INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

BUSINESS DATA MANAGEMENT PROJECT

FINAL REPORT

Enhancing Mill Efficiency through Data-Driven Insights

Submitted by:
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December 10, 2023

Declaration Statement

I am working on a Project titled “Enhancing Mill Efficiency through Data Driven Insights”. I extend my appreciation to **Subha Sree Rice Mill,** for providing the necessary resources that enabled me to conduct my project.

I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered from primary sources and carefully analyzed to assure its reliability.

Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

I am dedicated to adhering to the information of academic honesty and integrity, and I am receptive to any additional examination or validation of the data contained in this project report.

I understand that the execution of this project is intended for individual completion and is not to be undertaken collectively. I thus affirm that I am not engaged in any form of collaboration with other individuals, and that all the work undertaken has been solely conducted by me. In the event that plagiarism is detected in the report at any stage of the project’s completion, I am fully aware and prepared to accept disciplinary measures imposed by the relevant authority.

I understand that all recommendations made in this project report are within the context of the academic project taken up towards course fulfillment in the BS Degree Program offered by IIT Madras. The institution does not endorse any of the claims or comments.

Signature of Candidate: **(Digital Signature)**

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Date: 10-12-2023

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1 Executive Summary

The data analysis project for Subha Sree Rice Mill is designed to elevate operational efficiency and decision-making through data-driven insights. With a primary focus on improved production planning, supplier evaluation, and ensuring timely deliveries to suppliers, the project strives to maximize profits by optimizing the milling process. By leveraging advanced analytics using MS Excel, the goal is to identify strategic opportunities for efficiency gains, cost-effectiveness, and overall process optimization. This holistic approach ensures that Subha Sree Rice Mill is positioned for sustained success in the competitive rice and dal processing industry, emphasizing profitability and operational excellence.

Project Objectives:

Operational Analysis:

Conduct a detailed analysis of the mill's current operational processes, including the milling workflow, resource utilization, and production timelines.

Supplier Relationship Management:

Evaluate the relationships with raw material suppliers to ensure a streamlined and efficient supply chain. Assess the quality and consistency of raw materials received, with a specific focus on timely deliveries to suppliers.

Production Planning:

Develop and implement data-driven production planning strategies to optimize resource allocation, minimize downtime, and enhance overall operational efficiency.

Process Optimization:

Identify opportunities for process optimization within the milling operations. This could involve automation, technology upgrades, or workflow adjustments for increased efficiency.

Data-Driven Decision-Making:

Establish a framework for utilizing data insights to make informed decisions regarding production schedules, inventory management, and resource allocation.

Conclusion:

The data analysis project for Subha Sree Rice Mill has provided valuable insights and strategic recommendations to enhance operational efficiency and decision-making. By focusing on improved production planning, supplier evaluation, and ensuring timely deliveries to suppliers, the mill is well-positioned for sustained success in the competitive rice and dal processing industry. The project emphasizes a holistic approach to maximize profits, optimize processes, and leverage advanced analytics for informed decision-making.

As Subha Sree Rice Mill moves forward, integrating these data-driven insights will not only address current challenges but also position the mill as an industry leader. The commitment to operational excellence, technological integration, and proactive supplier management will contribute to long-term growth, profitability, and competitiveness. This comprehensive data analysis initiative serves as a foundation for Subha Sree Rice Mill to thrive in a dynamic market environment and meet the evolving demands of the industry.

2 Detailed Explanation of Analysis Process

The analytical methodology employed for the rice and dal processing mill involved a systematic approach utilizing Microsoft Excel for insightful data analysis sourced primarily from the Mill's Operations Register.

Data Collection:

Initiating the analytical process, the data is meticulously collected from the Mill's Operations Register, spanning a broad spectrum of information. This included details about supplier quantities of different varieties, processing times, production quantity, and final product quantities. This comprehensive dataset laid the groundwork for a thorough exploration of the operational intricacies within the rice and dal processing mill.

Data Entry:

After collecting the data each data point is entered into Microsoft Excel, ensuring a structured layout organized into rows and columns. This step was fundamental in preserving data integrity, simplifying subsequent analysis, and averting errors. The careful organization facilitated a seamless transition from raw data to actionable insights.

Pivot Table Implementation:

In a strategic application of pivot tables, evaluation and ranking of suppliers based on key performance indicators was performed, facilitating a thorough supplier evaluation. Additionally, pivot tables played a central role in optimizing production planning by dynamically summarizing processing times, identifying bottlenecks, and enhancing resource allocation. Furthermore, pivot tables were utilized to analyze earnings across different varieties, providing a nuanced perspective on the financial performance associated with specific product lines.

