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Phase 4: Performance of the Project

Title: Quality Control in Manufacturing

Objective

The focus of Phase 4 is to enhance the performance and reliability of the Quality Control (QC) processes in manufacturing. This includes:

- Refining inspection procedures
- Increasing production line efficiency
- Strengthening compliance with standards
- Reducing defect rates
- Improving overall product consistency through robust documentation and feedback mechanisms

1. Inspection Process Optimization

Overview:

Evaluation and refinement of manual and system-based inspections to improve precision, coverage, and speed. Focus is on minimizing human error and standardizing assessment procedures.

Key Enhancements:

- Improved Checklists: Detailed steps for product evaluation
- Standard Operating Procedures (SOPs): Uniform inspections across batches

Outcome:

Consistent inspection processes reduce variability and ensure accurate, timely defect identification.

2. Sampling and Testing Efficiency

Overview:

Enhanced sampling methods to balance thoroughness with speed, especially in high-output scenarios.

Key Enhancements:

- Statistical Sampling: Random and stratified techniques for representative inspections

- Rapid Testing: Fast, non-destructive compliance checks

Outcome:

Maintains productivity while ensuring sufficient inspection coverage, avoiding production **bottlenecks**.

3. Documentation and Compliance Tracking

Overview:

Standardizing and centralizing QC records for easy traceability and audits.

Key Enhancements:

- Unified Documentation: Standard formats for defect logs, corrective actions, and tests
- Compliance Monitoring: Regular audits for adherence to ISO/internal standards

Outcome:

Improved audit readiness and trend tracking through centralized quality data.

4. Feedback Integration for Continuous Improvement

Overview:

Close collaboration between production and inspection teams to address quality issues through root cause analysis.

Key Enhancements:

- Defect Pattern Analysis: Categorization of issues for root cause identification
- Process Corrections: Equipment calibration or training improvements

Outcome:

Dynamic quality control with continuous improvements to prevent recurring issues.

5. Performance Metrics and Line Monitoring

Overview:

Tracking key quality indicators (KQIs) to evaluate line performance and identify improvement areas.

Key Enhancements:

- Rejection Rate: Monitoring failed units
- First-Pass Yield: Tracking products that pass without rework
- Downtime Logs: Recording equipment-related issues

Outcome:

Enables data-driven decision-making and real-time quality process optimization.

Key Challenges in Phase 4

- Consistency Across Inspectors
 - Challenge: Subjectivity in manual inspections
 - Solution: SOPs and retraining sessions
- Maintaining Speed with Accuracy
 - Challenge: Thorough inspections may slow production
 - Solution: Use of statistical sampling and rapid testing
- Paper-Based Record Errors
 - Challenge: Prone to human errors or data loss
 - Solution: Move to digital documentation for better traceability

Outcomes of Phase 4

- Enhanced defect detection through standardized inspections
- Improved efficiency via optimized sampling and testing
- Full traceability and compliance through consistent documentation
- Continuous process enhancements via actionable feedback loops

Next Steps for Finalization

- Introduce digital tools for documentation and monitoring
- Plan for integration with production systems for real-time tracking
- Move toward full automation of quality processes

SOURCE CODE:

```
phse 4 > ...
1  import matplotlib.pyplot as plt
2
3  # Sample data: defects found in each of 10 batches
4  batches = list(range(1, 11))
5  defects_per_batch = [2, 1, 0, 3, 1, 0, 0, 2, 1, 1]
6
7  # First Pass Indicator: 1 if no defects, 0 otherwise
8  first_pass = [1 if defects == 0 else 0 for defects in defects_per_batch]
9
10 # Create the plot
11 fig, ax1 = plt.subplots(figsize=(10, 6))
12
13 # Bar chart for defects per batch
14 ax1.bar(batches, defects_per_batch, color='skyblue', label='Defects per Batch')
15 ax1.set_xlabel("Batch Number")
16 ax1.set_ylabel("Number of Defects", color='blue')
17 ax1.set_title("Phase 4 Quality Control Performance Metrics")
18 ax1.set_xticks(batches)
19
20 # Overlay First Pass Yield line
21 ax2 = ax1.twinx()
22 ax2.plot(batches, first_pass, 'go--', label='First Pass (1 = Pass)', linewidth=2)
23 ax2.set_ylabel("First Pass Indicator", color='green')
24
25 # Combine legends
26 lines1, labels1 = ax1.get_legend_handles_labels()
27 lines2, labels2 = ax2.get_legend_handles_labels()
28 ax1.legend(lines1 + lines2, labels1 + labels2, loc='upper right')
29
30 # Display the plot
31 plt.tight_layout()
32 plt.show()
33
```

OUTPUT:

