



Six Sigma Development Solutions, Inc.

UNDERWEIGHT REJECT REDUCTION



Food Manufacturing | Statistical Process Control

54.55%

BASELINE

Defect Rate



1.35%

ACHIEVED

Statistical Control

EXECUTIVE SUMMARY



THE CHALLENGE: 54.55% UNDERWEIGHT DEFECTS

High-speed food production line plagued by underweight rejects causing downstream instability, frequent production interruptions, and unclear root causes. Statistical investigation required to differentiate between equipment, operator, and measurement system issues.



98%

Defect Rate

54.55% → 1.35%



Aligned

Weigh-Scale Stability

All heads synchronized



↑ Substantial

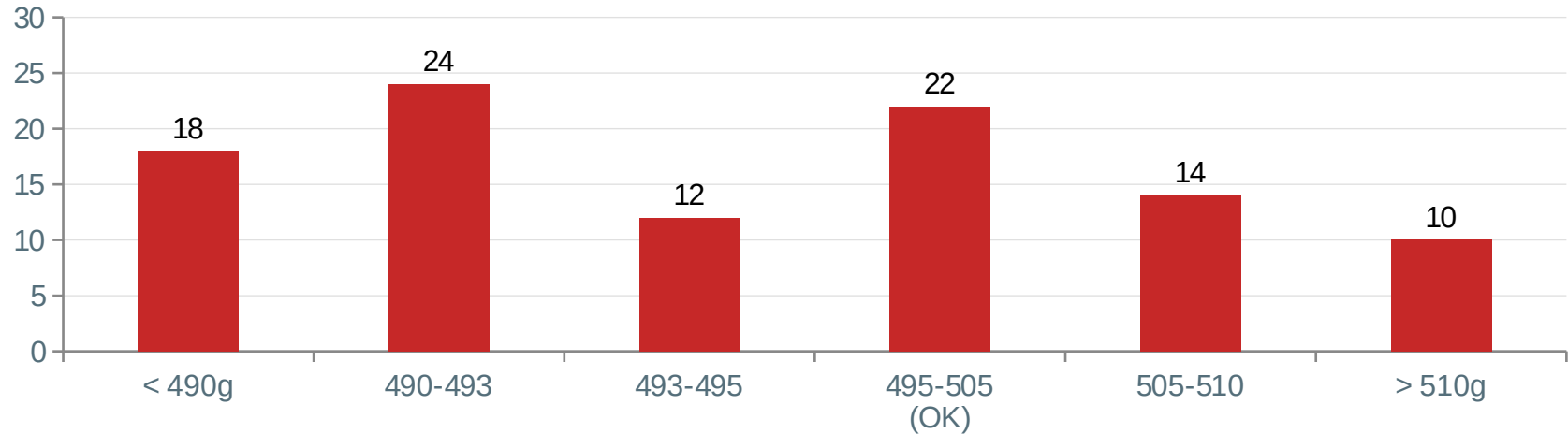
First-Pass Yield

Production stabilized

BASELINE PROCESS ANALYSIS

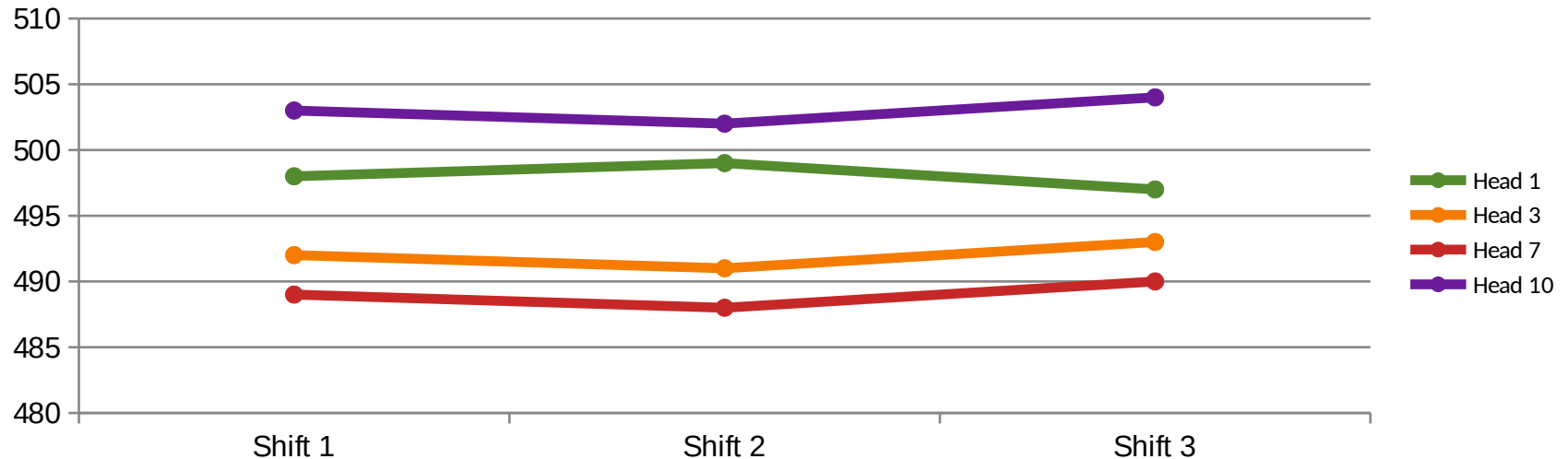
⚙️ Production: 12-head weigh-scale | Target: 500g $\pm$ 5g | 54.55% underweight rejects