This comprehensive analysis methodology, enriched by pivot table implementation, empowered the rice and dal processing mill with valuable insights for supplier management, production optimization, and strategic financial decision-making.

Visualizing Data:

Post data collection and data entry, the Microsoft Excel leveraged graphing and charting tools to transform numerical data into visually comprehensible representations. Employing pie charts, bar graphs, Radar charts, Line graphs and histograms, we illustrated the distribution of processed quantities, production costs, Supplier evaluation, Variety wise Earnings and other key metrics. Visualizations played a pivotal role in providing a clear and intuitive understanding of the mill's operational landscape.

Analysis Process for Subha Sree Rice Mill:

Market Analysis:

Target Audience: Define the primary customers, which are the suppliers. Analyze their requirements, preferences, and expectations.

Trends and Patterns: Research market trends in rice and dal processing, including changes in supplier preferences, technological advancements, and emerging product demands.

Production Planning:

Resource Optimization: Implement data-driven production planning strategies to optimize resource allocation, minimize downtime, and enhance overall operational efficiency.

Efficiency Enhancement: Develop strategies to enhance overall efficiency in the production process, streamlining workflows, and minimizing unnecessary delays.

Variety-wise Production: Tailor production planning to accommodate the processing needs of different rice and dal varieties, optimizing the overall production process.

Financial Analysis:

Revenue and Expenses: Review the mill's financial records to understand revenue sources, production costs, and operational expenses related to processing rice and dal for suppliers.

Profit Margins: Analyze profit margins per processed product category to determine the most profitable segments for both the mill and suppliers.

Operational Efficiency Analysis:

Processing Efficiency: Evaluate the efficiency of the milling process, including processing times, resource utilization, and output quantities with a focus on meeting supplier demands.

Production Planning: Develop and implement data-driven production planning strategies to optimize resource allocation, minimize downtime, and enhance overall operational efficiency.

Strategic Recommendations:

Based on the analysis: Propose actionable strategies to enhance processing efficiency, improve communication with suppliers, and improve production planning.

Comprehensive Plan: Develop a detailed plan encompassing operational enhancements, communication strategies, and collaborative initiatives to strengthen the mill-supplier relationship.

3 Results and Findings

3.1 Supplier Contribution to Total Earnings

In the visual depiction presented in the pie chart (Figure 1), the distribution of earnings among suppliers is clearly illustrated. Supplier 5 emerges as the largest contributor, claiming a substantial 29% share of the total earnings. Following closely, Supplier 1 holds a significant position with a 27% contribution. Supplier 2 and Supplier 4 make substantial, yet comparatively moderate, impacts, securing 21% and 15% of the earnings, respectively. In contrast, Supplier 3's performance is notably limited, representing only 8% of the total earnings. This graphical representation provides an at-a-glance understanding of the varying degrees of contribution, aiding in strategic decision-making and supplier relationship management.

In Figure 1, the insightful analysis reveals a concentrated distribution of earnings among suppliers, with Supplier 5 and Supplier 1 emerging as pivotal contributors, collectively accounting for more than 50 percent of the company's total earnings. This consolidated share underscores the significant impact of these suppliers on the company's financial landscape. Suppliers 2 and 4, while making noteworthy contributions, exhibit a more moderate influence on the overall earnings. In stark contrast, Supplier 3's performance stands out as notably deficient, signaling an area that warrants further scrutiny and potential optimization strategies.

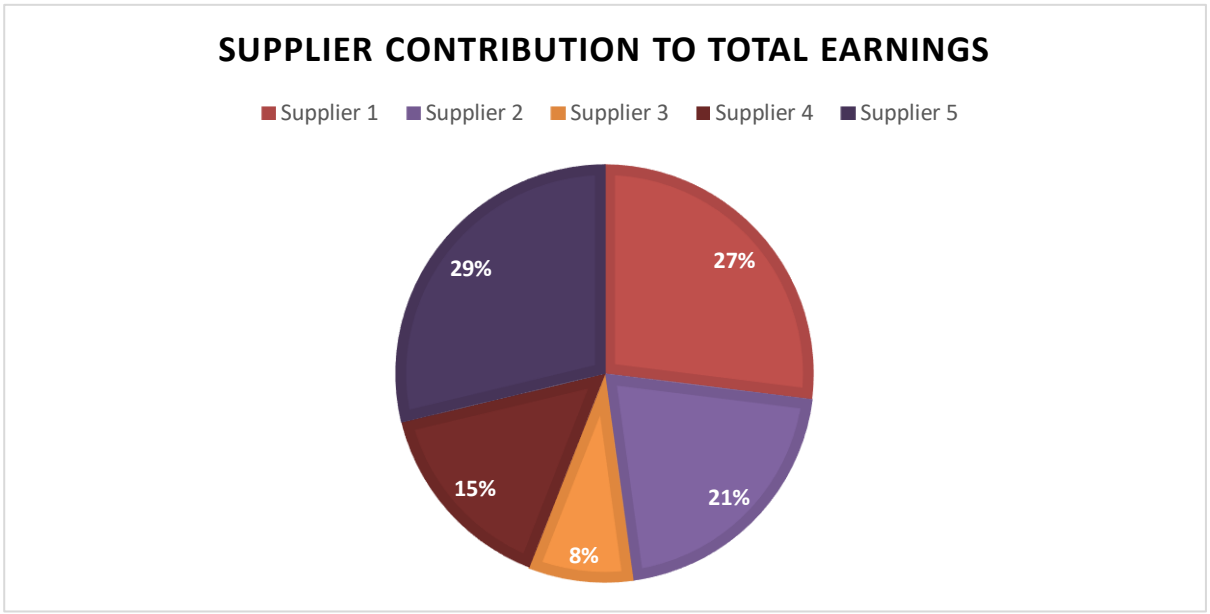

Figure 1: Supplier Contribution to Total Earnings

3.2 Supplier-Variety Count Distribution

In Figure 2 supplier vs variety count analysis, several patterns and trends become apparent, shedding light on the preferences and distribution of different varieties across suppliers. Here's a summarized overview of the key findings.

Supplier 1:

Max Counts: Basmati Rice (55), Chana Dal

Additional Notable Counts: Parboiled Rice

Supplier 2:

Max Counts: Ponni Rice

Additional Notable Counts: Basmati Rice (4)

Supplier 3:

Max Counts: Long Grain Rice

Supplier 4:

Max Counts: Urad Dal and Toor Dal

Supplier 5:

Max Counts: Basmati Rice, Chana Dal, Urad Dal, Toor Dal

Variety-Specific Insights:

Basmati Rice: Highest counts from Supplier 1 (55) and Supplier 5. Notably, Supplier 2 also contributes with a count of 4.

Chana Dal: High counts from Supplier 1 and Supplier 5.

Urad Dal and Toor Dal: Both varieties show significant counts from Supplier 4 and Supplier 5.

Seeraga Semba Rice: Highest count from Supplier 2.

Long Grain Rice: Highest count from Supplier 3.

Ponni Rice: Predominantly supplied by Supplier 2.

Parboiled Rice: Predominantly supplied by Supplier 1.

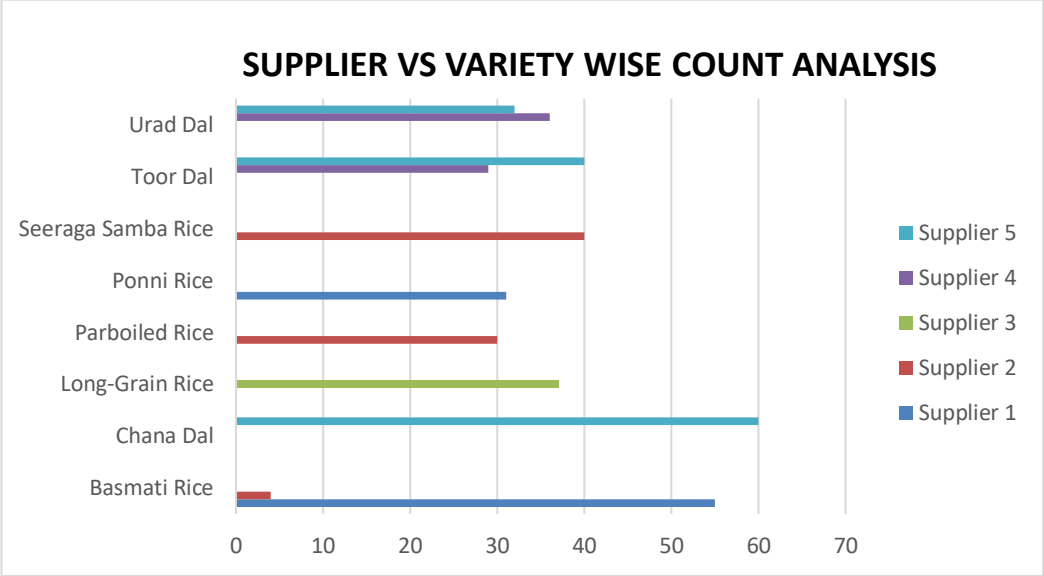

Figure 2: Supplier vs Variety wise Count Analysis

3.3 Analyzing Purchase Volumes by Variety

In Figure 3 the annual analysis of purchase volumes by variety, distinct procurement patterns emerge, shedding light on the company's sourcing dynamics. Notably, Basmati Rice stands out with an annual purchase volume of approximately 50 tons, indicating a significant investment in this variety. Equally robust in procurement are Toor Dal and Urad Dal, both boasting substantial purchase volumes around the 50-ton mark, underlining their pivotal roles in the company's sourcing strategy. Chana Dal follows closely with a noteworthy annual purchase volume of around 45 tons, contributing substantially to the overall procurement landscape.

