Manufacturing Operations Analysis

Project Overview

This Project Provides A Comprehensive Technical Analysis Of Manufacturing Operations For A Biscuit Production Facility. The Analysis Covers Production Performance, Machine Efficiency, Quality Control, Overall Equipment Effectiveness (Oee), And Production Planning.

Dashboards Analyzed

The Project Analyzes Five Operational Dashboards:

1. **Factory Overview Dashboard** - Production Metrics, Downtime, Performance Indicators

2. **Machine Performance Analysis Dashboard** - Speed, Downtime, And Machine-Specific Metrics

3. **Product Quality & Production Dashboard** - Defects, Good Units, And Quality Trends

4. **Oee Detailed Analysis Dashboard** - Overall Equipment Effectiveness And Loss Analysis

5. **Production Insights Dashboard** - Planning Metrics And Product Distribution

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Key Findings

Performance Metrics

- Overall Performance: 89%

- Quality Rate: 60%

- Oee: 54%

- Availability: 99%

- Reject Rate: 39%

Critical Issues

Low Quality Rate (60%)

- Root Cause: Biscuit Filling Machine Quality Index Of 0.59

- Impact: 39% Reject Rate, Significant Annual Losses

Suboptimal Oee (54%)

- World-Class Target: 85%

- Gap: 31 Percentage Points

- Operating At 50% Of Theoretical Capacity

Machine Bottleneck

- Biscuit Filling Machine: 44,000 Minutes Downtime (31% Of Total)

- System Capacity Constraint

Production Volatility

- Daily Output Varies From 510k To 1.91m Units

- "No Order" Downtime: 73% Of Total Downtime

- Poor Demand Forecasting

Recommendations

Immediate Actions (0-30 Days)

- Biscuit Filling Machine Maintenance Overhaul

- Implement Real-Time Quality Monitoring

- Establish Preventive Maintenance Schedule

Short-Term (1-3 Months)

- Reduce Changeover Time By 50%

- Deploy Predictive Maintenance System

- Implement Quality Management System

Medium-Term (3-12 Months)

- Upgrade Biscuit Filling Machine Capacity

- Deploy Production Planning System

- Launch Six Sigma Quality Program

Expected Impact

- Total Investment Required: $1.5m

- Potential Annual Benefits: $2.8m

- Payback Period: 6-7 Months

- First Year Roi: 187%

Tools & Technologies

Data Cleaning

- Python (Pandas, Numpy)

- Data Validation And Preprocessing

Data Analysis

- Microsoft Excel

- Power Bi

- Statistical Analysis

Methodologies

- Oee Analysis

- Root Cause Analysis

- Six Sigma

- Theory Of Constraints

Project Structure

Manufacturing-Analysis/

Data/

- Cleaned_Data.Csv - Data After Python Cleaning Process

- Data_Dictionary.Txt - Description Of Data Fields

Python_Scripts/

- Data_Cleaning.Py - Main Data Cleaning Script

- Notebook.Pdf

Reports/

- Technical_Report.Pdf - Full Technical Analysis Report

- Business_Report.Pdf - Business-Focused Report With Recommendations

Dashboards/

- Dashboard_01_Factory_Overview.Png - Production Metrics And Performance Indicators

- Dashboard_02_Machine_Performance.Png - Machine Efficiency And Speed Analysis

- Dashboard_03_Quality_Production.Png - Quality Metrics And Defect Analysis

- Dashboard_04_Oee_Analysis.Png - Overall Equipment Effectiveness Breakdown

- Dashboard_05_Production_Insights.Png - Production Planning And Insights

Presentation/

- Project_Presentation.Pptx - Main Presentation Slides

Analysis/

- Power_Bi_Dashboard.Pbix - Power Bi Dashboard File

- Excel_Analysis.Xlsx - Excel Analysis Workbook

Key Metrics

Oee Calculation

Oee = Availability × Performance × Quality

Oee = 0.99 × 0.89 × 0.60 = 54%

Production Metrics

- Average Production: 166,950 Units/Cycle

- Actual Speed: 5,530 Units/Hour

- Target Speed: 11,050 Units/Hour

- Speed Achievement: 50%

Quality Metrics

- First Pass Yield: 60%

- Defect Rate: 39%

- Average Defects: 56,300 Units/Cycle

- Average Good Units: 110,650 Units/Cycle

Production Distribution

- Chocolate Cookies: 55.77% (6m Units)

- Custard Creams: 16.17% (2m Units)

- Jammy Creams: 14.46% (1m Units)

- Bourbon Creams: 13.60% (1m Units)

Machine Performance

Downtime Ranking

1. Biscuit Filling Machine: 44,000 Min (31%)

2. Biscuit Mixing Machine: 19,000 Min (14%)

3. Biscuit Forming Machine: 19,000 Min (14%)

Quality Performance

- Best Quality Day: 81%

- Worst Quality Day: 55%

- Average Quality: 71%

Implementation Timeline

Months 1-3: Emergency Maintenance, Quality Controls, Quick Wins

Months 4-6: Changeover Reduction, Predictive Maintenance, Quality System

Months 7-12: Capacity Upgrade, Planning System, Six Sigma Program

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Financial Impact

Current Annual Losses

- Quality Problems: $1,250,000

- Downtime Costs: $900,000

- Inefficiencies: $650,000

- Total: $2,800,000/Year

After Improvements

- Quality Improvement: $812,500 Savings

- Oee Improvement: $1,500,000 Revenue

- Downtime Reduction: $490,000 Savings

- Total Benefit: $2,802,500/Year

Performance Targets

12-Month Targets:

- Oee: 54% To 75%

- Quality: 60% To 85%

- Biscuit Filling Machine Downtime: 44,000 To 20,000 Minutes

- Production Volatility: Reduce By 60%