

Process Variability Reduction in the AC4 Manual Dispatch Workflow at Parker Curtis Instruments PR, Inc.

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Prof. Luis Olivares | IE 4995 Capstone Extension Spring-2026

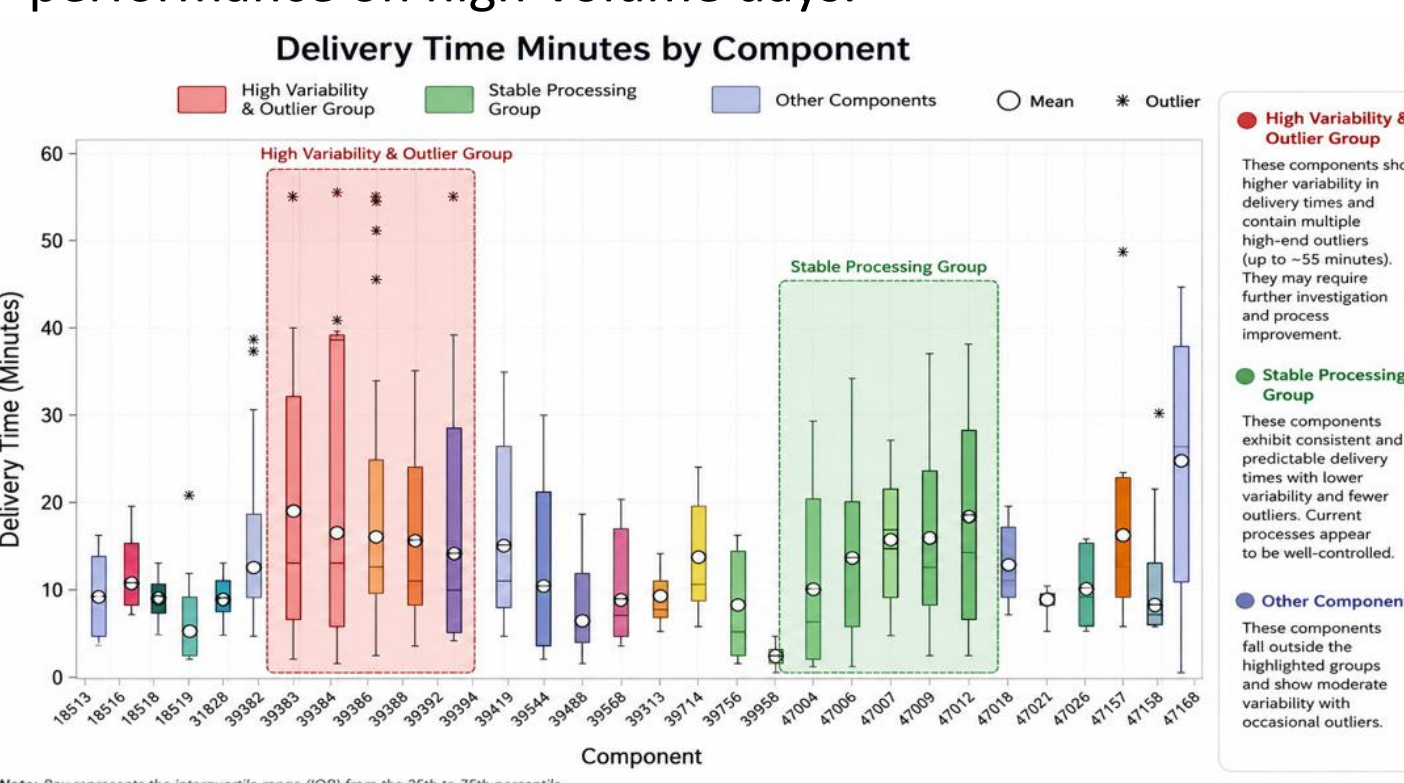
1. DEFINE

PROJECT INTRODUCTION

Curtis Instruments PR, Inc. operates a 92,200 sq. ft. manufacturing facility in Carolina, Puerto Rico, established in 1986 with over 250 employees and more than 300 SKUs. The site supports high-volume production of motor speed controllers for electric mobility applications such as golf carts, forklifts, and wheelchairs. This project applies the DMAIC methodology to improve the AC4 material dispatch process by reducing dispatch delays, inventory visibility issues, excessive travel distance, and manual warehouse execution.

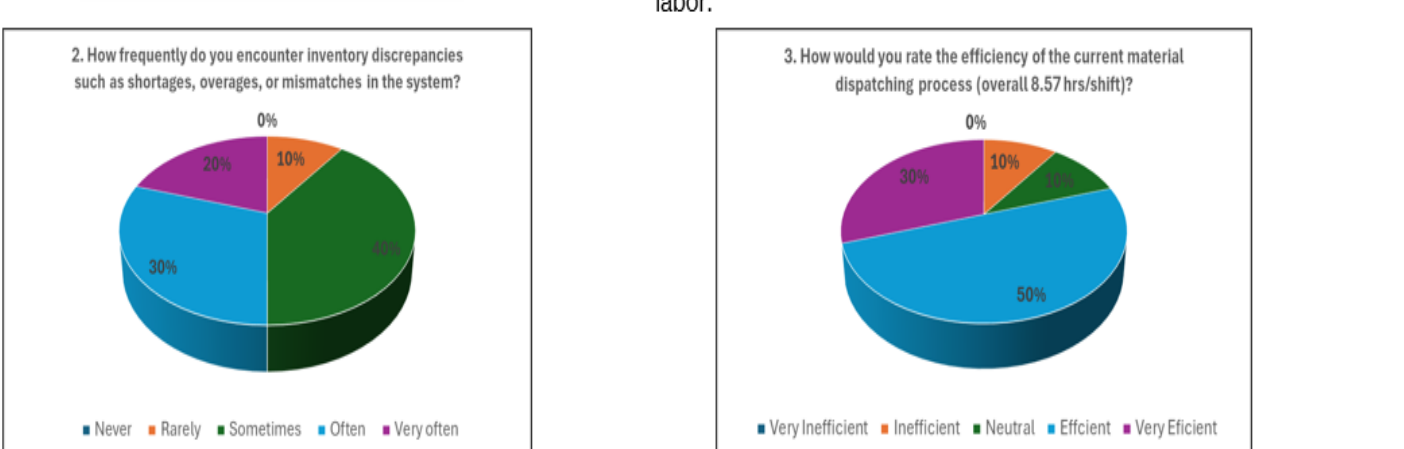
PROBLEM STATEMENT

The AC4 dispatch process shows high delivery time variability, ranging from 1.12 to 19.70 minutes per cycle with a coefficient of variation of 112% (n = 329). The 39XXX part family includes multiple outliers above 40–50 minutes, and higher daily delivery volumes (±15 dispatches) significantly increase cycle times. This project aims to reduce variation to ≤56%, lower the fastest-to-slowest cycle ratio to ≤2:1, and stabilize dispatch performance on high-volume days.



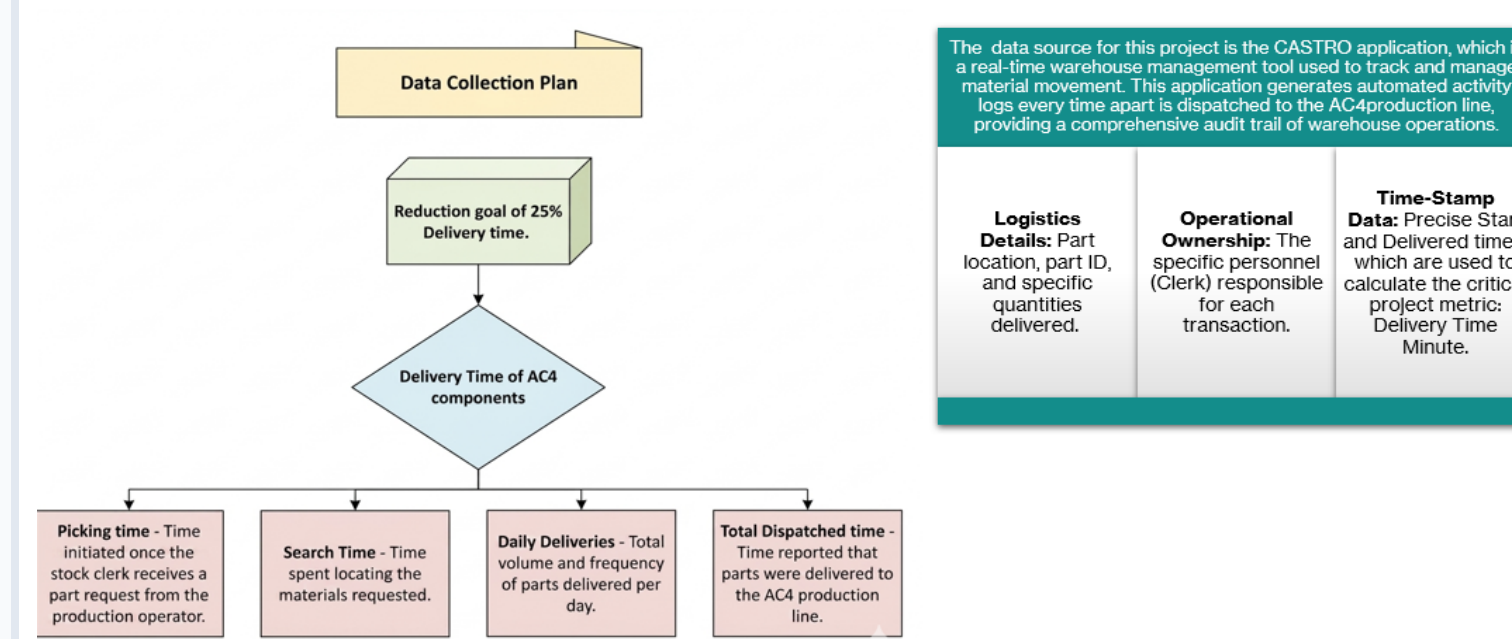
VOICE OF EMPLOYEE

Inventory Visibility Stakeholders reported that the current system is "very old" and "lacking", often showing data that does not match physical reality. **Impact on Production** Incomplete inventory and system discrepancies "greatly affect planning" and frequently stop or delay production tasks. **Dispatch Efficiency** While some users find the current 6.57 hours/shift process "efficient", others label it "inefficient" due to the high volume of manual work. **Ergonomics & Safety** Significant concern regarding the handling of "heavy plates" without lifting belts. Lack of workables in receiving leads to merchandise being placed on the floor. **Desired Improvements** Users requested better ERP/WMS integration, improved scanning systems, and work standardization to reduce manual labor.