Seeraga Semba Rice maintains a solid presence, with an annual purchase volume of approximately 35 tons, reflecting its importance in the company's product portfolio. Long Grain Rice follows suit, with an annual purchase volume hovering around 30 tons. Additionally, Parboiled Rice and Ponni Rice contribute significantly to the company's sourcing strategy, each registering an annual purchase volume of around 25 tons. These findings collectively underscore the diverse procurement landscape, with specific varieties playing key roles in shaping the overall annual purchase volumes.

This nuanced analysis of annual purchase volumes provides strategic insights into the company's procurement dynamics, guiding decisions related to production planning, supplier relationships, and product offerings. The identified patterns offer a comprehensive understanding of the relative significance of each variety, empowering the company to optimize its procurement strategy for enhanced efficiency and market responsiveness.

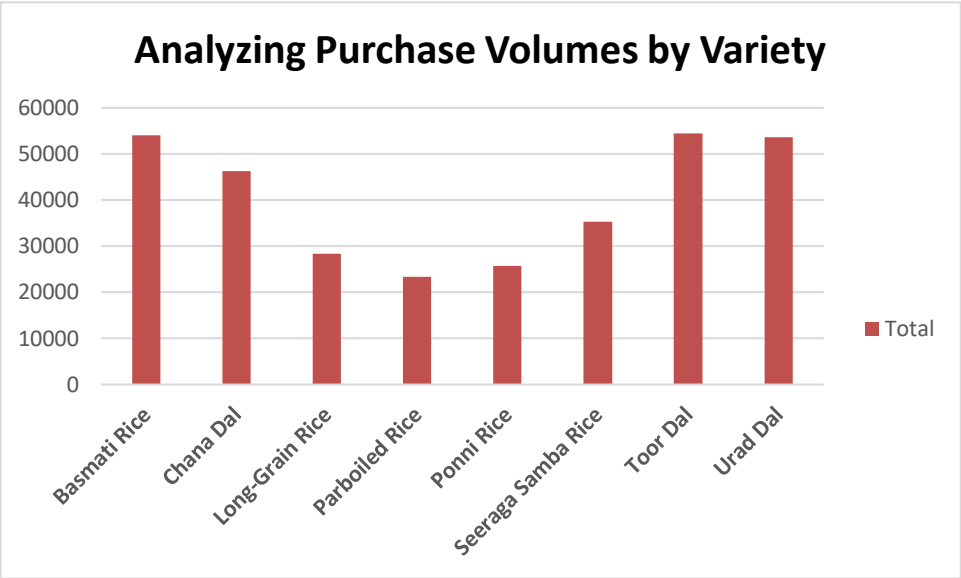

Figure 3: Analyzing Purchase Volumes by Variety

3.4 Month Wise Revenue Analysis

In Figure 4 month-wise revenue analysis graph, a distinctive trend unfolds, capturing the revenue fluctuations across the calendar year. From January to September, the graph exhibits subtle deviations, suggesting a steady but moderate revenue trajectory during this period. However, the dynamics shift notably in October, marked by a discernible decline, indicating a potential shift in consumer preferences or market conditions.

The pronounced decline in October is followed by a sudden and significant incline in November. This surge can be attributed to the heightened processing and demand for Basmati Rice during this month. November coincides with a peak season for marriages, contributing to the surge in processed Basmati Rice, a staple in celebratory occasions. This surge likely plays a pivotal role in the overall revenue boost observed in November.

Contrastingly, the graph takes a sharp downturn in December, signifying a substantial decline in revenue. This decline could be attributed to various factors, including potential market saturation post the festive season and a natural tapering off in demand after the heightened activities in November.

In summary, the month-wise revenue analysis graph unveils a nuanced narrative of steady performance from January to September, a distinctive decline in October, a significant surge in November fueled by Basmati Rice processing during the marriage season, and a subsequent substantial decline in December. These observations provide valuable insights for strategic planning, allowing the company to anticipate and adapt to the seasonal variations in demand, especially around the festive and marriage seasons.

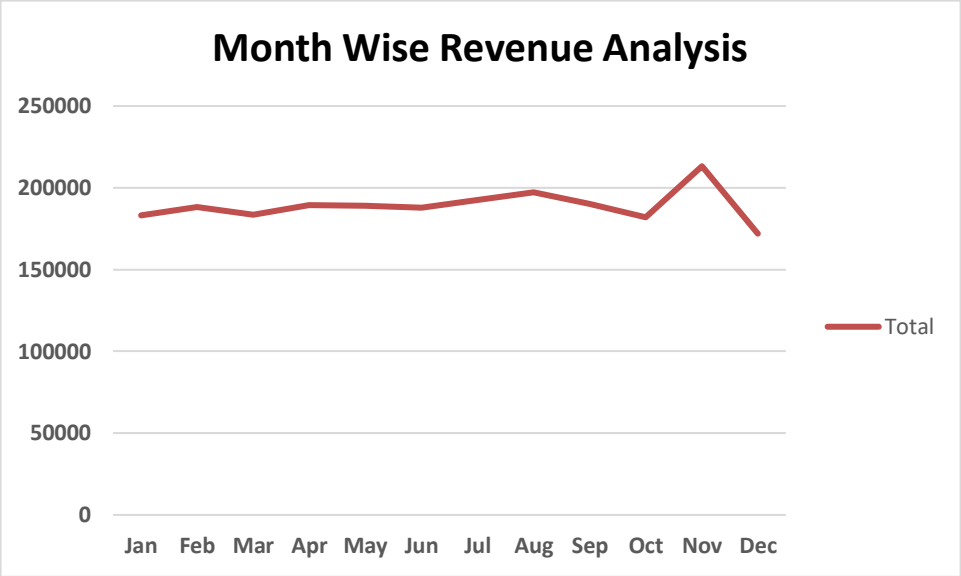

Figure 4: Month Wise Revenue Analysis

3.5 Planned Production Vs Actual Production

In Figure 5, the scatter plot portraying the relationship between planned and actual production reveals intriguing insights. Rather than adhering closely to the expected linear trend, distinct clusters of points emerge, signaling notable deviations. These outliers, as discerned from the data, coincide with days marked by operational challenges. On these occasions, the original production plans were disrupted, necessitating the rescheduling of rice production to the subsequent day.

This observation serves as a crucial indicator of potential operational vulnerabilities within the production process. The deviations in planned and actual production suggest the existence of operational challenges that intermittently disrupt the smooth execution of the production schedule. The identification of these outliers underscores the significance of addressing operational disruptions to enhance the overall efficiency and reliability of the production process.

The scatter plot not only pinpoints areas of concern but also emphasizes the broader importance of adaptability in the face of unforeseen challenges. The ability to navigate and overcome operational disruptions is integral to maintaining a consistent and reliable production schedule. This adaptability is a key factor in ensuring that the company can respond effectively to unexpected events, ultimately contributing to a more resilient and streamlined production process.

In summary, the scatter plot in Figure 6 serves as a valuable tool for recognizing and understanding the impact of operational challenges on planned and actual production. It prompts a strategic focus on addressing these challenges, fostering adaptability, and fortifying the production process for sustained success.