Baseline Weight Distribution



MULTI-VARI ANALYSIS: WEIGH-SCALE HEADS

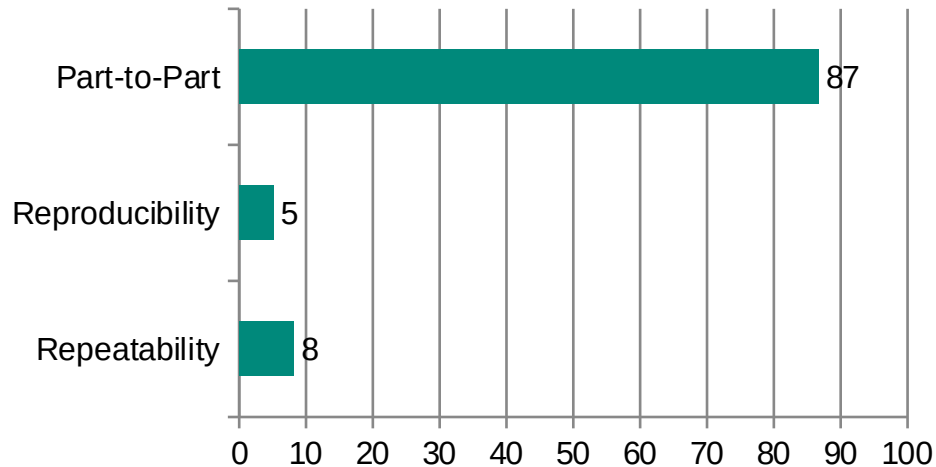
Weight Variation by Weigh-Scale Head



FINDING: Significant variation BETWEEN heads (Head 7: 6-9g low, Head 10: 3-4g high), minimal WITHIN heads. Equipment-specific issues confirmed.

GR&R: MEASUREMENT SYSTEM ANALYSIS

Study: 3 Operators × 10 Parts × 3 Trials | Objective: Validate measurement precision



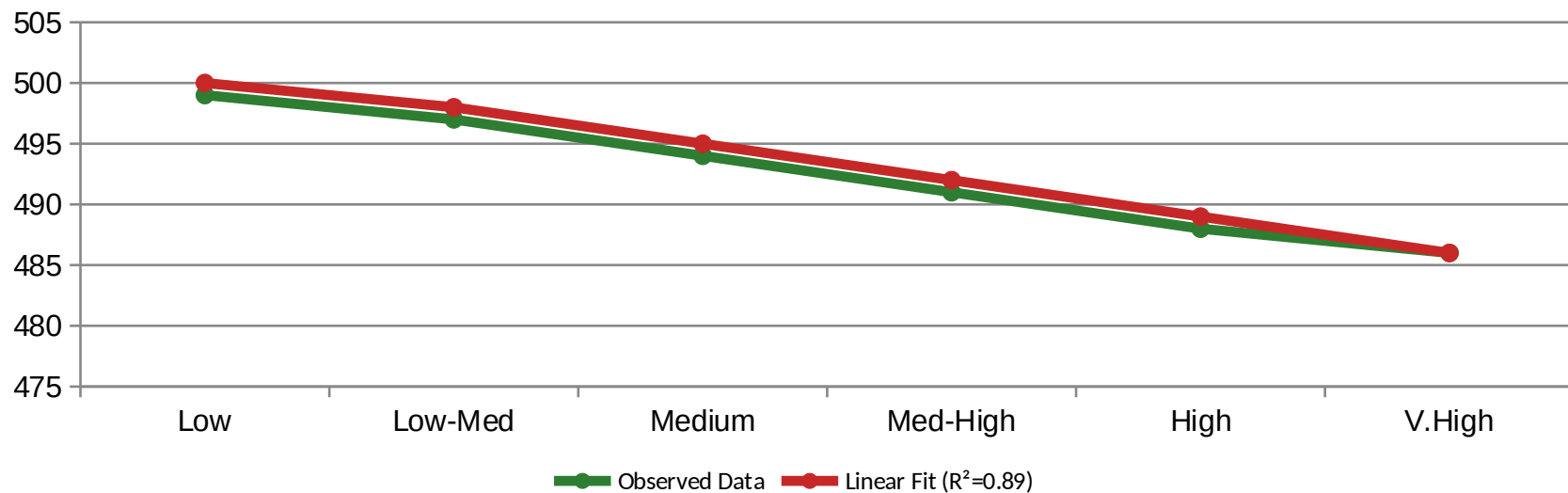
Source	% Study Var
Repeatability	8.2%
Reproducibility	5.1%
Total GR&R	9.7% ✓ PASS