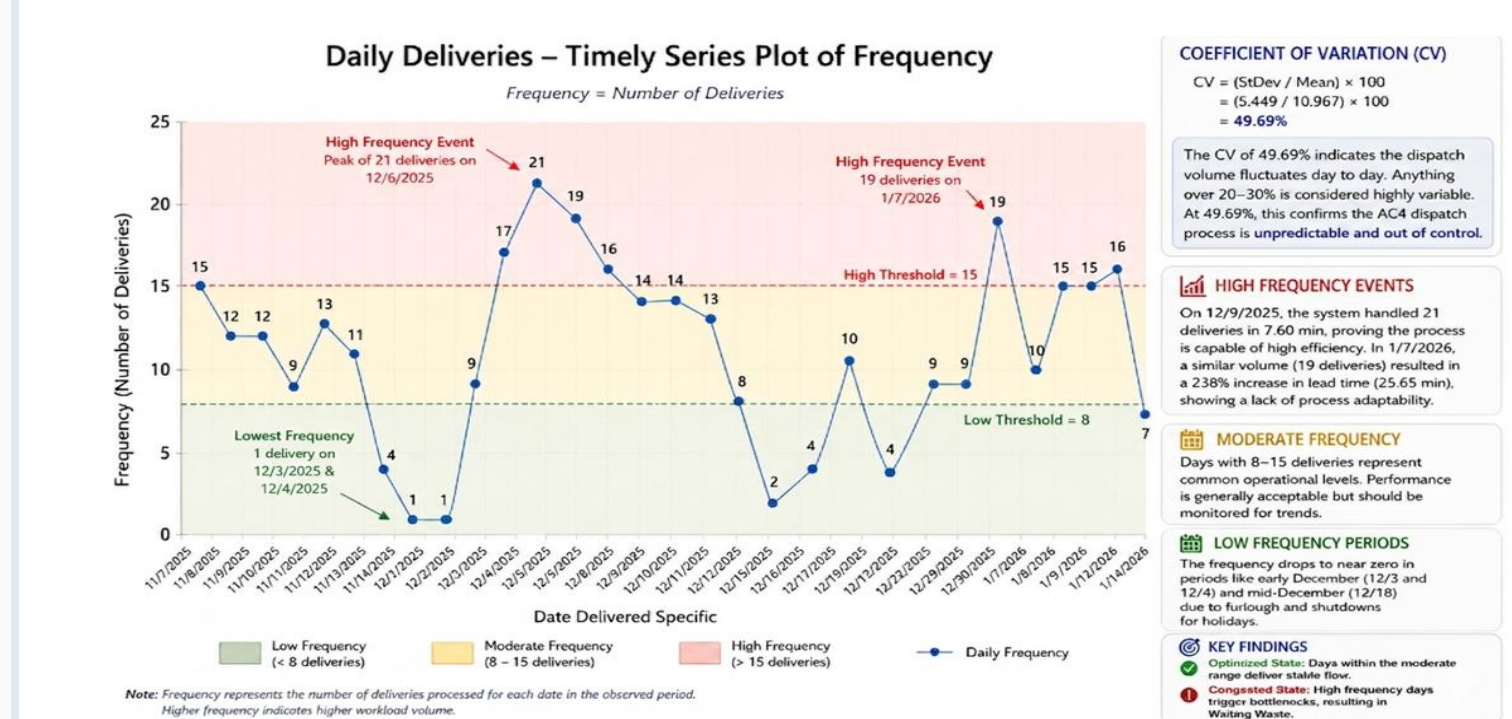
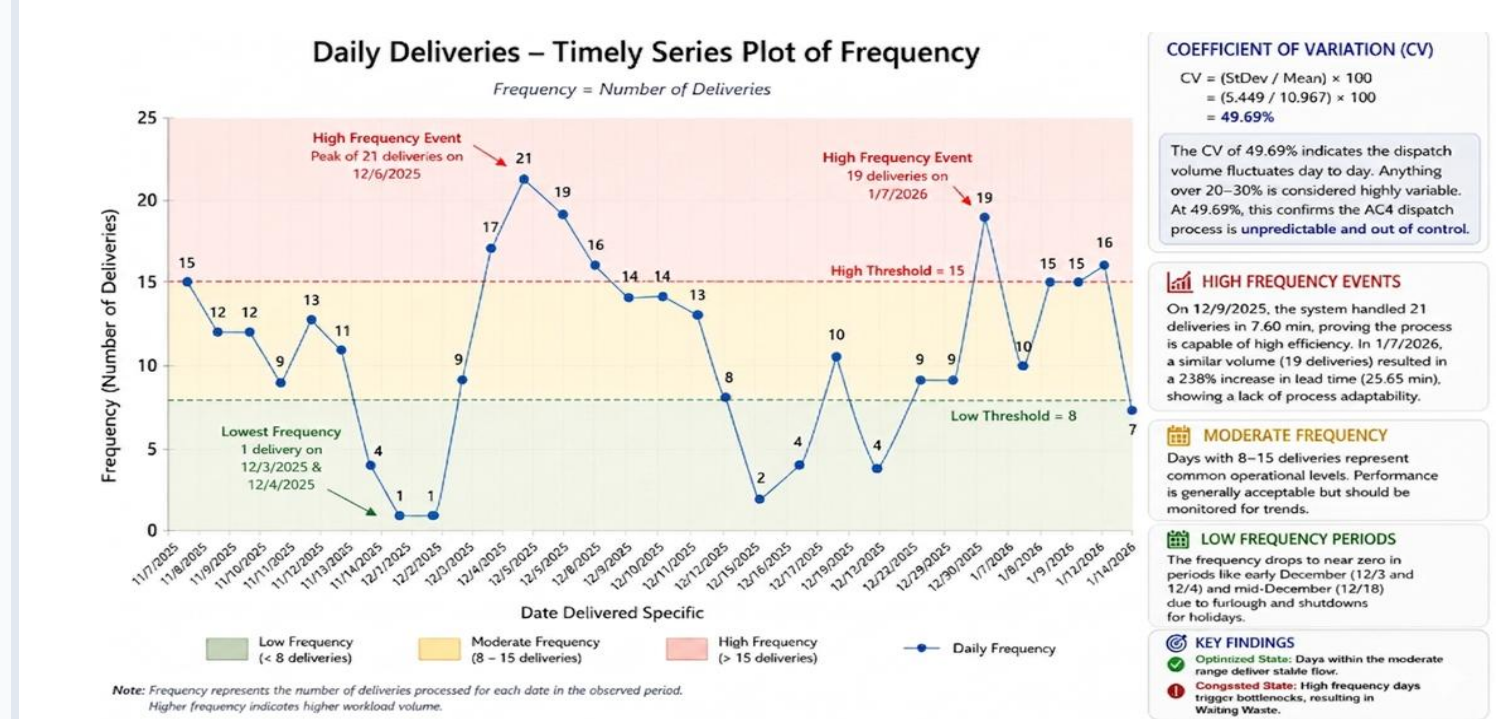