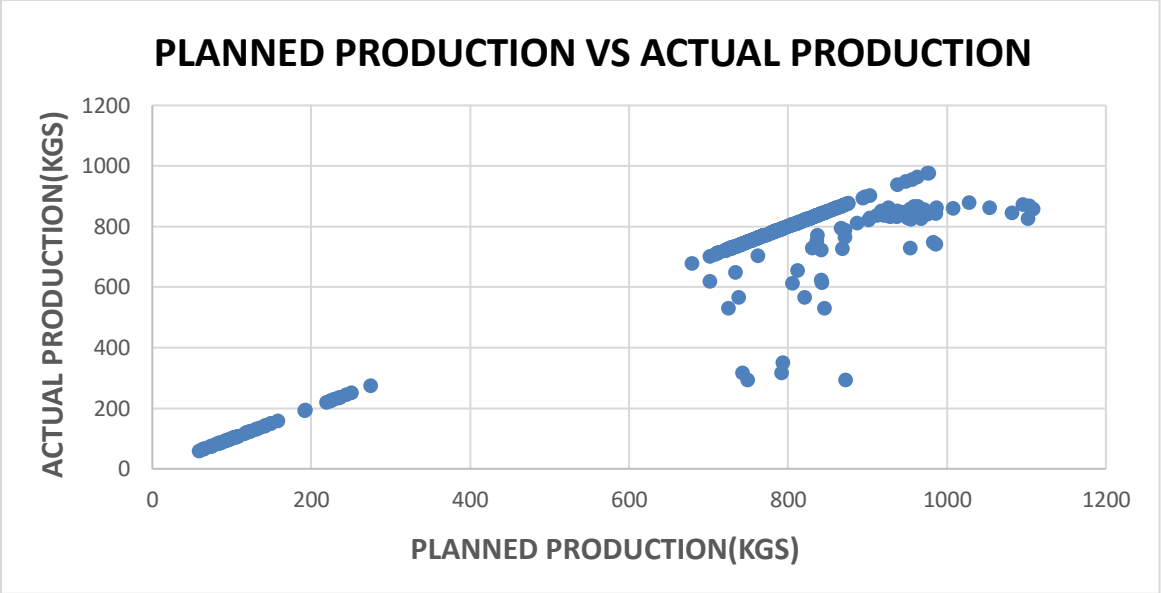

Figure 5: Scatter Plot of Planned Vs Actual Production

Upon further analysis using a box and whisker plot in Figure 6, specific deviations in planned and actual production points within the scatter plot have been identified, providing nuanced insights into various varieties.

In the case of Long Grain Rice, two points fall outside the boxes, suggesting instances where the actual production significantly deviates downward from the anticipated range. This calls for a more in-depth investigation into the factors influencing production on these specific days to address potential operational challenges.

For Urad Dal, two points exhibit downward deviations from the boxes, indicating occasions when the actual production was lower than expected. This signals the need for a closer examination of factors affecting Urad Dal production during these occurrences, with a focus on optimizing the production process.

In the context of Basmati Rice, three points deviate downward from the boxes, revealing instances where planned production falls short of the actual production. This recurrent trend prompts consideration for adjustments in planning strategies to ensure a more accurate alignment with actual demand.

Similarly, in the case of Toor Dal, three points deviate downward from the boxes, indicating occasions when actual production surpassed the planned production. This highlights potential areas for refinement in Toor Dal production planning to better align with actual demand fluctuations.

For Seeraga Samba Rice, the consistent deviation pattern suggests that actual production is consistently less than planned production, warranting a focused examination of the underlying factors. Conversely, for Chana Dal, the two are nearly similar, indicating a relatively stable production process.

The analysis of Ponni Rice reveals a substantial difference in boxes and deviated points, implying noteworthy variations in planned and actual production. This prompts a detailed examination of the contributing factors and potential adjustments in production planning strategies.

In the case of Parboiled Rice, while the boxes remain consistent, one point deviates downward, signifying an isolated incident of lower-than-expected actual production. Investigating this specific occurrence is crucial to understanding the root cause of the deviation and implementing targeted improvements.

These findings emphasize the utility of the box and whisker plot in pinpointing specific instances of deviation within each variety. The downward deviations underscore consistent trends of lower-than-planned production on certain days, calling for targeted strategies to address and mitigate operational challenges for enhanced production efficiency and reliability.

