \text{ units}} = 10\%$$

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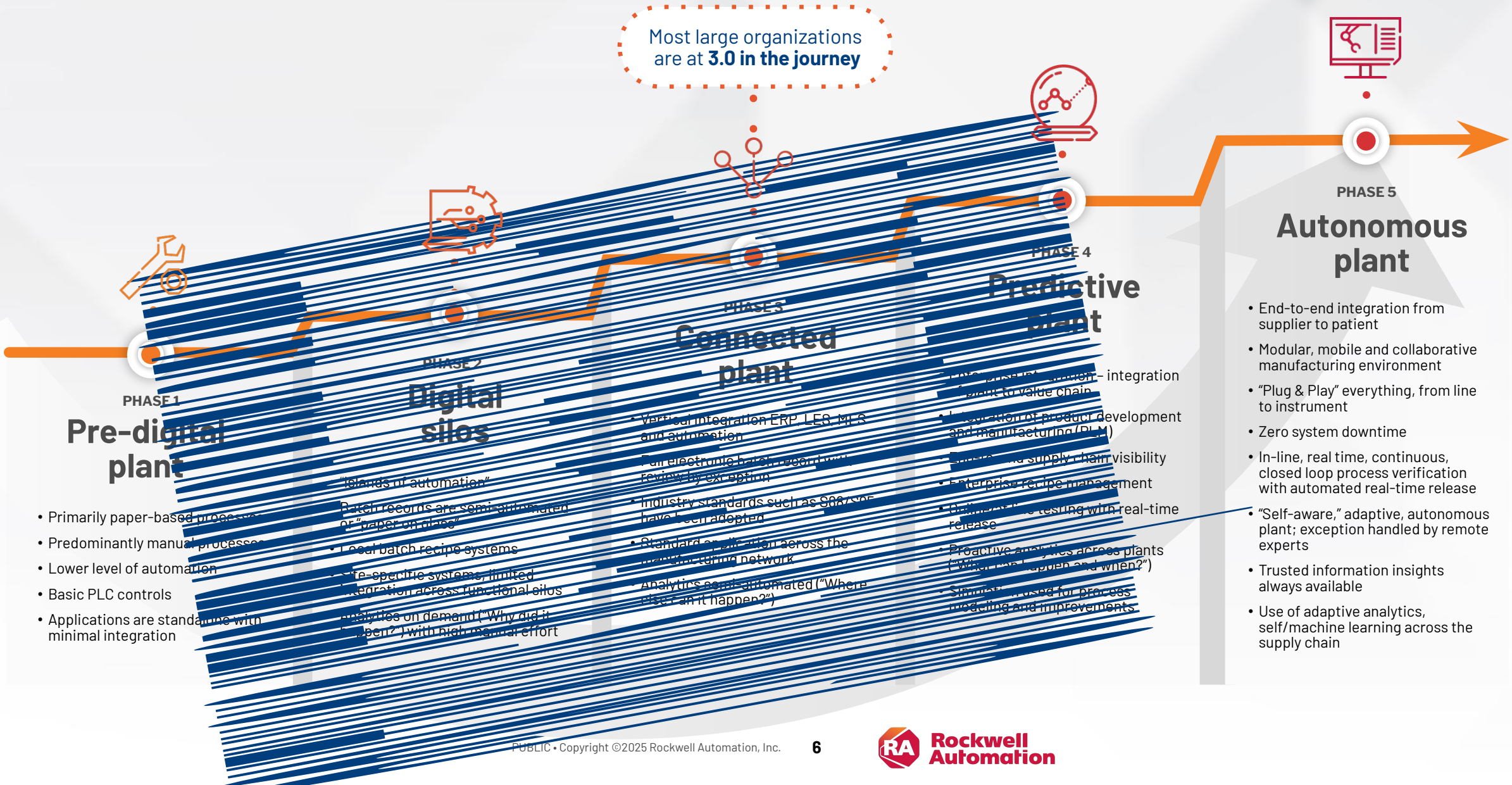
Manufacturers are progressing their digital maturation

Most large organizations are at **3.0 in the journey**



PHASE 1

Pre-digital plant

- Primarily paper-based processes
- Predominantly manual processes
- Lower level of automation
- Basic PLC controls
- Applications are standalone with minimal integration

PHASE 2

Digital silos

- "Islands of automation"
- Batch records are semi-automated or "paper on glass"
- Local batch recipe systems
- Site-specific systems, limited integration across functional silos
- Analytics on demand ("Why did it happen?") with high manual effort

PHASE 3

Connected plant

- Vertical integration ERP, LES, MES and automation
- Full electronic batch record with review by exception
- Industry standards such as S88/S95 have been adopted
- Standard application across the manufacturing network
- Analytics semi-automated ("Where else can it happen?")