2. MEASURE

DATA COLLECTION PLAN



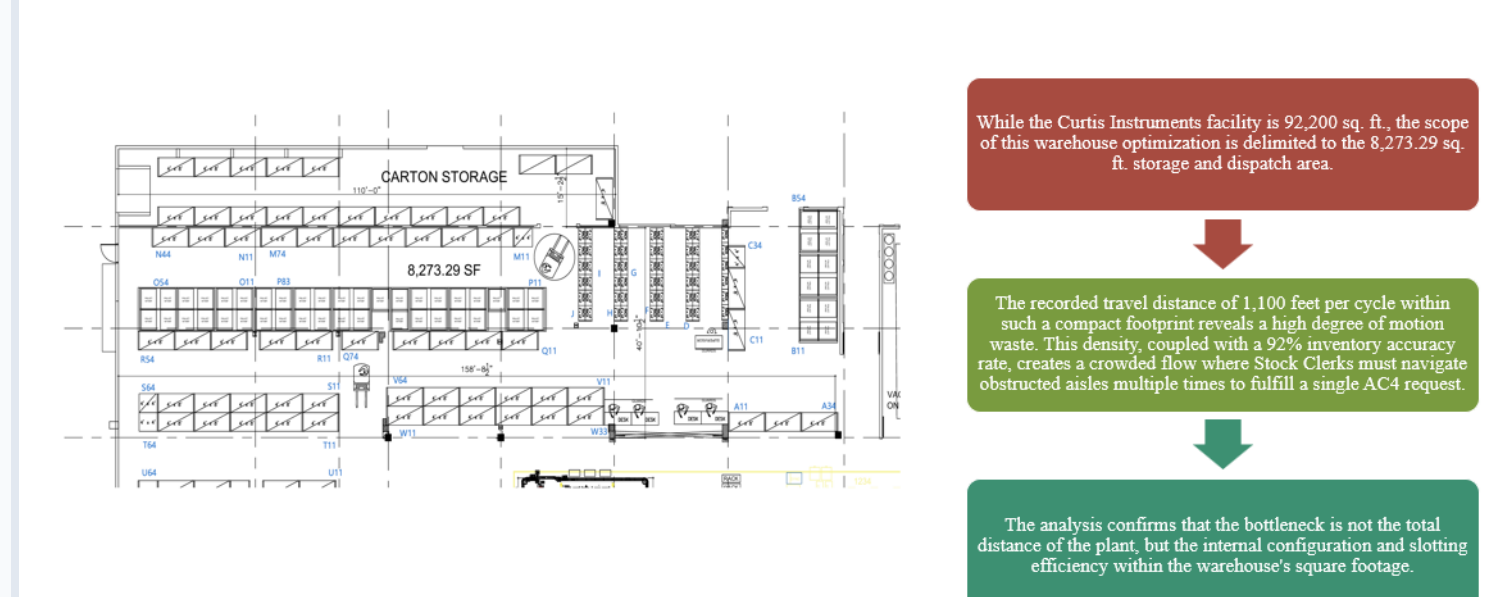
MEASURABLE FINDINGS



LEAN WASTE ANALYSIS

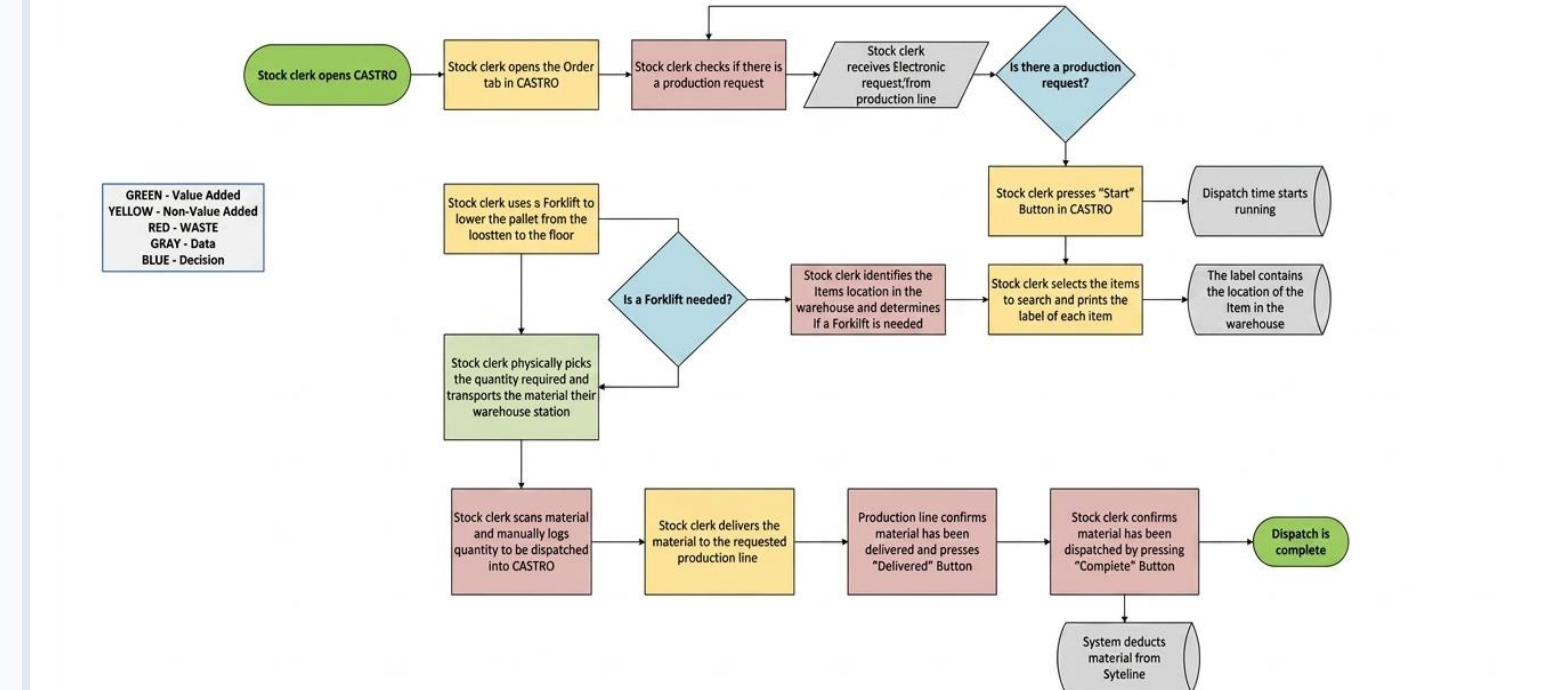
Waste Category	Definition & Examples	Quantified Impacts	Variability & Root Causes
Waiting	System (The Log): Delay loop creates (Log) Time. Confirmation Delay: Clerk wait for "OK" press.	1.20 Minutes per cycle confirmation delay.	High variability from inconsistent production line confirmation.
Motion	Forklift Requirement for high racks. Search Waste for item locations.	Significant forklift motion time.	Highly variable; can lead to extreme outliers (e.g., 54.15 minutes).
Transport	Non-value-added material transport to production line.	2.40 Minutes per cycle. Fixed waste due to 1,100 ft travel distance.	Low variability; a fixed waste of the existing warehouse layout.
Extra-Processing	Manual logging into CASTRO. Administrative clicks consuming time.	1.40 Minutes.	Consistent low value activity; potential for future automation.
Inventory	Batching surges, large batches. High-demand components.	Surges create excess stock! Top 3 parts drive 30% activity (124/329 deliveries).	Demand variability; creates temporary bottlenecks.
Defects	Location identification issues. Manual entry risk of data errors.	Significant impact on search times.	Inventory Accuracy 92% (Target >98%). Drives variable search times and outliers.
Overproduction	Early Picking during low-volume. Producing before line need.	Clutters space; potentially clutters line-side activity.	Lack of pull signal/demand synchronization.
Unused Talent	Idle while waiting for confirmation.	975 Lost Labor Hours annually. Forced idle time.	Forced systemic walk-times.