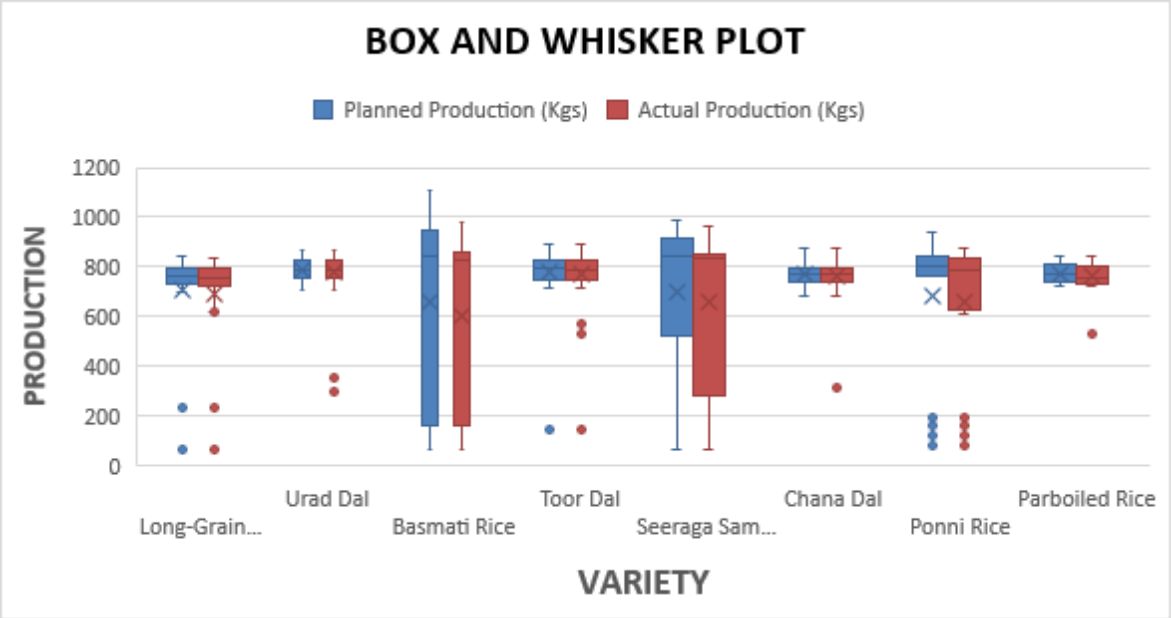

Figure 6: Box and Whisker Plot of Planned and Actual Production

3.6 Variety-Specific Purchase Trends over Time

Figure 7 presents a comprehensive overview of the monthly purchase quantities for various varieties of Rice and Dal, unraveling distinct trends and patterns. Particularly noteworthy is the procurement pattern of Basmati Rice, characterized by an initial increase in the first two months, followed by a gradual decline until reaching its lowest point in June. Subsequently, the trajectory becomes dynamic, marked by fluctuating patterns with notable peaks occurring in November. This surge can be attributed to heightened demand during the frequent marriage ceremonies in Tamil Nadu, where Basmati rice holds significant cultural importance.

In the realm of other rice varieties, there are discernible fluctuations observed throughout the observed period. These variations could be influenced by factors such as seasonal availability, market dynamics, and consumer preferences, contributing to the dynamic nature of the monthly purchase quantities.

Shifting focus to the dal varieties, Urad dal stands out with a substantial peak in July, aligning with heightened market demand during this period. In contrast, Chana dal experiences a decline in the same month, suggesting potential shifts in consumer preferences or market conditions. The remaining dal varieties exhibit typical fluctuations, reflecting the inherent variability in procurement trends over the observed months.

This nuanced analysis of monthly purchase quantity trends provides valuable insights into the dynamics of procurement for different varieties. The observed patterns serve as crucial indicators for strategic decision-making, enabling the company to align its procurement strategies with market demands, seasonal fluctuations, and cultural events, ultimately enhancing adaptability and responsiveness in the procurement process.

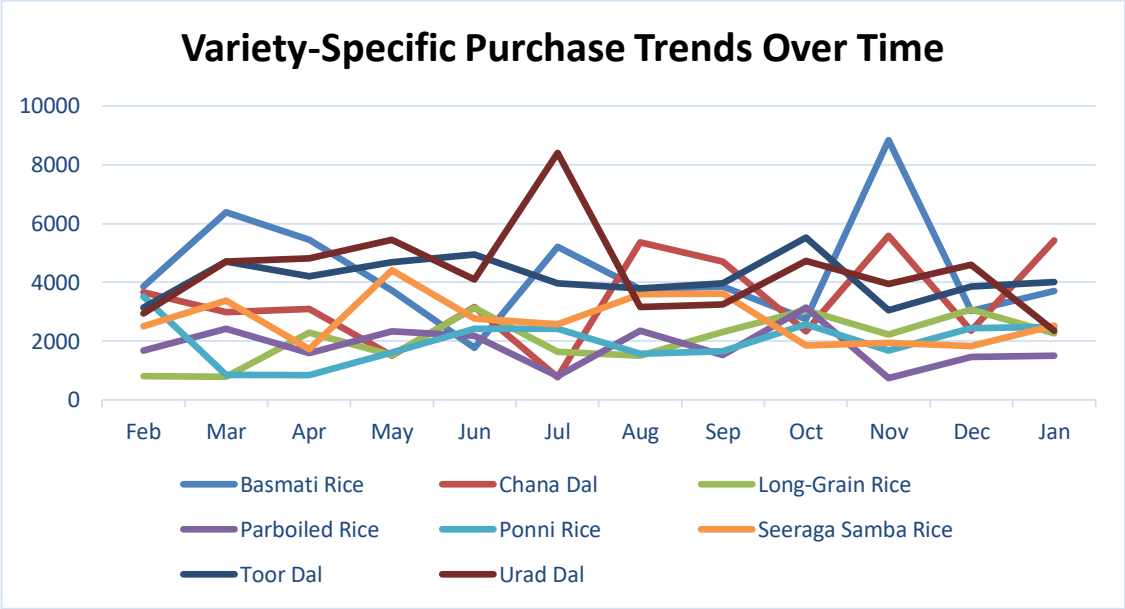

Figure 7: Variety-Specific Purchase Trends Over Time

3.7 Production Dynamics Radar

In Figure 8 the radar chart for planned and actual production provides a visual representation of production dynamics. Notably, the chart highlights a maximum planned production of around 1.2 tons. A distinct pattern emerges, indicating a challenge for the mill when the production crosses the 1-ton threshold. In these instances, the chart vividly illustrates that the mill encounters difficulties in achieving the planned production targets.