PHASE 4

Predictive plant

- Enterprise IoT solution – integration plant to value chain
- Integration of product development and manufacturing (PLM)
- Enterprise and supply chain visibility
- Enterprise recipe management
- Continuous quality testing with real-time release
- Proactive analytics across plants ("What can happen and when?")
- Simulation used for process modeling and improvements

PHASE 5

Autonomous plant

- End-to-end integration from supplier to patient
- Modular, mobile and collaborative manufacturing environment
- "Plug & Play" everything, from line to instrument
- Zero system downtime
- In-line, real time, continuous, closed loop process verification with automated real-time release
- "Self-aware," adaptive, autonomous plant; exception handled by remote experts
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Material Variance is a major lever for yield loss

But, without an MES, it's difficult to pinpoint where these losses are occurring across the value chain[1]

	P&L Totals	RM PREP	MIXING / BATCHING	CONVERSION / ASSEMBLY	PACKAGING	FINISHED STORAGE
TOTAL REVENUE	***115***					
TOTAL COST	***100***					
VARIABLE COST	***80***					
Raw Materials	*50.0*	*50.0*	*49.0*	*48.0*	*47.0*	*46.0*
Identified Food Variance	*-3.33*	*-0.67*	*-0.67*	*-0.67*	*-0.67*	*-0.67*
***Unidentified** Food Variance*	*-1.67*	*-0.33*	*-0.33*	*-0.33*	*-0.33*	*-0.33*
Packaging Material	*5.0*				*5.00*	*4.60*
Package Variance					*-0.40*	*-0.10*
Direct Labor	*20.0*	*1.00*	*4.00*	*5.00*	*8.00*	*2.00*
Energy	*4.0*	*0.50*	*0.30*	*1.50*	*0.45*	*0.50*
Other Inputs	*1.0*	*0.15*	*0.15*	*0.15*	*0.15*	*0.10*
FIXED COST	*20.0*					
Labor & Salaried	*6.0*	*0.85*	*0.85*	*0.85*	*0.85*	*0.85*
Maintenance	*5.0*	*0.25*	*1.25*	*1.50*	*0.25*	*0.25*
Energy	*1.0*	*0.15*	*0.15*	*0.15*	*0.15*	*0.10*
Other Overhead	*5.0*	*0.75*	*0.75*	*0.75*	*0.75*	*0.50*
Depreciation[1]	*3.0*	*0.15*	*0.30*	*0.70*	*0.70*	*0.15*
NON-PLANT COSTS						
VALUE POOLS (round)		**53.3**	**55.0**	**57.5**	**60.6**	**54.6**

