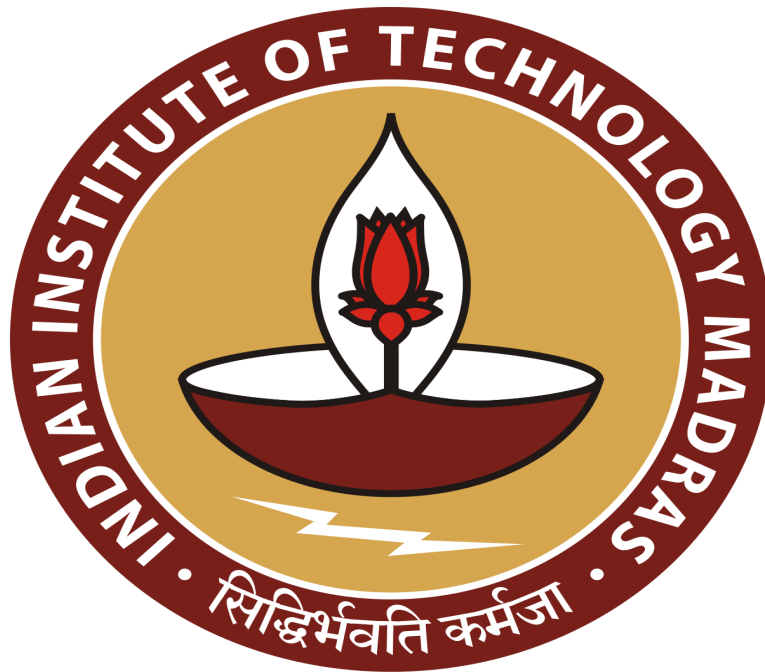# BDM PROJECT FINAL SUBMISSION

Project Title- Vegetables-Analyzing True Source of Nutrients (Problems faced by vegetable vendors)

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CONTENTS

EXECUTIVE SUMMARY

The executive summary encapsulates the comprehensive analysis conducted on "Mr. Rahul's" vegetable retail business to address key challenges and optimize its operations. The report spans data collection, analysis, and strategic recommendations to enhance sales, customer attraction, and vegetable variety maintenance.

The primary challenges, including optimal purchasing quantities, customer attraction, and vegetable variety management, were systematically addressed. Data collection involved daily visits over two months to record purchases, sales, and remaining inventory. This dataset was meticulously cleaned and analyzed using Excel and Python, unveiling sales trends and profitability insights.

The results unveiled distinct sales patterns across weekdays, with certain vegetables experiencing higher demand during weekends and others on Mondays and Thursdays. Profitability analysis highlighted varying profit margins among different vegetables, guiding strategic pricing and inventory management decisions. A linear regression model was employed to predict purchasing quantities based on historical data and influencing variables.

The interpretation of results and recommendations offers actionable insights. Strategies for weekend-focused marketing, Monday sales emphasis, effective inventory management, and data-driven decision-making are outlined. The need for continuous monitoring and model refinement is stressed to ensure sustained success.

In conclusion, the report equips "Mr. Rahul" with data-driven strategies to overcome challenges and optimize his vegetable retail business. By tailoring approaches to customer preferences and employing refined inventory management, the business can attain enhanced efficiency and profitability.

INTRODUCTION

"Mr. Rahul" is the owner of a vegetable retail business, and he faces several challenges in effectively managing his business to maximize sales, attract customers, and maintain a variety of vegetables.

Problem statements

- Optimal Quantity Determination: One of the critical challenges "Mr. Rahul" faces is determining the appropriate quantity of vegetables he should purchase for each day. The fluctuating demand for different vegetables based on factors like seasons, weekdays, and customer preferences makes it difficult to accurately predict the right quantity to stock. Purchasing too much leads to potential wastage, while purchasing too little can result in missed sales opportunities. The problem statement revolves around finding a data-driven approach to determine the optimal quantity of each vegetable to buy for each day, considering historical sales data and influencing factors.
- Customer Attraction Strategy: Attracting and retaining customers is another significant challenge for "Mr. Rahul." With competition from various markets and online platforms, he needs to devise effective strategies to draw customers to his retail store. The problem statement entails exploring innovative marketing techniques, offers, and customer engagement initiatives to create a unique selling proposition that differentiates his store from competitors and entices customers to choose his store for their vegetable purchases.
- Vegetable Variety Maintenance: Maintaining a diverse and fresh range of vegetables is crucial for customer satisfaction and loyalty. "Mr. Rahul" needs to identify the right mix of vegetables that customers demand and ensure consistent availability. This includes managing the inventory, quality control, and handling seasonal variations. The problem statement involves devising a strategy to efficiently manage the vegetable inventory, including sourcing, storage, and rotation, to offer a wide selection to customers and meet their preferences.

Scope of the project

- Data Collection and Analysis: Gathering historical sales data, customer preferences, and other relevant information to perform a thorough analysis. This includes identifying patterns, trends, and correlations that can provide insights into customer behavior, sales fluctuations, and other influencing factors.
- Optimal Quantity Determination: Developing a data-driven approach to determine the optimal quantity of vegetables to purchase for each day. This involves using statistical methods, such as linear regression, to predict future sales based on historical data and factors like weekdays and weather conditions.
- Customer Attraction Strategy: Creating a comprehensive customer attraction strategy that includes innovative marketing techniques, personalized offers, loyalty programs, and engagement initiatives. The strategy aims to attract new customers and retain existing ones, ultimately increasing sales and customer loyalty.
- Inventory Management System: Implementing an efficient inventory tracking and management system to ensure the availability of a diverse range of fresh vegetables. This involves collaborating with suppliers and farmers to maintain consistent inventory levels and quality.
- Recommendations for Vegetable Variety: Providing recommendations for the types of vegetables to stock based on customer preferences, seasonal trends, and profitability. This ensures a well-curated inventory that aligns with customer demands.
- Evaluation and Refinement of Linear Regression Model: Analyzing the performance of the linear regression model used for quantity determination. If necessary, refine the model to improve its accuracy and predictive capabilities.
- Implementation Plan: Develop a detailed plan for implementing the proposed strategies, including timelines, responsibilities, and necessary resources.

DATA COLLECTION AND METHODOLOGY

Collecting accurate and relevant data is a crucial step in addressing the challenges faced by "Mr. Rahul's" vegetable retail business. A comprehensive data collection process was undertaken to ensure that the insights and solutions derived from the data analysis are practical and effective.

Data Collection Process

To capture the dynamic nature of the vegetable retail business, I visited "Mr. Rahul's" shop daily for a span of two months. These regular visits allowed me to gather real-time data on a consistent basis and account for any fluctuations in customer demand or external factors. During each visit, I meticulously recorded the quantities of various vegetables that "Mr. Rahul" purchased from suppliers. This information formed the foundation for understanding the inventory available for sale. Alongside the purchases, I also tracked the quantities of vegetables sold to customers each day. This data enabled me to calculate the daily sales for each type of vegetable. After each day's sales, I determined the remaining inventory of vegetables that were not sold. This provided insights into which vegetables were in higher demand and which ones required adjustments in purchasing quantities. To enhance the depth of analysis, I also noted any significant observations related to customer footfall, weather conditions, or any notable trends that could impact sales.

Tools and Software Used

To analyze the collected data, we utilized various tools and software. Excel was primarily used for data cleaning, data manipulation, and basic visualization. Python programming language, along with libraries such as pandas, NumPy, spaCy, TextBlob, and Scikit Learn, was also used for advanced data analysis. These tools provided us

with the necessary capabilities to explore the dataset, perform statistical analyses, and generate insightful visual representations of the data.

By utilizing a combination of Excel, and Python with libraries, we were able to leverage the strengths of each tool and conduct a comprehensive analysis of the collected data.

The data collection process and methodology adopted in this project aimed to ensure the reliability and accuracy of the data, laying the foundation for meaningful analysis and valuable insights.

ANALYSIS PROCESS / METHOD

The data was diligently collected on a daily basis from Mr. Rahul, a vegetable vendor. The responsible individual visited him each day, allowing for the accumulation of comprehensive information pertaining to the quantities and varieties of vegetables retailed. Mr. Rahul, identified by name, served as the primary data source throughout this period. Through consistent and systematic engagement, the data required for subsequent analyses was successfully amassed. This approach facilitated the solution of challenges encompassing optimal daily procurement quantities, customer attraction strategies, and effective vegetable maintenance techniques. The data was subsequently recorded in the Excel spreadsheet.