WAREHOUSE LAYOUT

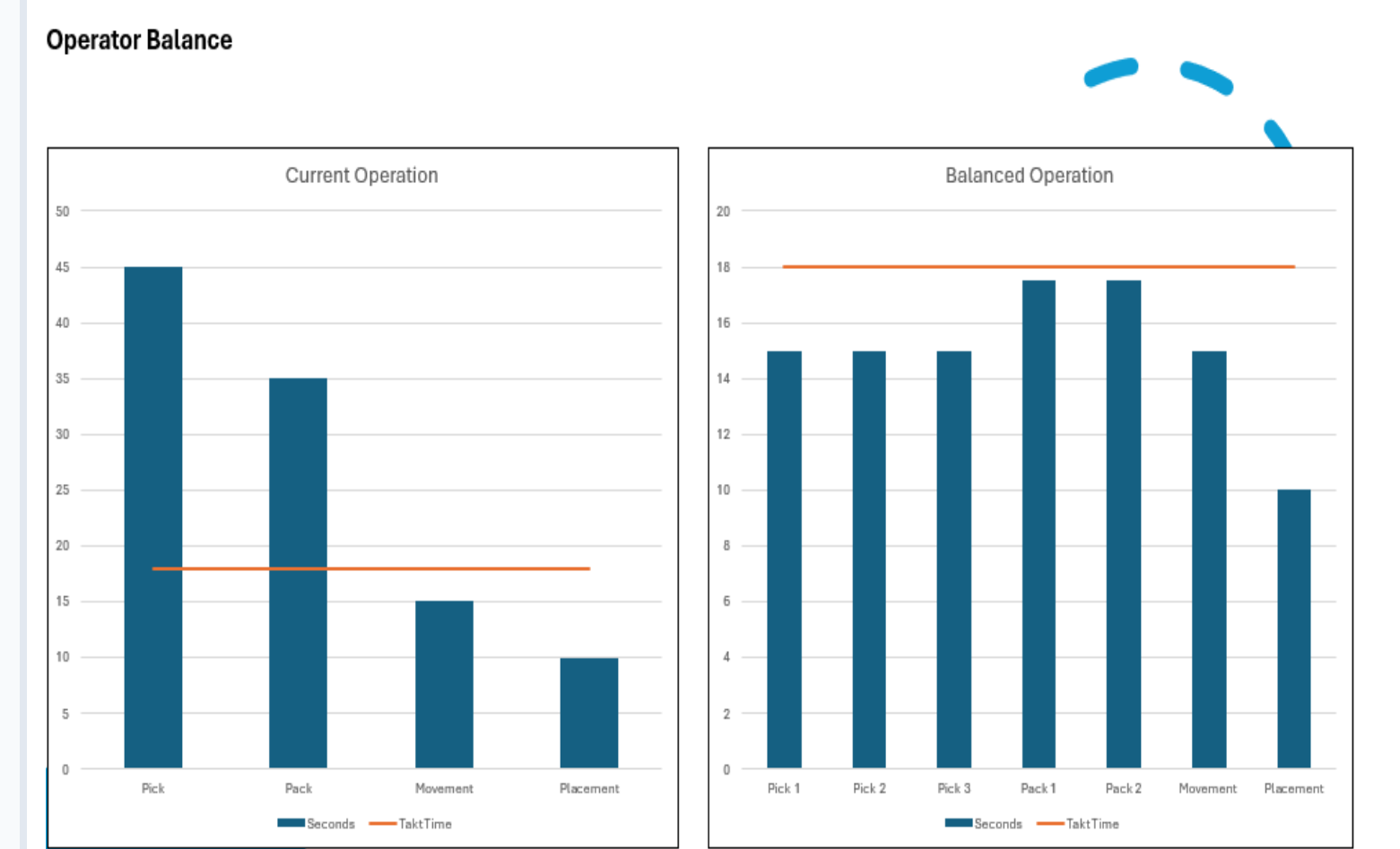


3. ANALYZE

CURRENT-STATE PROCESS MAPPING OF AC4 MATERIAL DISPATCH WORKFLOW

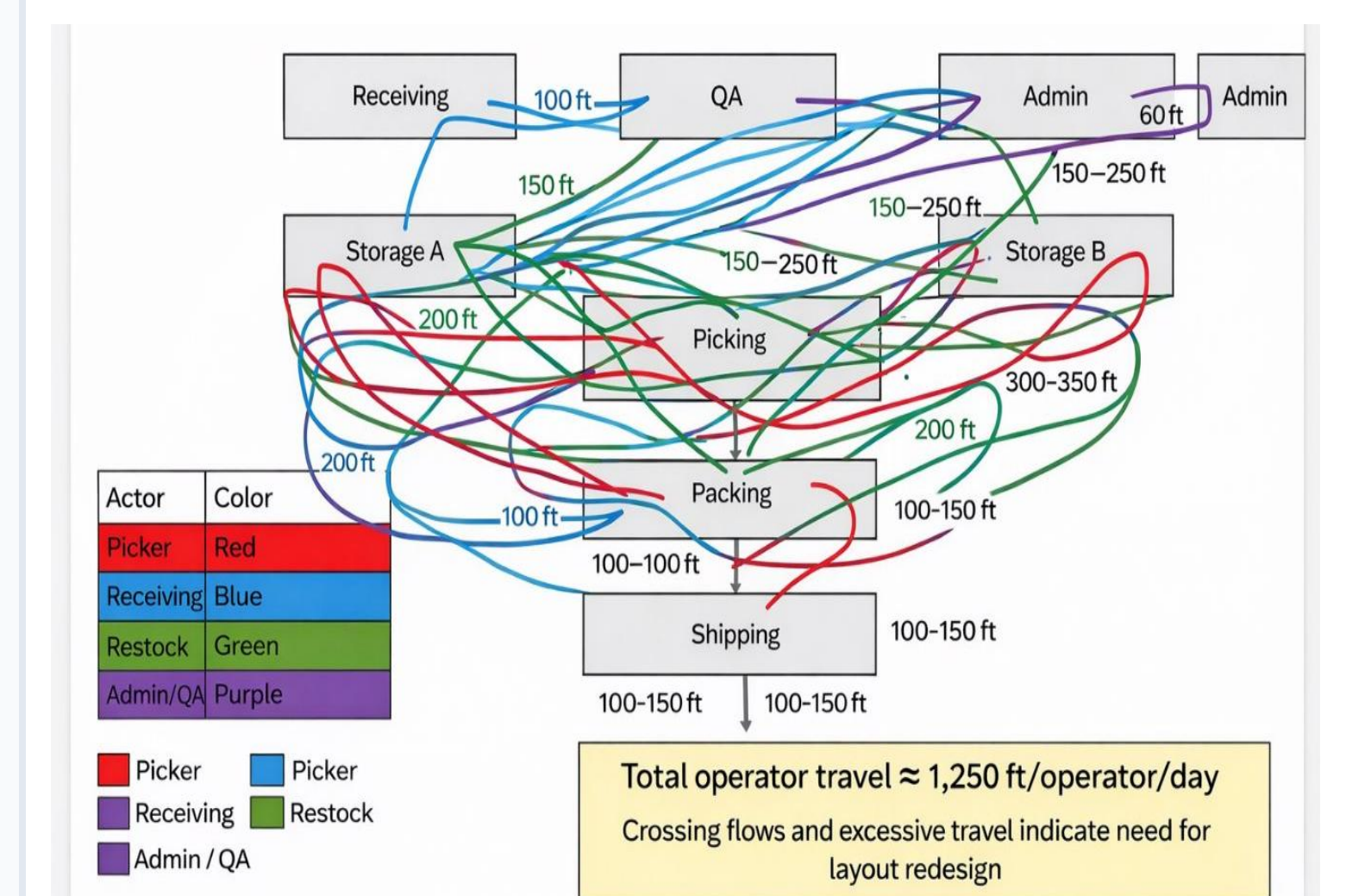


OPERATOR BALANCE



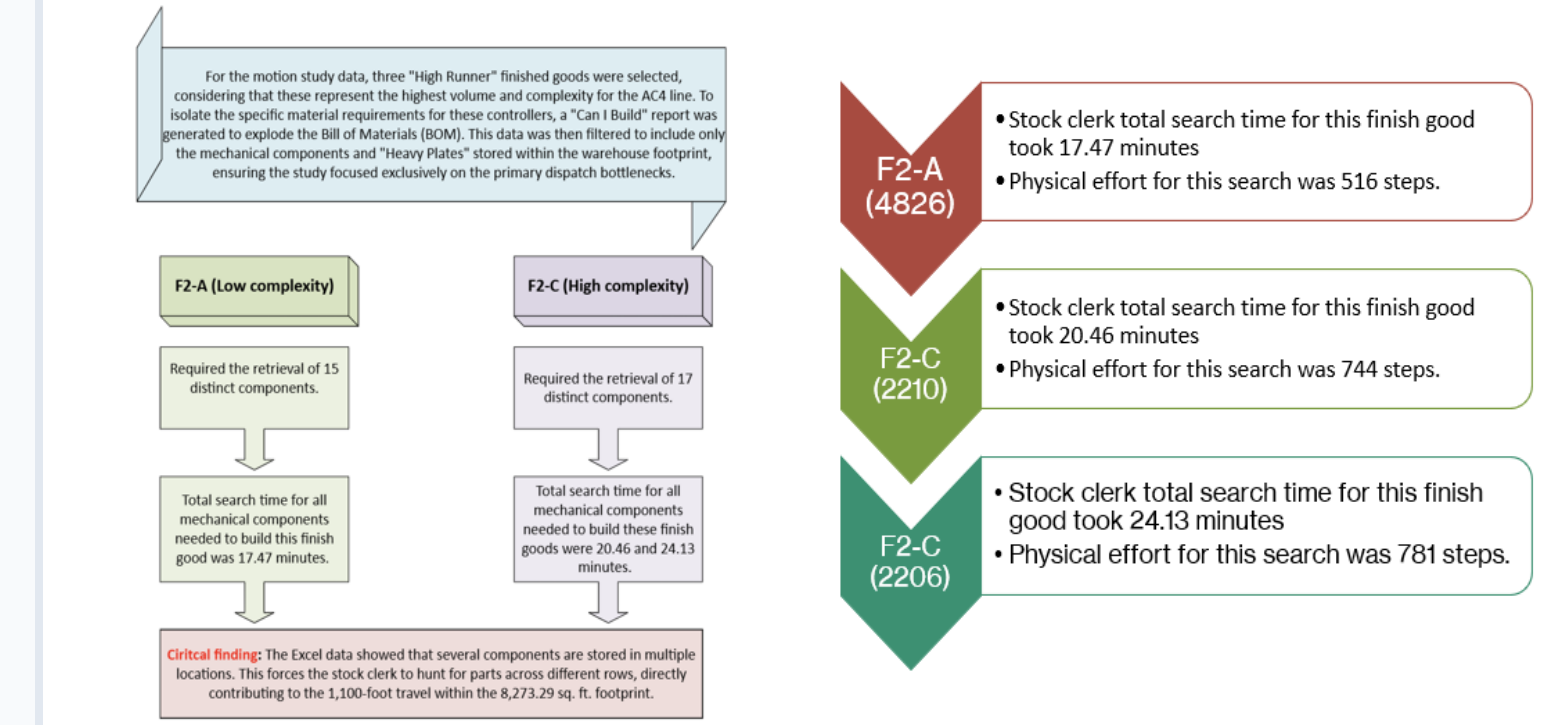
Operator balance analysis showed significant workload variability across 329 dispatch cycles, with times ranging from 1.12 to 19.70 minutes and a coefficient of variation of 112%. High-volume days and inconsistent task distribution increased operator travel and retrieval times, contributing directly to process instability and dispatch delays.