1 - Example scenario, actual results may vary

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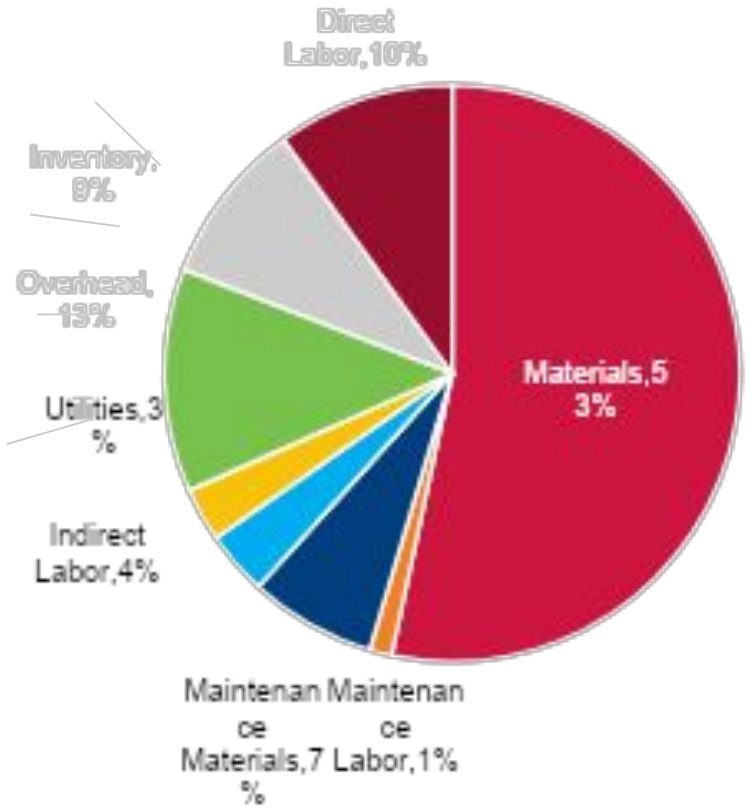
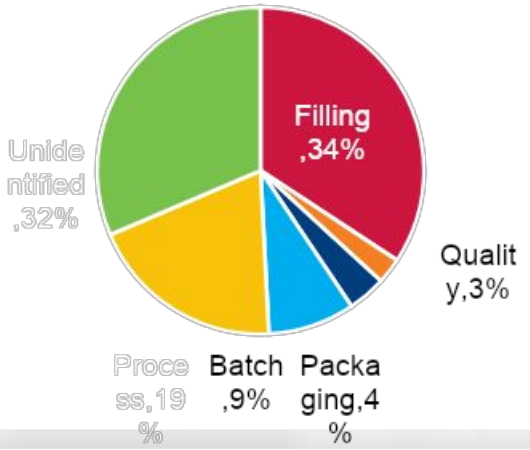
MES enables production visibility