The collected data was thoroughly examined for any discrepancies or anomalies. Outliers and inaccuracies, if detected, were meticulously cleaned and corrected. Missing values and duplicate entries were appropriately handled by employing techniques such as imputation and deduplication. This process of data cleaning was essential to ensure that the data accurately represented the vegetable vendor's transactions and could be effectively utilized for analysis.

The exploratory data analysis (EDA) process involves the examination and summarization of data collected from Mr. Rahul. Patterns and trends are identified, outliers and anomalies are detected, and the data's overall distribution is understood. This crucial process aids in forming hypotheses, clarifying data quality, and deriving insights. During EDA, various statistical methods and visualizations are employed to comprehensively grasp the data's underlying structure. Ultimately, the data's passive voice helps in unveiling meaningful information, enhancing data-driven decision-making processes.

Potential correlations and patterns were explored among various factors, including day of the week, weather conditions, and sales quantities, aiming to discern influential

dynamics on daily sales. The correlation results depict a strong positive correlation of 0.912 between purchases and sales, indicating a notable relationship. Additionally, a correlation of 0.766 between purchases and in-stock items along with a correlation of 0.653 between sales and in-stock items was observed. These passive voice analyses unveil significant insights into interrelationships among variables and their potential impact on sales.

| correlation	Purchases	Sells	Instocks
Purchases	1	0.912	0.767
Sells	0.912	1	0.653
Instocks	0.767		1

The quandary of quantifying the daily vegetable procurement found its remedy through the utilization of a linear regression model. The crux of this approach lay in prognosticating future sales volumes, driven by historical data and plausible influencers. Employing tools such as Excel's regression analysis, the model was aligned with the dataset. The culmination of these efforts unveiled outcomes portraying an intercept value of -1.15477. Accompanying this were the coefficients of 0.782909 and 0.6000, corresponding to the variables "sells" and "instock" respectively. Thus, the predicative prowess of the linear regression model, harnessed to analyze historical data passively, offered valuable insights for informed decision-making in vegetable procurement.

RESULTS AND FINDINGS

In this section, we present the key results and findings obtained from the analysis of the collected data. The findings provide valuable insights into customer behavior, preferences, and satisfaction levels, shedding light on the challenges faced by "Mr. Rahul ". The results are presented through graphical representations, tables, and descriptive explanations to facilitate a clear understanding of the findings