One prominent observation from the radar chart is the consistent trend where actual production tends to fall below the planned production levels. This recurring pattern suggests operational challenges or constraints that hinder the mill's ability to meet the set production goals, particularly when the planned production exceeds 1 ton.

This visual representation offers a valuable starting point for in-depth analysis and strategic decision-making to enhance the mill's production capabilities and address the observed challenges in achieving planned production levels, particularly when crossing the 1-ton threshold.

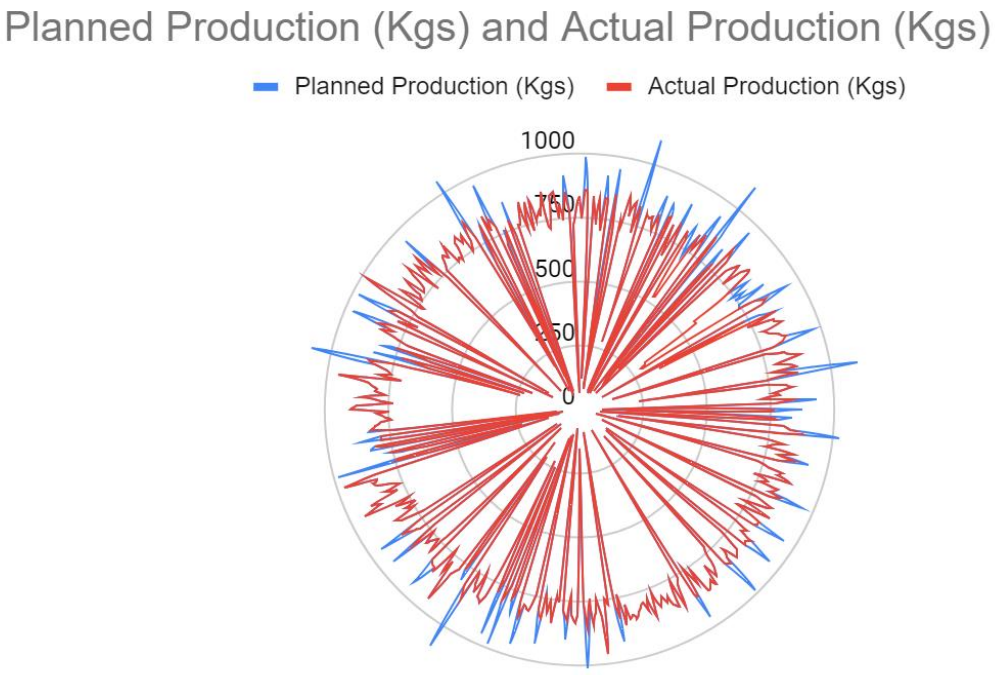

Figure 8: Radar Chart of Planned and Actual Production

4 Interpretation of Results and Recommendations

The analysis unveils a comprehensive understanding of the mill's operational landscape. Firstly, the strategic significance of Supplier 1 and Supplier 5, contributing to a substantial 55% of the mill's earnings, underscores the importance of fostering stronger collaborations with these suppliers. Additionally, the identification of Basmati Rice, Toor Dal, and Urad Dal as high-value varieties, based on their elevated processing charges per kg, highlights the need for focused processing efforts to maximize profitability. Simultaneously, the results shed light on operational challenges, including intermittent delayed deliveries and a notable struggle when planned production exceeds 1 ton, especially evident in the processing of Basmati Rice. This nuanced interpretation provides a holistic view, linking supplier selection, variety processing, and operational challenges for strategic decision-making.

Recommendations:

- Strengthen relationships with Supplier 1 and Supplier 5 for enhanced collaboration and favorable terms.
- Prioritize processing efforts on Basmati Rice, Toor Dal, and Urad Dal to maximize profitability.
- Implement an integrated production approach for simultaneous processing of Rice and Dal varieties.
- Conduct a detailed analysis of production processes to address delays and streamline operational efficiency.
- Investigate and strategize solutions for overcoming struggles in production, especially when processing varieties exceeding 1 ton.
- Establish a robust production planning system, considering demand forecasting and inventory levels, to ensure timely deliveries and operational efficiency.