In this case we see that filling is the largest contributor to yield loss

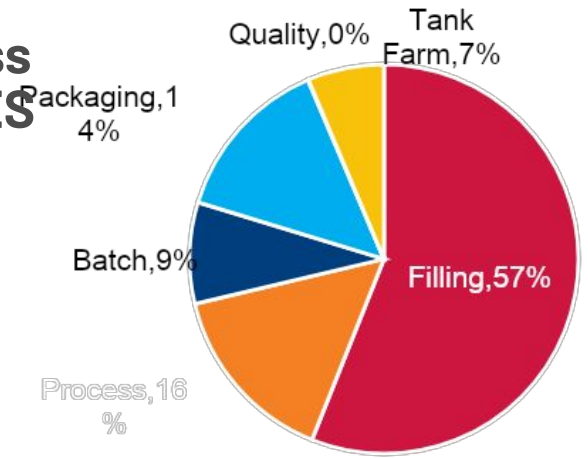
Zero based analysis opportunity



Yield loss pre-MES

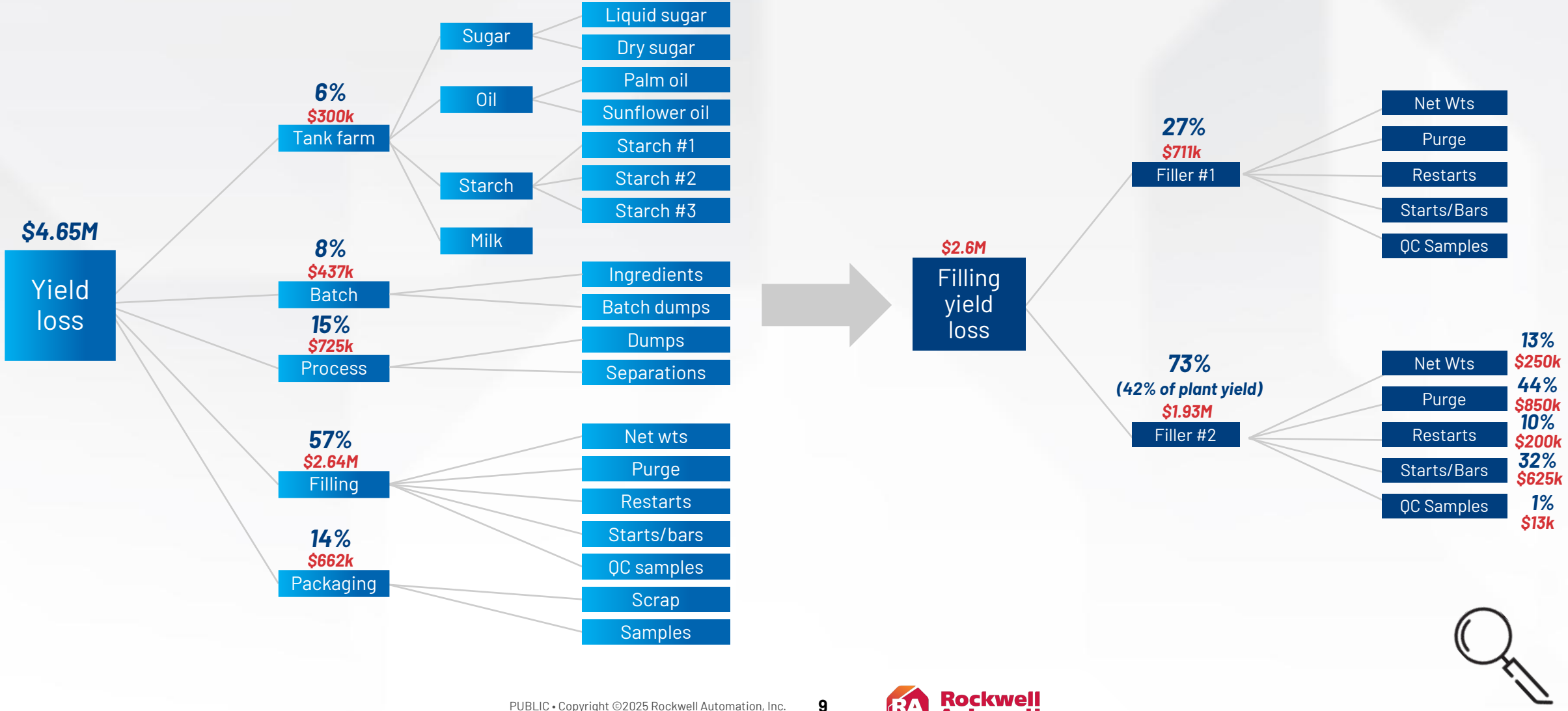


Yield loss post-MES



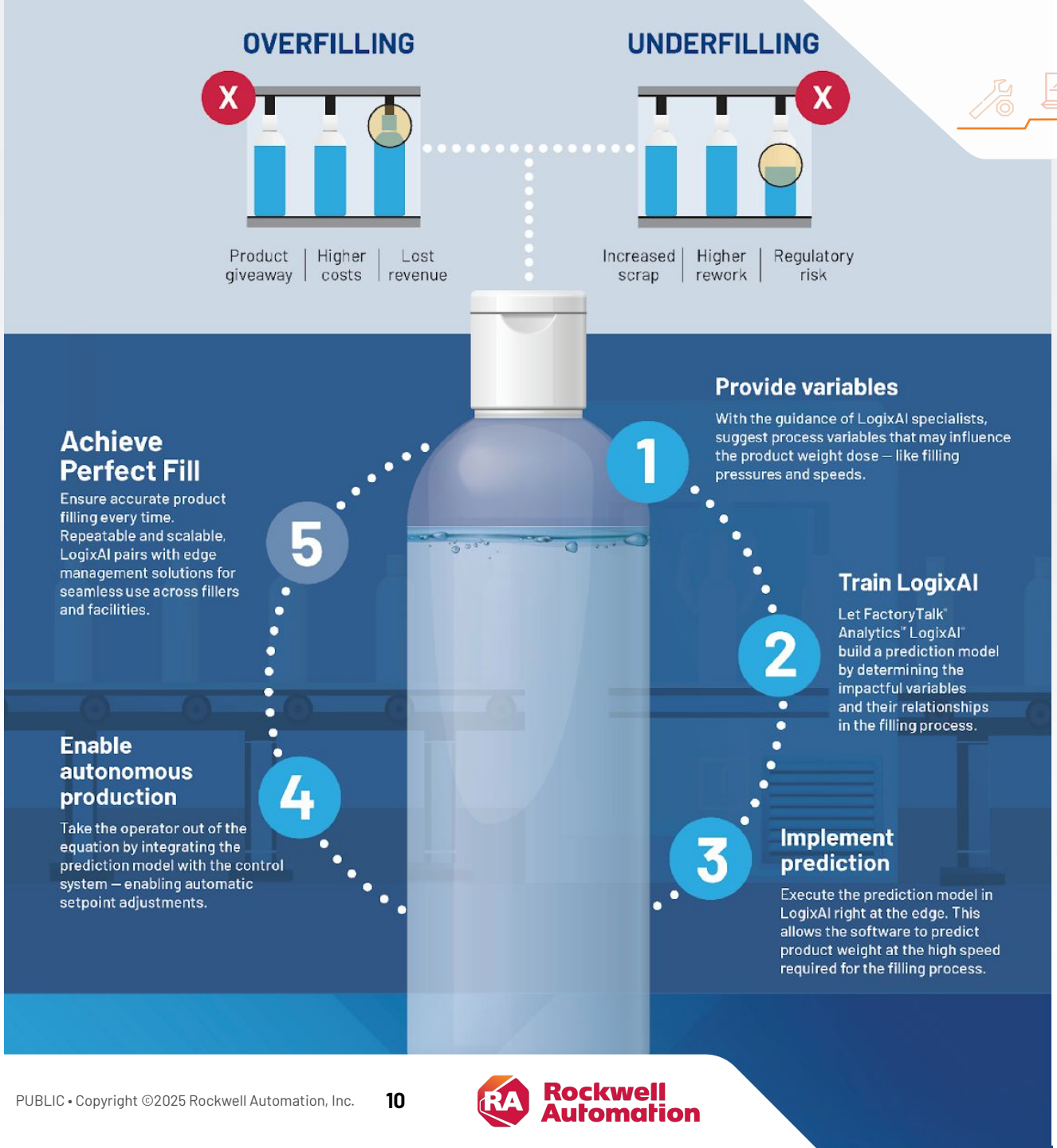
Pinpointing specific areas of yield loss