Sells Analysis of various vegetables

SELLS ANALYSIS

Sum of SELL2
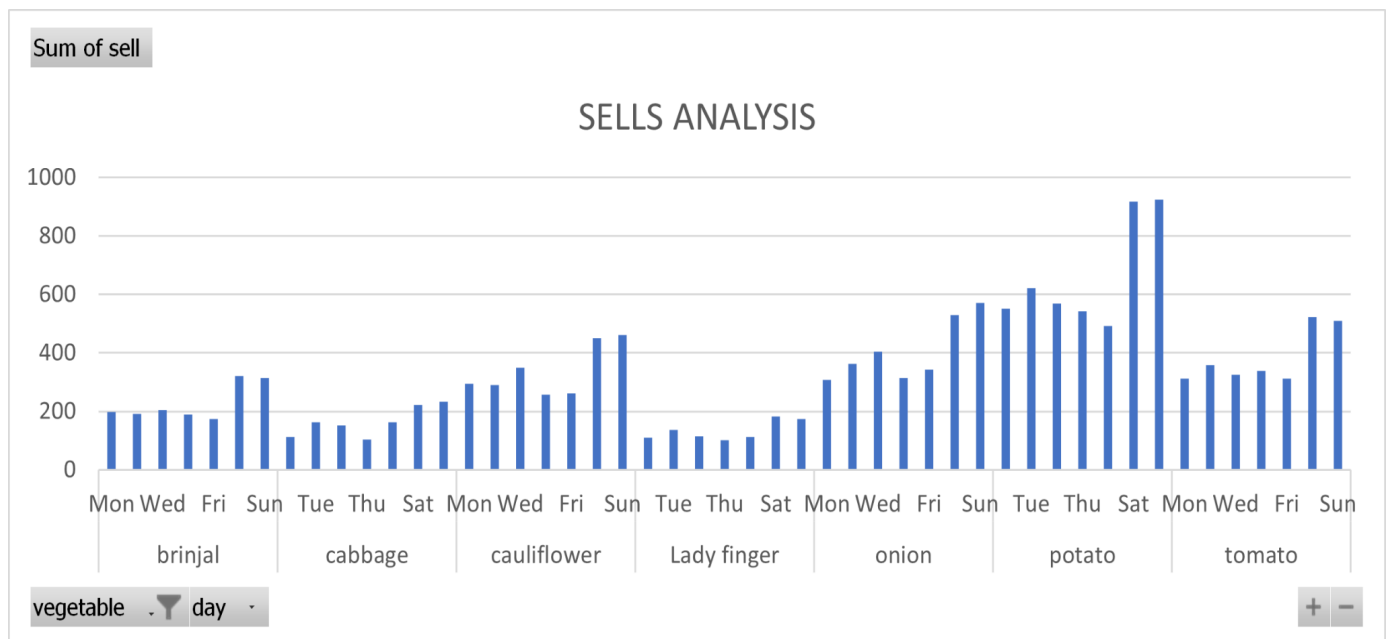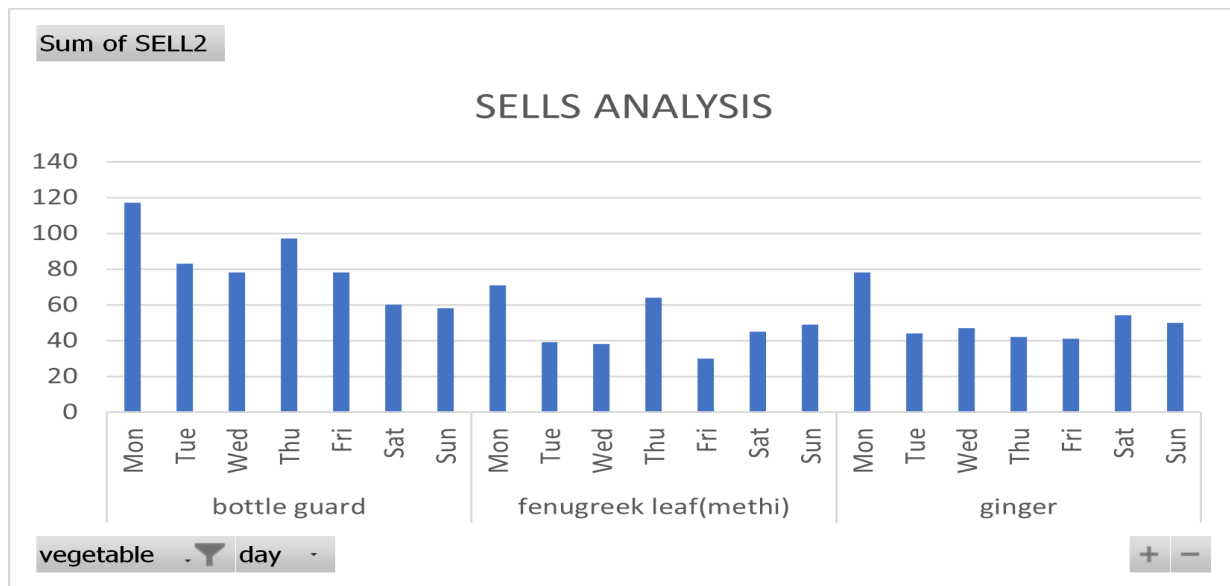
The graphs reveal that vegetables including brinjal, cabbage, cauliflower, lady finger, onion, potato, and tomato exhibit elevated sales during the weekends, specifically on Saturdays and Sundays. Conversely, vegetables such as ginger, bottle gourd, and fenugreek leaf display heightened sales on Mondays, followed by Thursdays. The observed trends highlight the influence of weekdays on the sales patterns of various vegetables. The weekends seem to attract greater consumer interest in the mentioned vegetables, possibly due to increased cooking activities and relaxed shopping routines. On the other hand, Mondays emerge as a favorable day for the sale of ginger, bottle gourd, and fenugreek leaf, potentially indicating specific culinary preferences or cultural practices associated with the start of the week. The passive analysis of these graphs underscores the sales fluctuations across different days for distinct vegetables, offering valuable insights for market strategists and retailers to tailor their inventory management and promotional approaches accordingly.