SPAGHETTI DIAGRAM



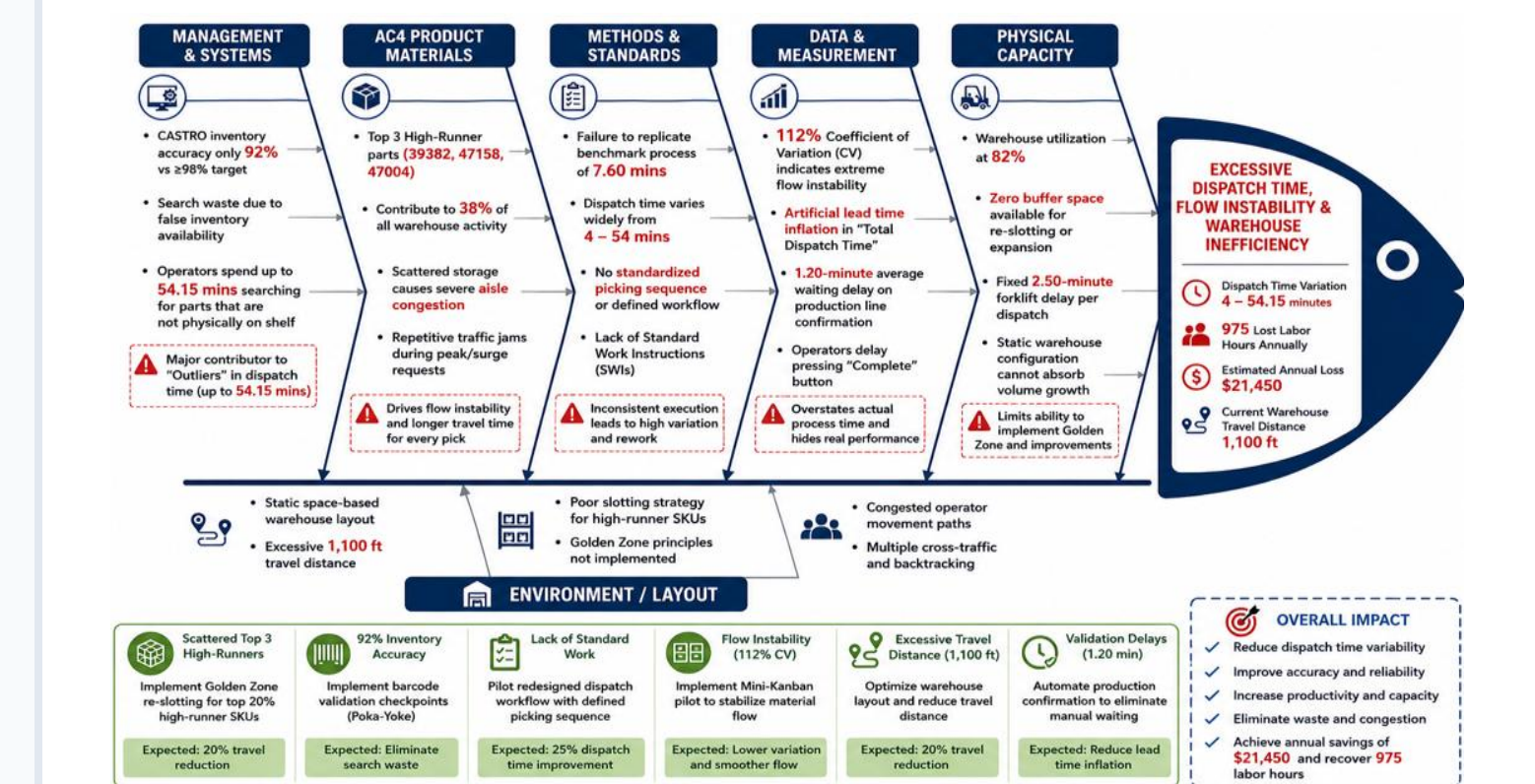
4. IMPROVE

COMPONENT RETRIEVAL TIME AND TRAVEL EFFORT VARIABILITY IN AC4 DISPATCH OPERATIONS

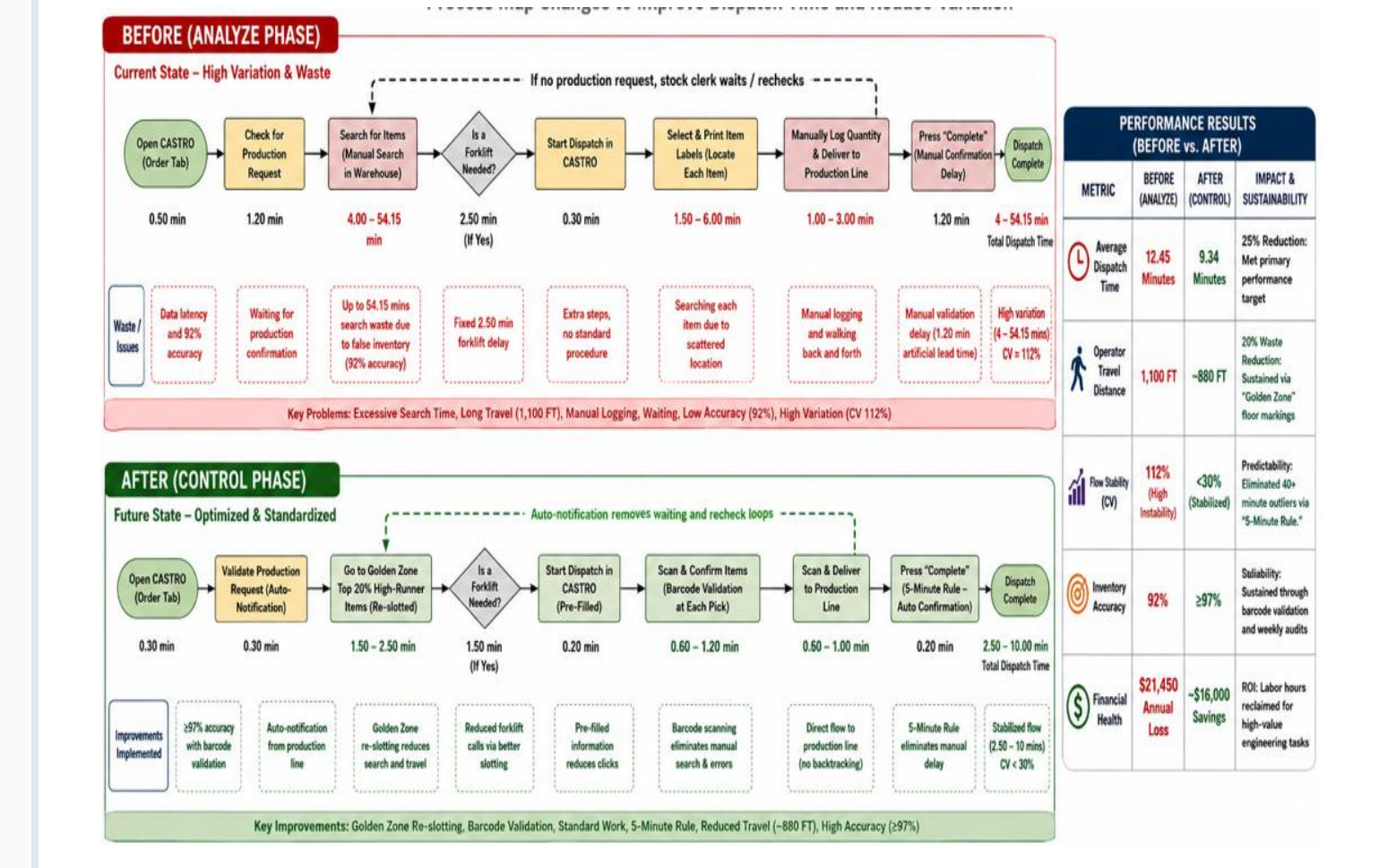


Post-implementation results showed significant improvement in operator balance and dispatch stability. The AC4 process reduced cycle time variability from 112% to 56%, while process consistency improved from a 17:1 to a 2:1 cycle ratio, demonstrating more balanced operator workload and standardized dispatch performance.

FISHBONE DIAGRAM



AC4 DISPATCH PROCESS - BEFORE VS AFTER



5. CONTROL

FINANCIAL IMPACT SUMMARY



RECOMMENDATIONS

Control Element	Implementation Description	Operational Purpose	KPI Target	Frequency	Corrective Action Trigger
Visual Controls	Parts 3902E, 4758, and 4759 are assigned to a physical color code. "Golden Zone" near the dispatch desk to ensure prime picking locations for high-runner SKUs only.	Reduce travel distance, aisle congestion, and search waste while sustaining lean picking flow.	Maintain >20% travel reduction and prevent siding congestion.	Weekly visual inspection	Any misplaced non-high runner items in Golden Zone triggers immediate re-organizing correction.
Standard Work	Monthly audit checklist verifies compliance with the Redesign Dispatch Workflow, including sequential picking paths and elimination of "backing back".	Sustain standardized dispatch execution and minimize performance variation between operators.	Maintain average dispatch time < \$3.24	Monthly	No training initiated if workflow deviations or repeated rule infractions are observed.
