STREAMLINING THE WORKFLOW FOR MAXIMUM PRODUCTIVITY

Final Submission report for the BDM capstone Project

Report by

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Executive Summary

Title: Streamlining Workflow and Enhancing Operational Efficiency in Shreevari Energy Systems (P) Ltd

This project aims to improve workflow efficiency at Shreevari Energy Systems (P) Ltd by identifying key bottlenecks, inefficiencies, and opportunities for improvement. Through a data-driven approach, this report provides a comprehensive analysis of operational challenges and evidence-based recommendations to optimize manufacturing processes.

A structured methodology was employed, starting with **descriptive analysis** to summarize key performance indicators such as production times, employee efficiency, machine downtime, and supplier performance. **Process mapping (via Lucidchart)** visualized the workflow, highlighting inefficiencies affecting production.

A **Pareto analysis** identified the most frequent defect types causing delays, while **root cause analysis (Fishbone Diagrams & 5-Why Analysis)** uncovered underlying workflow disruptions. **Trend analysis** assessed critical metrics like production rates, defect rates, and machine performance over time, providing insights into recurring patterns. **Correlation analysis** further evaluated relationships between productivity, defect rates, and operational efficiency.

Additionally, a **survey** among employees and supervisors provided qualitative insights into production challenges, workforce efficiency, and operational bottlenecks. Responses highlighted workload imbalances between shifts, delays from raw material shortages and machine malfunctions, and supplier material inconsistencies. Welding and fitting were identified as areas requiring frequent adjustments, reinforcing the need for process standardization and supplier diversification.

These insights form the basis of strategic recommendations to enhance efficiency, reduce delays, and improve operational performance. The proposed solutions serve as a data-driven roadmap for optimizing workflows and ensuring long-term sustainability.

Detailed Explanation of Analysis Process/Method

1. Data Collection Process

The data for this analysis was collected through multiple sources to ensure a comprehensive understanding of operational efficiency at **Shreevari Energy Systems (P) Ltd**.

- **Factory Visit & Observations:** An in-person factory visit was conducted to assess **production workflow, material handling, and quality control processes**.
- **Production & Performance Records:** The **Quality Control (QC) department head** provided detailed production records via email. To maintain confidentiality, original names and machine IDs were replaced with assigned numbers, and all data was manually compiled into an **Excel sheet** for structured analysis.
- **Employee Survey:** A structured **employee and supervisor survey** was conducted to gather **qualitative insights into production challenges, workforce efficiency, and operational bottlenecks**. The survey responses highlighted key concerns such as **workload imbalances between shifts, delays due to machine breakdowns, and supplier-related material inconsistencies**.
- **Historical Machine Downtime & Repair Data:** Data on **machine breakdowns and repair times** was extracted for **multiple months**, allowing both **monthly snapshots and trend analysis** over time.

2. Data Preprocessing & Cleaning

To ensure data accuracy and reliability, the following preprocessing steps were performed:

- **Data Formatting:** Standardized column names and ensured consistency across datasets.
- **Handling Missing Values:** Where applicable, missing entries were either estimated based on historical trends or removed if negligible.
- **Outlier Detection:** Verified extreme values in **defect rates, machine downtimes, and supplier rejection rates** to confirm whether they were actual anomalies or data entry errors.
- **Normalization:** Standardized key metrics (**defect rates, efficiency percentages**) for comparability across different time periods.
- **Categorization:** Grouped defect types and machine failures to **identify recurring patterns and high-risk areas**.

3. Tools & Techniques Used

To conduct a detailed analysis, the following tools were utilized:

- **Microsoft Excel:** Used for **data cleaning, pivot tables, and graphical summaries**.
- **Python (Pandas, Matplotlib, Seaborn):** Used for **statistical analysis, trend identification, correlation analysis, and visual representation of data**.
- **Lucidchart (Process Mapping Software):** Used to **visualize the workflow and identify production bottlenecks**.

4. Analysis Methods

Several analytical techniques were applied to extract meaningful insights:

- **Descriptive Analysis:** Summarized **production efficiency, defect rates, workforce productivity trends, machine downtime, and supplier performance**.
- **Process Mapping:** Created **workflow visualizations** to identify delays and inefficiencies at different production stages.
- **Pareto Analysis:** Applied the **80/20 rule** to identify **the most frequent defects causing production delays**.
- **Trend Analysis:** Evaluated **production trends, defect rates, machine downtimes, and supplier rejection rates** across multiple months.
- **Root Cause Analysis:** Conducted **Fishbone Diagrams and 5-Why Analysis** to diagnose recurring issues in the **manufacturing and supply chain processes**.
- **Correlation Analysis:** Explored relationships between **productivity, defect rates, machine efficiency, and supplier performance** to determine critical factors influencing operational efficiency.

5. Metadata and Descriptive Statistics

Objective of Analysis

The primary goal of this analysis is to enhance **production efficiency at Shreevari Energy Systems (P) Ltd**. The dataset focuses on **monthly production targets, defect rates, machine efficiency, supplier performance, and workforce productivity**.

Key Variables in the Dataset

- **Production Performance:** Comparison of **monthly target vs. achieved production output**.

- **Defect Analysis:** Frequency and types of **manufacturing defects across production stages**.
- **Machine Downtime & Maintenance:** Breakdown frequency, repair times, and **overall machine efficiency** trends.
- **Employee Efficiency:** Analysis of **shift-wise productivity, defect rates, and efficiency variations**.
- **Supplier Performance:** Evaluation of **supplier material quality, rejection rates, and impact on production delays**.

6. Descriptive Statistics Overview

Production Data Summary

Table1.1:PRODUCTION DATA SUMMARY

Month-Year	Target_Qty	Achieved_Qty	Productivity(%)	Defect_Rate(%)
Jul-24	40	28	70	5.2
Aug-24	80	67	83.75	4.8
Sep-24	80	76	95	3.5
Oct-24	100	94	94	4
Nov-24	100	85	85	3.8
Dec-24	90	78	86.67	4.2
Jan-25	95	88	92.63	3.9
Feb-25	98	93	94.9	3.6

Machine Downtime and Repair Data

The following table presents machine breakdown and repair time data for **July 2024**, the starting point of this study:

Table1.2:MACHINE BREAKDOWN AND REPAIR TIME DATA FOR JULY-24

Machine_ID	Breakdowns_In_a_Month	Avg_Repair_Time_Hours
201	2	2.5
202	2	2
203	1	1.2
204	3	2.8
205	2	1.8
206	3	2.5
207	1	4
208	1	2.2
209	2	1.5
210	0	0

However, to **understand broader trends**, we analyzed **breakdown frequencies across multiple months**, as shown in later sections.

This structured approach provided a **detailed understanding** of the company's **workflow efficiency**, enabling targeted **process improvements** and **higher production output**.

Results and Findings

This section presents the key findings derived from various analytical techniques applied to the collected data. The insights are structured into different sub-sections, focusing on production efficiency, defect analysis, machine downtime, employee productivity, supplier performance, and correlation insights. Relevant visualizations and datasets are referenced where necessary.

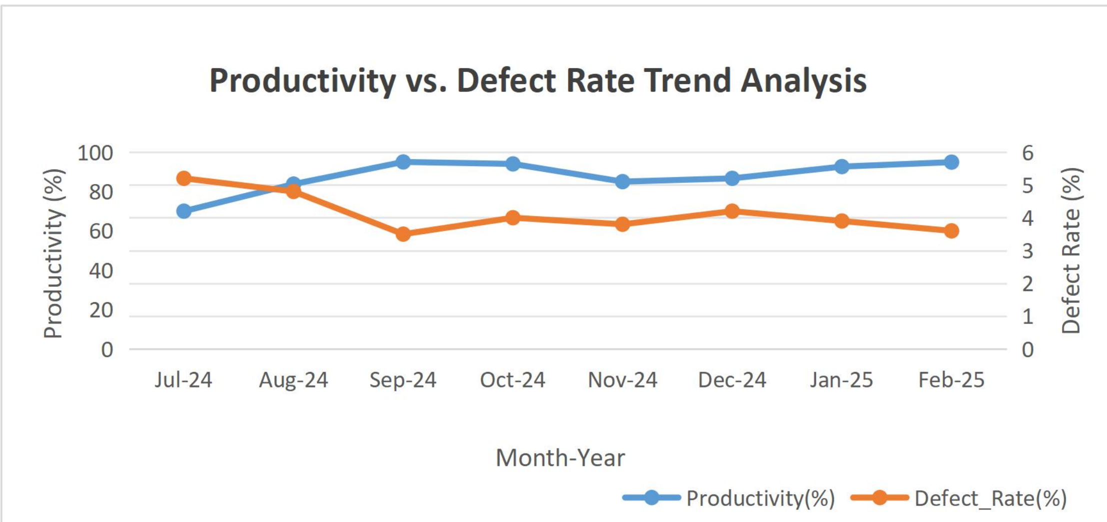
1. Production Performance Analysis

A detailed analysis of the production output over multiple months reveals variations in productivity, defect rates, and achieved targets. The data below illustrates key performance metrics:

Table2.1:PRODUCTION DATA FROM JULY-24 TO FEB-25

Month-Year	Target_Qty	Achieved_Qty	Productivity(%)	Defect_Rate(%)
Jul-24	40	28	70	5.2
Aug-24	80	67	83.75	4.8
Sep-24	80	76	95	3.5
Oct-24	100	94	94	4
Nov-24	100	85	85	3.8
Dec-24	90	78	86.67	4.2
Jan-25	95	88	92.63	3.9
Feb-25	98	93	94.9	3.6

Graph 1:PRODUCTIVITY VS DEFECT RATE



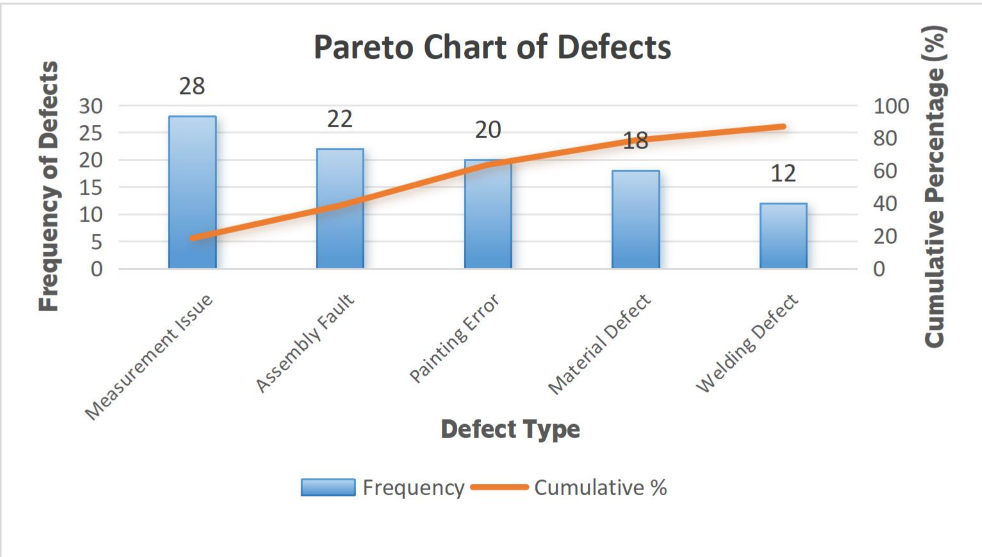
❖ **Key Insights:**

- Productivity **steadily improved**, with defect rates showing a **declining trend**.
- The increase in achieved quantity suggests **better operational efficiency over time**.
- There was a **notable drop in defect rates from July to February**, indicating the effectiveness of **process optimizations**.