In this case we see that Filler #2 is the primary contributor



Filling optimization to reduce giveaway

- Continuous monitoring of upstream input variables
- Predicts fill accuracy in real-time
- Prescribes recommended set point changes back to the controller for closed-loop optimization



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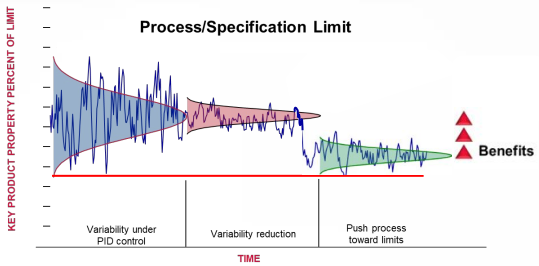
From prediction to precision: AI insights combined with closed-loop control

CHALLENGE

- Mayonnaise filling
- **300 bottles/minute**
- Viscous material
- Fill heads **lose accuracy over time**
- Strict **lower limit**
- Inaccuracies in fill level = **product giveaway**
- **Frequent operator adjustments** to keep near fill limit

SOLUTION

- Self-learning AI module **deployed to the edge**
- Learned the **contributing variables and coefficients**, trained on historical and real-time streaming data
- ML model **predicts fill weights**
- **Optimizer adjusted or closed-loop control** to minimize error