✓ MEASUREMENT SYSTEM VALIDATED

GR&R = 9.7% confirms measurement precision.
Observed variation is REAL process variation, not measurement error.

REGRESSION ANALYSIS: ROOT CAUSE

Hypothesis: Sanitation residue buildup affects weigh-scale accuracy | $R^2 = 0.8924$ (89.24% variance explained)



ROOT CAUSE: Residue buildup coefficient = -1.89g/unit ($p < 0.001$). Each unit increase in residue reduces weight by 1.89g. Solution: Enhanced sanitation SOP.

SOLUTIONS IMPLEMENTATION



Enhanced Sanitation SOP

Structured cleaning protocol every 2 hours

Regression KPIV ($R^2=0.89$)

Residue ↓ 87%



Span-Adjust Calibration

Pre-shift standardized calibration

Multi-Vari KPIV (Head-to-Head)

Scale
Alignment



Maintenance-Production Ownership

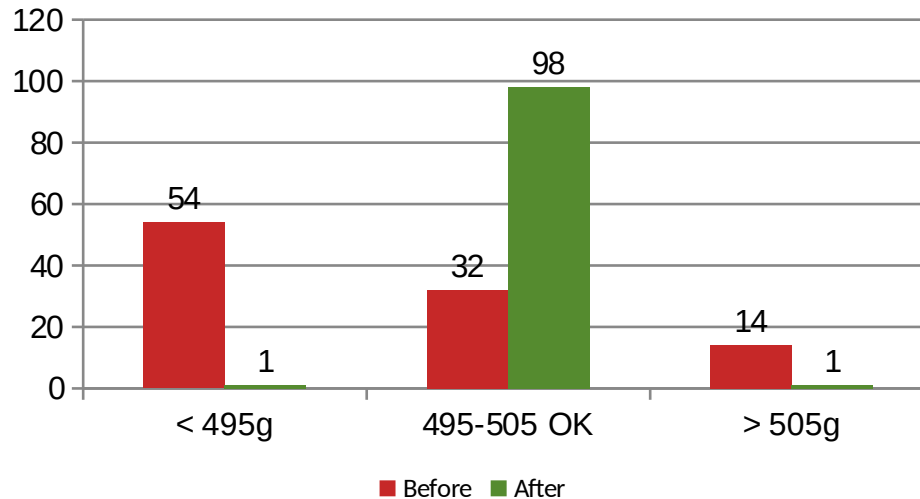
Shared accountability & real-time monitoring

Sustainability & Control

Process
Stability

RESULTS: DEFECT ELIMINATION

Weight Distribution: Before vs. After



Metric	Before	After	Change
Defect Rate	54.55%	1.35%	↓ 98.5%
Mean Weight	497.2g	500.1g	↑ 2.9g
Std Dev	6.8g	1.2g	↓ 82%
Cpk	0.17	1.94	+ 1041%

SECONDARY BENEFITS

- ✓ First-pass yield improved
- ✓ Packaging interruptions eliminated
- ✓ Production speed ↑ 8%
- ✓ Staff confidence strengthened

CONTROL PLAN & SUSTAINABILITY

Control Activity	Owner	Frequency	Method
Pre-Shift Calibration	Supervisor	Every shift	Std weights
Sanitization Check	Maintenance	Every 2 hrs	Visual + log
Real-Time X-Bar Chart	Quality Op	Continuous	SPC board
Weekly Capability	Engineer	Weekly	Cpk > 1.67

Metric	Target	Current
Defect Rate	< 2%	1.35% ✓
Cpk	> 1.67	1.94 ✓
SOP Adherence	> 95%	99.2% ✓

REPLICATION OPPORTUNITY

This methodology is replicable across all 8 production lines in facility. Expected facility-wide benefit: 40% defect reduction.

CONCLUSION



Multi-Vari Precision



Equipment-specific issues isolated across weigh-scale heads



GR&R Validation

Measurement system verified (9.7%), confirming real process issues



Regression Root Cause



Sanitation residue identified as 89% driver ($R^2=0.89$)



54.55% → 1.35% defect elimination | 98.5% reduction | Cpk: 0.17 → 1.94

Statistical rigor replaced guesswork with precision