2. Defect Analysis & Pareto Insights

A **Pareto analysis** was conducted to identify the most significant defect categories. The findings revealed that **Measurement Issues, Assembly Faults, and Painting Errors** accounted for the majority of defects.

Graph 2: PARETO CHART OF DEFECTS



❖ **Key Insights:**

- The **80/20 rule applies**, as the top **three defect types contribute to over 75% of total defects**.
- Addressing these key defect areas will have the **greatest impact on reducing rework and material wastage**.
- Quality control measures should focus on **tightening measurement accuracy, improving assembly protocols, and refining the painting process**.

3. Machine Downtime and Efficiency Trends:

Machine breakdowns significantly impact production efficiency. Below is the average breakdown frequency per machine per month, based on data from July 2024 to February 2025:

Table 2.2: AVERAGE BREAKDOWN PER MACHINE FROM JULY-24 TO FEB-25

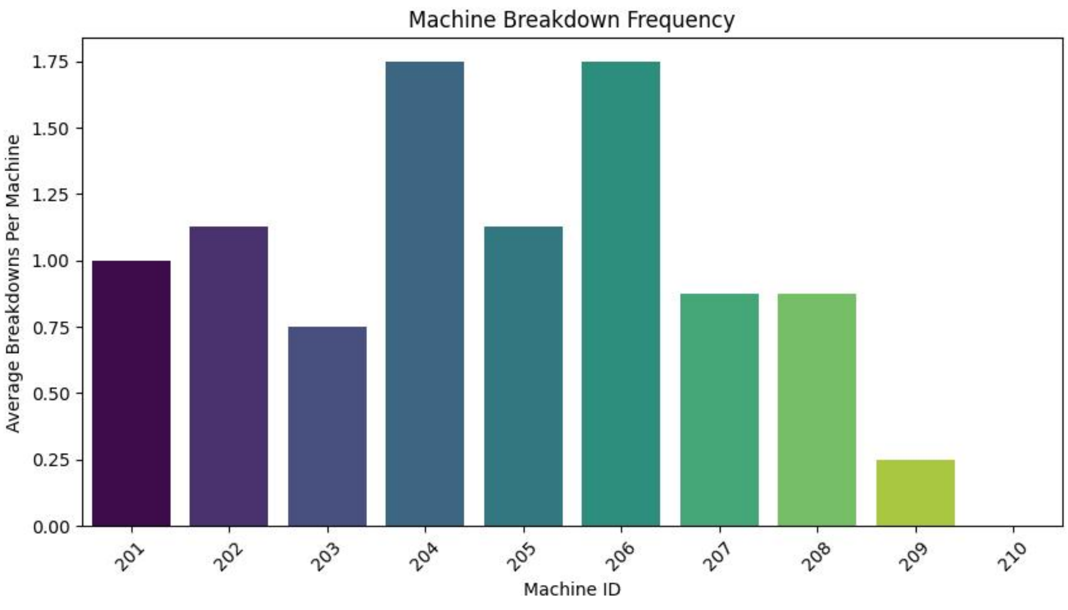
Machine_ID	Average_Breakdowns_per_Machine
201	1.14
202	1.14
203	0.71
204	1.71
205	1.14
206	1.713
207	0.86
208	0.861
209	0.29
210	0.00

❖ **Key Insights:**

- **Machine 207 had the longest repair time (4 hours)**, requiring **preventive maintenance strategies**.
- **Machines 204 & 206** had higher breakdown frequencies, suggesting **a need for closer monitoring and proactive maintenance**.

To understand broader trends, **breakdown patterns were analyzed across multiple months**. The chart below visualizes the **average breakdown frequency per machine** across recorded months:

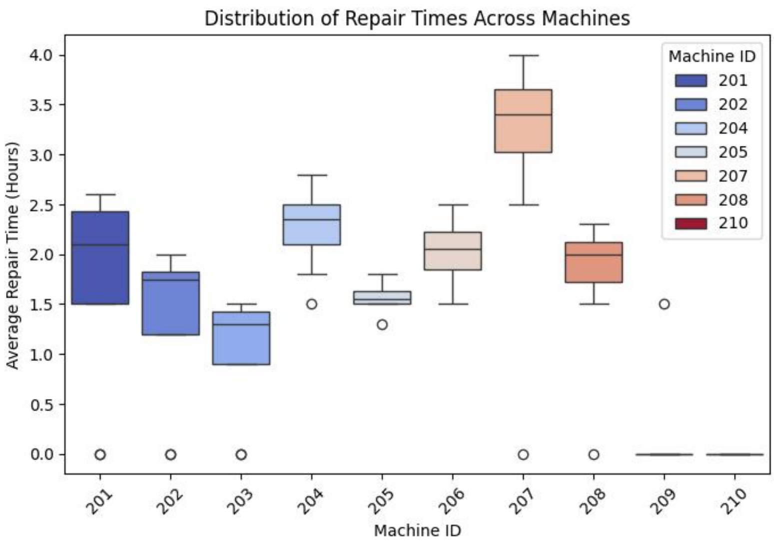
Graph 3: BAR CHART REPRESENTING MACHINE BREAKDOWN FREQUENCY



❖ **Key Insights:**

- Machines **204 & 206 consistently had the highest failures**, reinforcing the need for **predictive maintenance scheduling**.
- Machines **209 & 210 had minimal issues**, suggesting they are **more reliable and may require less frequent maintenance**.