RESULTS ACHIEVED

Production Test Results

96%
prediction accuracy

52%
reduction in giveaway

67%
elimination of underfill

0.4 second
prediction window

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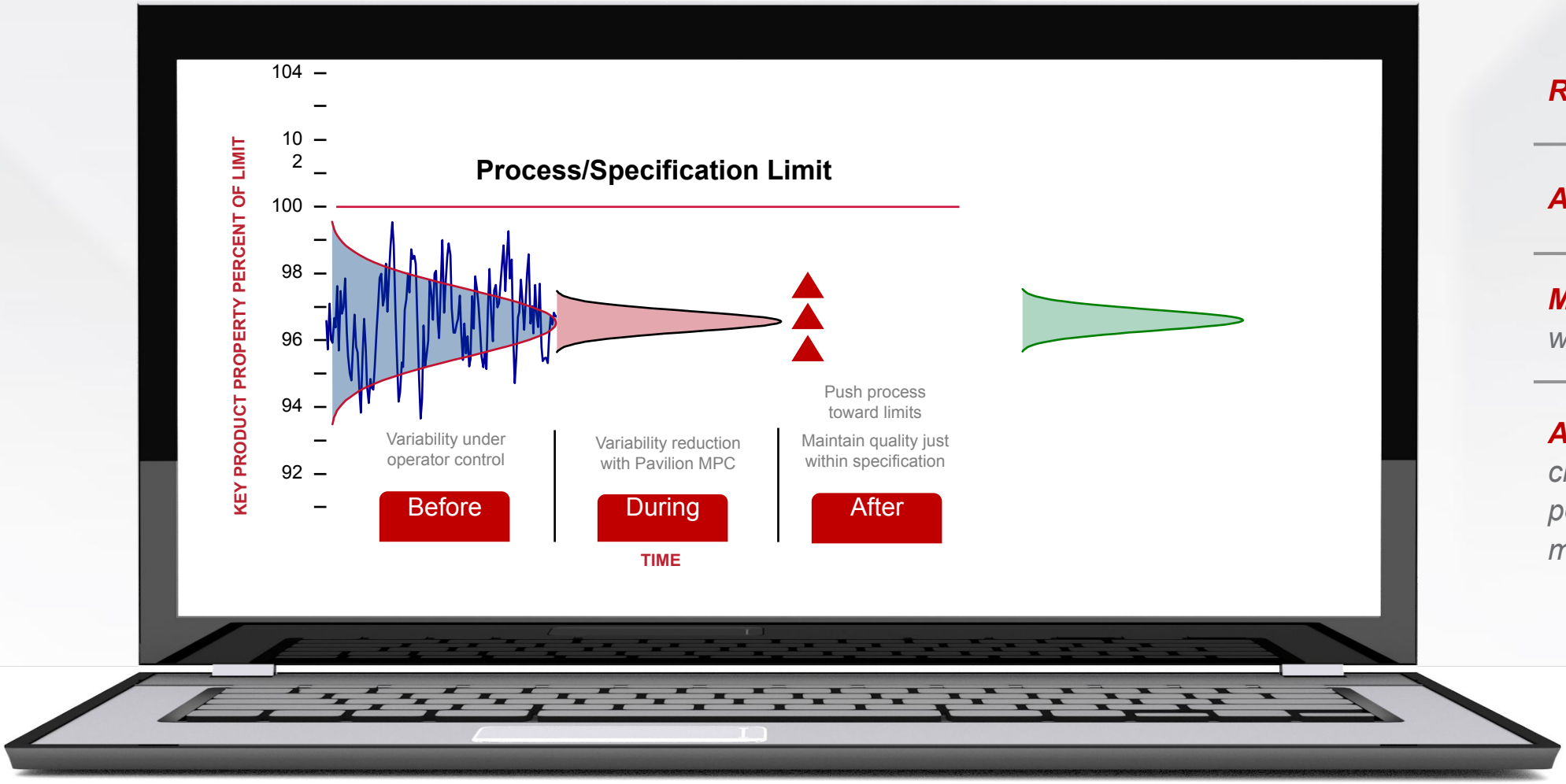
How Model Predictive Control (MPC) Generates Benefits



REDUCES *Variability*

ACHIEVES *"Plant Obedience"*

MANAGES *the process within constraints*

ACHIEVES UPLIFT *– operate closer to specifications and performance limits while maintaining safety margins*

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Jim Beam: Reduced variability in the distillation process by 60%

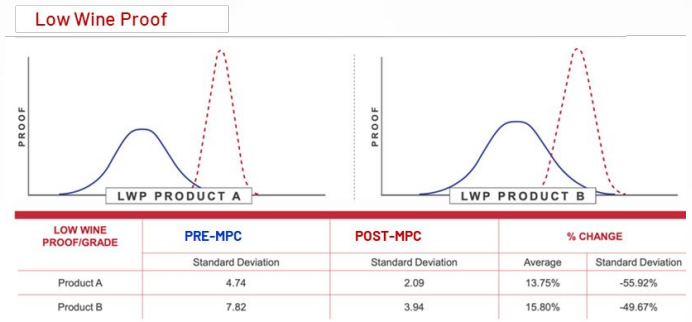
CHALLENGE

The goal was to **enable the plant to push up to operational limits,** adjusting to shifting process constraints automatically, maximizing throughput while maintaining product integrity.

SOLUTION

A multivariable control solution enabled to push up operational limits while respecting equipment and process constraints.

This resulted in a stable distillery operation, improved product quality and distillation yield.