Statistical Monitoring	Warehouse manager tracks the Coefficient of Variation (CV) to dispatch time performance using monthly dispatch data.	Detect process instability early and prevent a return of high-variability flow states.	Maintain CV below 30-35%	Monthly	CV above 35% automatically triggers a Root Cause Analysis (RCA) Review.
Digital Pick-to-Light	Barcode scanning validation is integrated into CASTRO. Operator cannot press "Complete" unless the correct part number and quantity are scanned successfully.	Prevent inventory inaccuracies at the point of pick and eliminate manual confirmation errors.	Sustain inventory accuracy at 97%	Real-time / Daily	System blocks transaction completion until validation is corrected.
5-Minute Rule	Dispatch requests remaining inactive beyond 5 minutes require immediate supervisor review or automatic escalation notification.	Eliminate artificial/unnecessary in-queue and system confirmation delays.	Reduce manual validation delay from 1.20 min to < 0.20 min.	Daily system monitoring	Escalation alert sent automatically to warehouse supervisor dashboard.
Weekly Accuracy Audits	Cycle count audits validate physical inventory against CASTRO records for high-runner SKUs.	Sustain inventory visibility and eliminate extreme search-line outliers.	Maintain > 97% inventory accuracy	Weekly	Inventory discrepancy investigation and recount procedure initiated immediately.

FINAL CONCLUSIONS & ACKNOWLEDGMENTS

Lean Six Sigma improvements reduced dispatch lead time by 25%, improved inventory accuracy from 92% to 97%, and stabilized process variability below 30% CV, demonstrating significant gains in warehouse efficiency and process standardization at Parker Curtis Instruments PR, Inc.

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