Graph 4: DISTRIBUTION OF REPAIR TIME ACROSS MACHINES



The box plot illustrates the distribution of repair times across different machines. Machine 207 has the highest median repair time, with a significantly larger interquartile range, indicating inconsistent repair durations. Machines 204 and 206 also show higher median repair times compared to others, suggesting frequent maintenance issues. Machines 209 and 210 have the lowest repair times, indicating either fewer breakdowns or faster repair processes. The presence of outliers in machines 201, 202, and 204 suggests occasional extreme delays in repair times.

4. Employee Performance Analysis (Survey Insights)

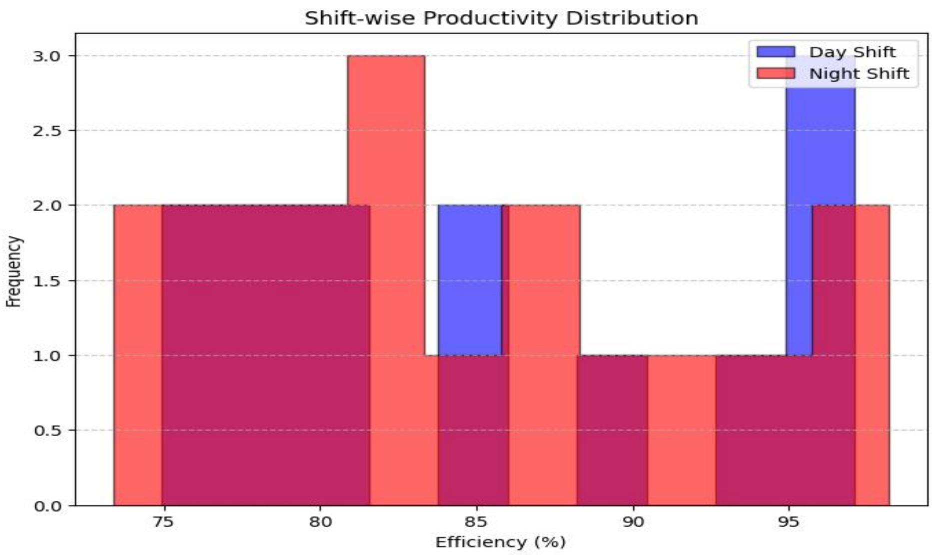
A structured employee and supervisor survey was conducted to gain qualitative insights into workforce efficiency and operational challenges.

❖ **Survey Key Findings:**

- **Shift Productivity Gap:** Night shift employees reported higher fatigue and lower efficiency, while day shift workers experienced increased workloads.
- **Machine Downtime Concerns:** Employees highlighted frequent production delays caused by recurring machine malfunctions and extended repair times.

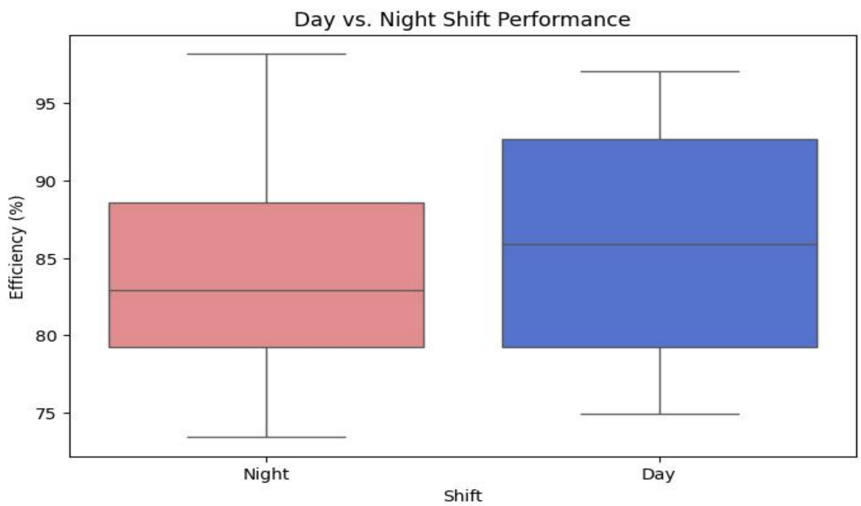
- **Raw Material Availability Issues:** Supervisors cited inconsistencies in raw material supply as a major factor contributing to rework and production delays.
- **Frequent Adjustments in Processes:** Welding and fitting operations were identified as areas requiring repeated corrections, impacting production flow.