LOW WINE PROOF/GRADE	PRE-MPC	POST-MPC	% CHANGE	
	Standard Deviation	Standard Deviation	Average	Standard Deviation
Product A	4.74	2.09	13.75%	-55.92%
Product B	7.82	3.94	15.80%	-49.67%

RESULTS ACHIEVED

Process stability

60%

Variability reduction while maintaining proofs

Yield

Increased production per minute

Productivity

Freed operators to focus on higher value tasks

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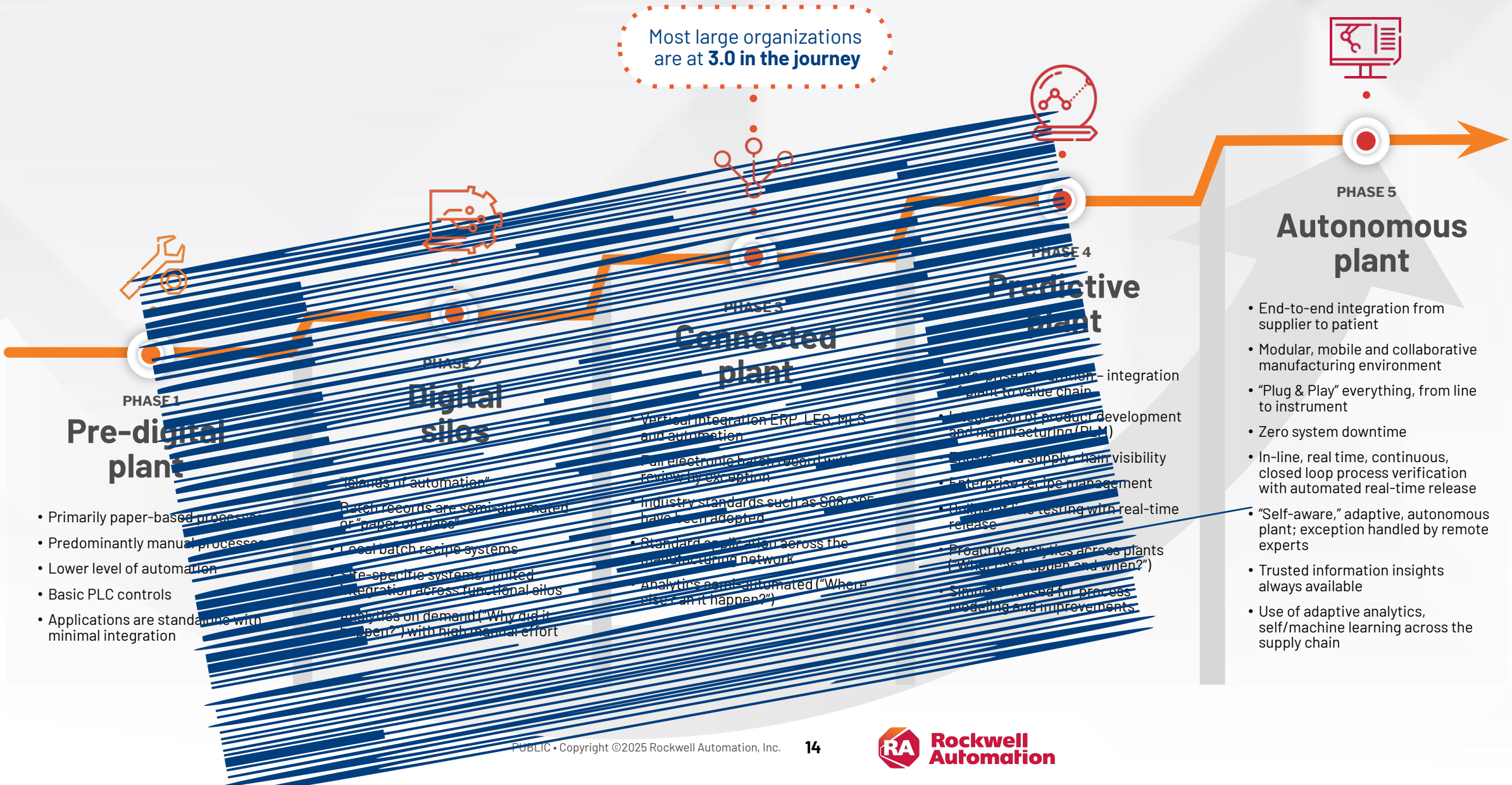

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Next Steps

Ready to scale

- Executive sponsorship in place
- Funding is secured
- Program is resourced
- Roadmap guides the work
- Use cases identified and prioritized
- Effectively utilizing agile methodology
- Change management work stream embedded in program

Ready for assessment and strategy

- Program momentum stalling
- Leadership increasingly impatient for digital transformation results
- Proof of Concept successes are isolated and note programmatic
- Struggling to scale program successes
- Difficulty securing funding & sponsorship
- Transformation objectives not aligned across corporate and plants

How ready are you? Take our Digital Manufacturing Readiness Quiz

Thank you

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