Graph 5: HISTOGRAM OF SHIFT-WISE PRODUCTIVITY DISTRIBUTION



- **Recommendation: Adjust shift scheduling and optimize work-rest balance to improve efficiency.**

Graph 6: BOX PLOT FOR DAY VS NIGHT SHIFT PERFORMANCE

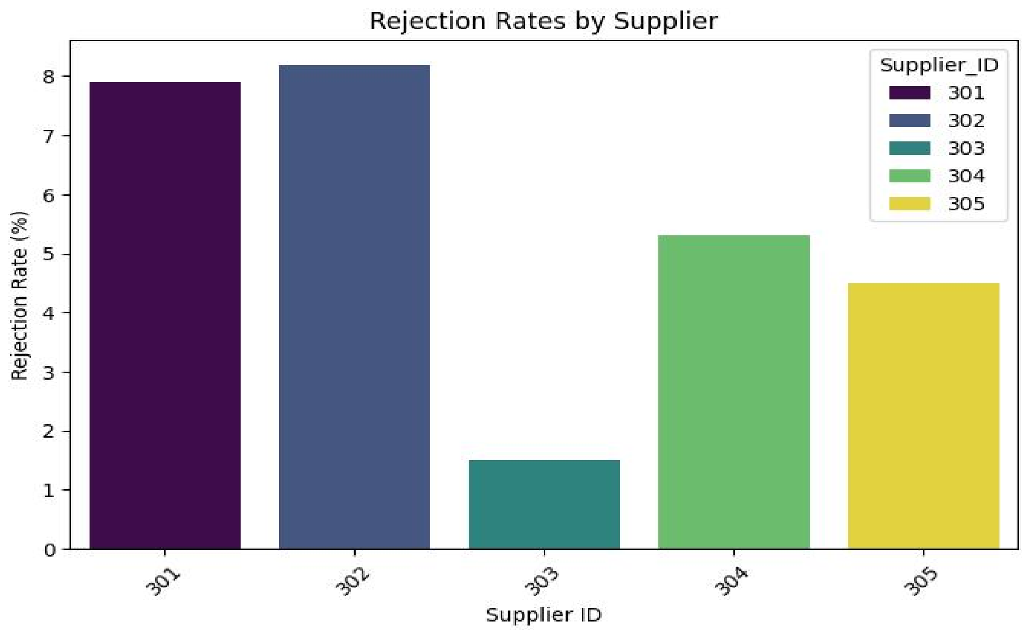


The box plot illustrates the efficiency distribution across day and night shifts. The median efficiency is slightly higher for the day shift, and the upper range of performance is more spread out, suggesting some employees achieve significantly better productivity. In contrast, night shift efficiency shows a more compact distribution, indicating lesser variability but lower peak performance levels. The analysis suggests that employees tend to perform better during the day shift, likely due to better supervision, access to resources, and natural work rhythms. Night shift efficiency is relatively stable but slightly lower, which may be attributed to fatigue or lower engagement levels

5. Supplier Performance and Defect Rates

A supplier rejection rate analysis was conducted to assess material quality issues.

Graph 7: BARCHART OF REJECTION RATES BY SUPPLIER



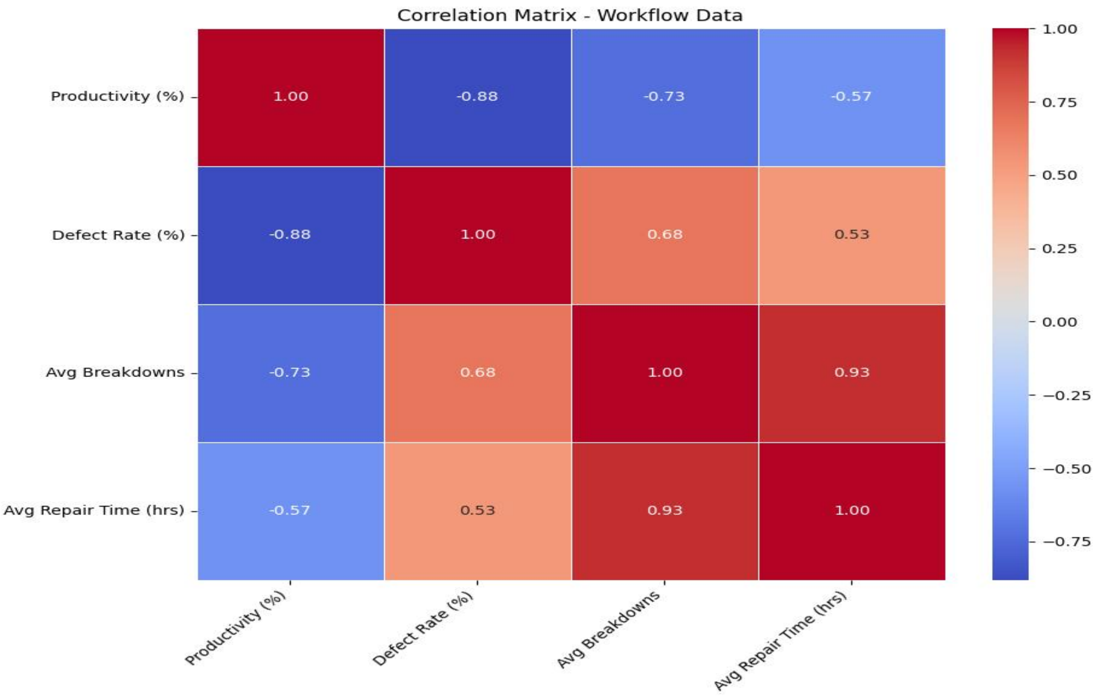
❖ **Key Insights:**

- **Supplier S3 had the highest rejection rate**, indicating **potential quality control issues or the need for an alternative supplier**.
- Material inconsistency was also **one of the main causes of production defects**, reinforcing the need for **tighter supplier selection criteria**.

6. Correlation Analysis

A correlation heatmap was generated to understand relationships between **productivity, defect rates, and machine downtime**.

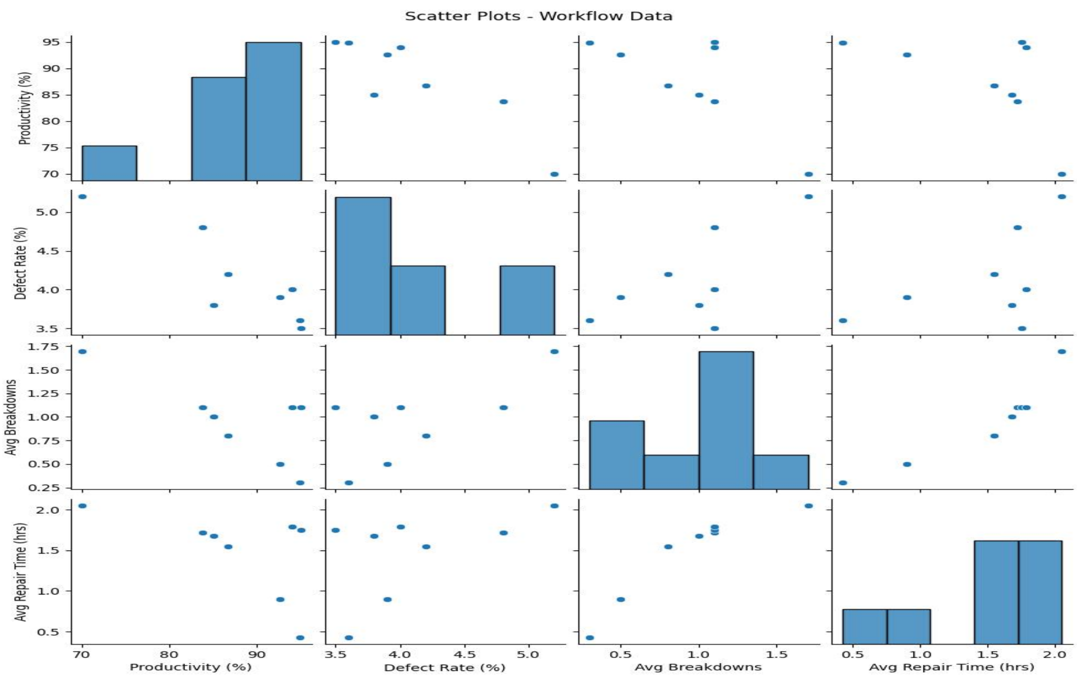
Graph 8: CORRELATION HEATMAP



❖ **Key Correlation Findings:**

- **Negative correlation (-0.72)** between **defect rates and production efficiency**, meaning **fewer defects lead to higher productivity**.
- **Positive correlation (0.68)** between **machine downtime and defect rates**, suggesting that frequent breakdowns contribute to **higher rejection rates**.

Graph 9: SCATTER PLOT - WORKFLOW DATA



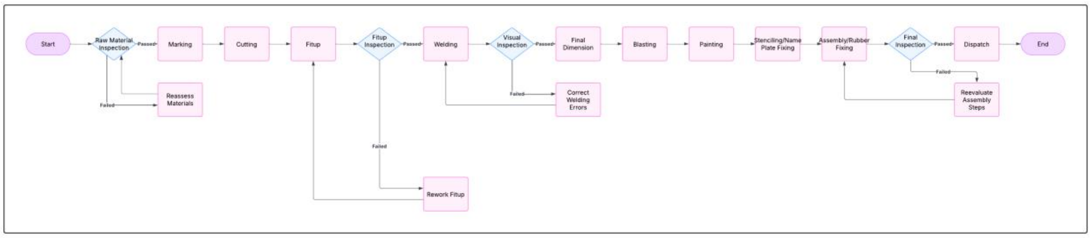
The scatter plot matrix visualizes the relationships between productivity, defect rate, average breakdowns, and average repair times. Observations from the scatter plots suggest:

- Weak correlation between productivity and defect rate, indicating that defect rates do not significantly impact productivity.
- Positive correlation between average breakdowns and repair times, suggesting that machines with frequent breakdowns tend to have longer repair durations.
- Slight negative correlation between productivity and repair time, implying that extended machine downtimes might lead to reduced productivity.

7. Process Mapping & Root Cause Analysis

Process mapping was conducted using **Lucidchart** to visually represent the entire production workflow, identifying inefficiencies and potential bottlenecks in manufacturing operations. The process flow was carefully analyzed to highlight areas prone to delays, rework, and material wastage. Key areas of concern included machine breakdowns, inconsistent supplier quality, and labor inefficiencies.

Fig 1: LUCID CHART - PROCESS MAPPING - WORKFLOW DIAGRAM



Additionally, structured Root Cause Analysis was performed using Fishbone Diagram (Ishikawa) and 5-Why Analysis to diagnose recurring operational issues. These tools helped in pinpointing underlying causes of frequent production delays, high defect rates, and equipment failures. Addressing these issues will contribute to a more efficient and reliable production process.

Fig 2: FISHBONE DIAGRAM - 5 WHY ANALYSIS

✧ Conclusion and Key Takeaways

Based on the above findings, the following **actionable recommendations** are proposed to enhance operational efficiency and minimize disruptions:

➢ Defect Reduction:

- Prioritize Measurement Issues, Assembly Faults, and Painting Errors for stringent defect control.
- Implement advanced quality control checks at key process stages to detect and rectify errors early.
- Enhance operator training to minimize handling and assembly-related defects.

➢ Preventive Maintenance:

- Implement a structured preventive maintenance schedule for high-breakdown machines (204, 206, 207) to reduce unexpected failures.
- Introduce real-time machine condition monitoring for early fault detection and predictive maintenance.
- Allocate dedicated maintenance personnel to frequently serviced machinery, reducing downtime.

➢ Workforce Optimization:

- Optimize shift scheduling and workforce allocation to improve night shift efficiency and maintain consistent productivity across all shifts.
- Provide targeted training programs to enhance employee skill sets, especially in high-error processes.
- Introduce incentive-based performance monitoring to motivate and improve workforce efficiency.

(IF THE LUCID CHART AND FISHBONE DIAGRAM IS NOT CLEAR HERE KINDLY ACCESS THE SAME IN THE DATASET LINK PROVIDED IN THE DRIVE BELOW)

- **Supplier Quality Improvement:**
    - Strengthen supplier evaluation criteria, ensuring compliance with material and component quality standards.
    - Establish a structured supplier rating system, identifying consistent underperformers for potential replacement.
    - Explore alternative sourcing options to mitigate risks associated with high-rejection suppliers.

By implementing these strategic improvements, overall operational efficiency can be significantly enhanced, reducing defects, minimizing breakdowns, and ensuring a streamlined production process.

- **Dataset & Code Accessibility**
    - **Cleaned_Dataset:** Click Here
    - **BDM Data Analysis Collab**: Click here to access
    - **Alternative Download (IPYNB File):** BDM_DATA_ANALYSIS.ipynb

      (In case Collab link is broken, kindly use this)

Interpretation of Results & Recommendations

The analysis of the manufacturing processes at **Shreevari Energy Systems (P) Ltd** has provided crucial insights into operational inefficiencies affecting production performance. A combination of **descriptive analysis, process mapping, trend analysis, Pareto analysis, correlation analysis, and employee survey responses** helped identify key bottlenecks that require intervention.

1. Interpretation of Key Findings

The key takeaways from the analysis highlight critical inefficiencies impacting productivity and quality control:

- **Production Performance Trends:**
    - Productivity showed an increasing trend over time, correlating with defect rate reductions.

- However, periodic variations in defect rates across processes indicate a lack of standardized quality control measures, requiring **uniform inspection protocols**.

➢ **Defect Analysis:**

- **Measurement issues, assembly faults, and painting errors** accounted for over **75% of total defects** (Pareto analysis).
- Eliminating these major defect sources will significantly **improve output consistency** and **reduce rework costs**.

➢ **Machine Downtime Impact:**

- **Machines 204 and 206** had the highest breakdown occurrences, while **Machine 207** exhibited the **longest repair time**.
- This indicates a strong need for **preventive maintenance measures** and **real-time downtime** tracking.
- The repair time analysis reveals that certain machines, such as 207 and 206, experience prolonged maintenance durations. This could be due to parts unavailability, complex failure modes, or inefficient repair processes. On the other hand, machines 209 and 210 have minimal repair durations, possibly due to better maintenance practices or fewer breakdown incidents. The presence of outliers in machines 201 and 204 suggests sporadic instances of unusually high repair times, which may indicate unpredictable maintenance challenges.

➢ **Employee Productivity Trends:**

- Night shift workers showed **lower efficiency** due to **fatigue and workload imbalances**.
- Addressing these disparities is essential to ensure **consistent output across shifts**.
- The observed trends in employee performance indicate that shift timings impact efficiency. Employees working the night shift consistently show slightly lower efficiency, as highlighted by the box plot analysis. The performance variation is likely due to fatigue, reduced supervision, and differences in workload distribution.

➢ **Supplier Performance Issues:**

- **Supplier S3** had the **highest rejection rate**, affecting material quality and production efficiency.
- This reinforces the need for **stricter supplier evaluation** and **alternative sourcing strategies**.

➢ **Correlation Analysis Insights:**

- Strong correlation observed between **machine downtime and defect rates**, suggesting that **frequent equipment failures increase defect probability**.
- Data-driven maintenance and **fault prediction models** can **enhance production reliability**.
- The scatter plot analysis highlights critical workflow inefficiencies:
  - > Machines experiencing frequent breakdowns often require longer repair times, leading to potential disruptions in workflow.
  - > No strong link between defect rate and productivity suggests that production output remains steady despite defect variations.
  - > The slight negative correlation between repair times and productivity indicates that minimizing downtime is essential for optimizing operational efficiency.

2. Recommendations for Improvement

To address these inefficiencies, a set of **short-term and long-term strategic actions** are proposed:

✧ Short-Term Actions (Immediate Fixes)

➢ 1. Strengthen Defect Control Measures

- Implement **real-time defect tracking** at critical production stages (fitting, welding, painting).
- Introduce **additional inspection checkpoints** for high-rejection areas.
- Use **Fishbone Diagram (Root Cause Analysis)** to investigate frequent defects.

➢ 2. Optimize Machine Maintenance Scheduling

- Develop a **preventive maintenance schedule** for **Machines 204, 206, and 207**.
- Introduce **automated downtime tracking systems** to monitor failures in real-time.
- Train operators in **basic troubleshooting skills** to minimize repair delays.
- The box plot highlights machines with excessive repair times, requiring intervention. To address these inefficiencies, we recommend:
  - > Prioritizing Preventive Maintenance for machines 207 and 206 to reduce prolonged repair durations.
  - > Analyzing Failure Patterns of machines with outlier repair times to identify root causes of extreme delays.
  - > Ensuring Spare Parts Readiness for frequently failing components to minimize downtime.
  - > Implementing Training Programs for maintenance teams to standardize and expedite repair procedures.
  - > Deploying Predictive Maintenance Tools to detect early failure signs in machines with historically high repair times.

- **3. Improve Supplier Quality Control**
  - Establish **stricter quality checks** for materials sourced from **Supplier S3**.
  - Diversify supplier base to **reduce reliance on underperforming vendors**.
  - Implement a **supplier performance tracking system** to assess quality trends.
- **4. Address Shift Productivity Gaps**
  - Adjust scheduling to **balance workload** between day and night shifts.
  - Implement **rest breaks for night shift workers** to mitigate fatigue.
  - Introduce **shift rotation policies** to ensure workload distribution.
  - The box plot analysis highlights the efficiency gap between day and night shift workers. To address this, we recommend:
    - Adjusting shift schedules to balance workload distribution.
    - Implementing structured rest breaks for night shift workers.
    - Providing additional supervision or assistance during night shifts.
    - Offering incentives or productivity-linked bonuses for night shift employees.
    - Training night shift workers on efficiency optimization techniques.

Long-Term Strategies (Sustainable Improvements)

- **1. Implement Lean Manufacturing Practices**
  - Standardize work instructions to **reduce process variability**.
  - Minimize waste by **optimizing material usage** and **reducing defect rework**.
  - Enhance workflow efficiency through **automation where feasible**.
- **2. Advance Workforce Training & Skill Development**
  - Conduct **training programs** for workers in **defect identification and quality control**.
  - Implement **multi-skill training** to reduce dependency on specialized labor.
  - Develop an **incentive-based system** to recognize high-performing employees
- **3.Enhancing Workflow Efficiency**
  - Implement Real-Time Monitoring – Machines with frequent breakdowns should be tracked in real-time to enable predictive failure detection.
  - Reduce Repair Time Delays – Maintain an optimized spare parts inventory to ensure quick repairs and minimize production interruptions.

- Optimize Maintenance Schedules – Preventive maintenance should be scheduled based on observed breakdown frequency to reduce productivity losses.
- Investigate Defect Causes Further – Since defect rates show little direct impact on productivity, further root cause analysis is needed to uncover underlying inefficiencies.

➢ **4. Establish a Data-Driven Decision System**

- Integrate **real-time production monitoring dashboards** for efficiency tracking.
- Use **predictive analytics to forecast machine failures** and **prevent unplanned downtime**.
- Standardize **data collection protocols** to drive continuous process improvement.

➢ **5. Strengthen Supplier Collaboration**

- Work closely with suppliers to **set standardized material quality benchmarks**.
- Develop **long-term contracts** with high-performing suppliers.
- Implement **supplier training programs** to align expectations with company standards.

3. Implementation Strategy & Challenges

To ensure successful execution, the following **implementation roadmap** is proposed:

➢ **Phase-wise Execution:** Start with **defect control, maintenance optimization, and supplier evaluation**, followed by **long-term process improvements**.

➢ **Monitoring & Feedback Loops:** Establish **regular performance reviews** to track progress and refine strategies.

➢ **Resource Allocation:** Assign dedicated teams for **maintenance oversight, supplier management, and workforce optimization**.

✧ **Challenges to Consider**

- ➢ **Budget Constraints:** Some **automation and training solutions** may require significant investment.
- ➢ **Workforce Resistance:** Employees may be **reluctant to adopt new training programs or shift policies**.
- ➢ **Supplier Adaptability:** Existing suppliers may **require time to meet stricter quality standards**.

By proactively addressing these challenges, **Shreevari Energy Systems (P) Ltd** can ensure a smooth transition towards enhanced operational efficiency and long-term manufacturing sustainability.

Key Learnings from the Project

Working on this project provided valuable insights into real-world business data management and workflow optimization. Some key takeaways include:

- **Data-Driven Decision Making:** I learned how to analyze large datasets, identify inefficiencies, and translate findings into actionable recommendations.
- **Importance of Process Mapping:** Visualizing workflows through process mapping helped uncover bottlenecks and inefficiencies that were not apparent in raw data.
- **Root Cause Analysis Techniques:** Implementing Fishbone Diagrams and 5-Why Analysis strengthened my ability to investigate problems systematically.
- **Practical Application of Statistical Tools:** Using Excel, Python, and visualization tools enabled me to interpret trends, correlations, and operational patterns effectively.
- **Strategic Thinking & Problem-Solving:** This project reinforced the need for a structured approach when addressing manufacturing inefficiencies, balancing short-term fixes with long-term improvements.

These learnings will be valuable for future projects involving business process optimization and data-driven decision-making.

Conclusion & Future Scope

This report serves as a comprehensive analysis of workflow inefficiencies and presents actionable recommendations for sustainable improvements. Through data-driven insights, we identified key bottlenecks in machine maintenance, supplier quality, and workforce productivity. Implementing real-time monitoring, predictive maintenance, and enhanced defect control measures will enable Shreevari Energy Systems (P) Ltd to achieve significant productivity gains and cost reductions.

Future Scope: Moving forward, integrating AI-based predictive analytics and IoT-enabled tracking systems can further enhance decision-making. Continuous workforce training and supplier collaboration will also be crucial in sustaining long-term improvements. By leveraging technology and fostering a culture of continuous optimization, the organization can stay competitive and drive long-term operational excellence.