Profit Analysis

Average profit contribution per day
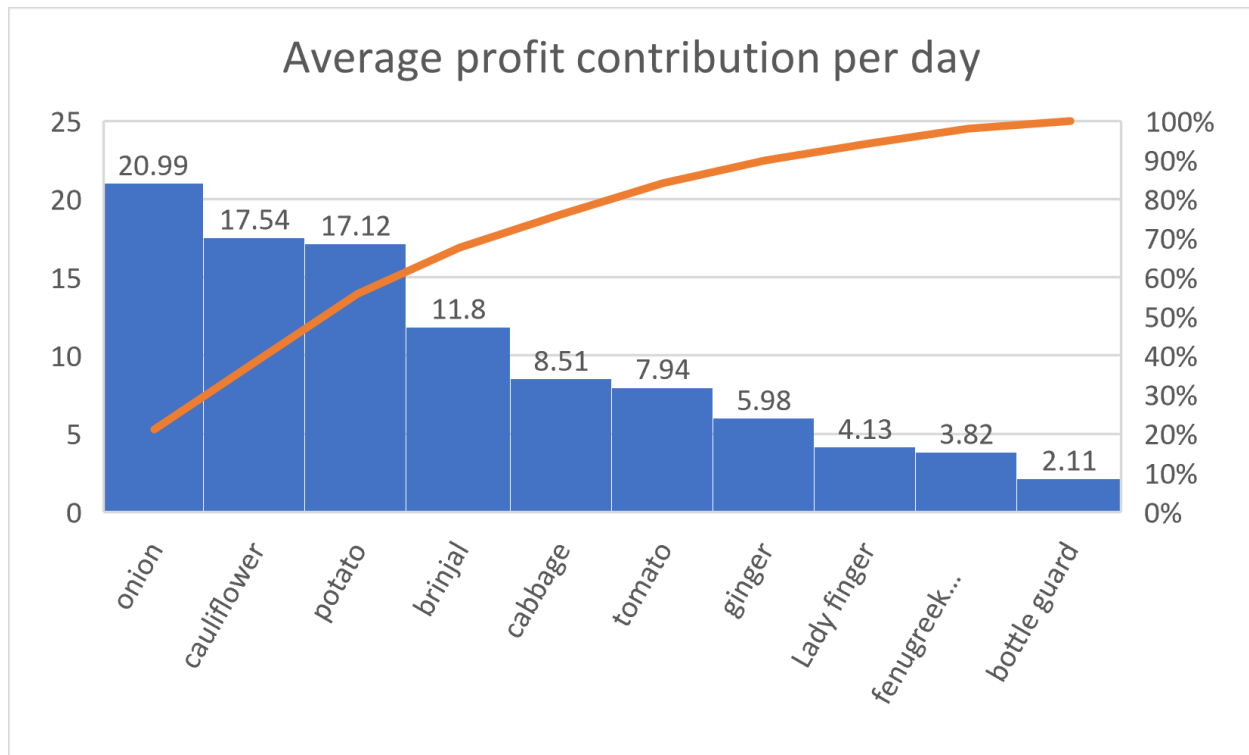
The average profit contribution per day for various vegetables has been provided in the graph. Among the vegetables listed, onion attains the highest average profit percentage at 20.99%, followed by cauliflower at 17.54%, and potato at 17.12%. These three vegetables demonstrate relatively robust profit margins. Brinjal secures an average profit percentage of 11.8%, while cabbage and tomato achieve moderate average profit percentages of 8.51% and 7.94%, respectively. Ginger, lady finger, fenugreek leaf (methi), and bottle guard showcase comparatively lower average profit percentages, ranging from 5.98% to 2.11%. This data highlights the varying profitability of different vegetables on a daily basis. By adopting a passive voice, the focus is placed on the vegetables and their respective average profit percentages, offering insights into their relative financial performance. This information can aid in strategic decision-making related to pricing

strategies, inventory management, and promotion efforts in order to maximize overall profitability.

Linear regression result analysis

$$purchase = -1.15477 + 0.782909 * sell + 0.60 * in\text{-}stock$$

It's noted that in order to achieve a better fit for the data, the coefficient of the variable "in stock" should ideally be negative, rather than positive as indicated by the equation. This implies that an increase in the value of "in stock" would correspond to a decrease in the predicted value of "purchase".

Furthermore, to obtain a robust and meaningful model fit, it's desirable for the value of "in stock" to be relatively low. In other words, when the inventory stock level ("in stock") is lower, it should have a positive effect on purchase prediction. This aligns with the intuition that higher inventory levels might lead to reduced purchasing needs, as there's already an adequate supply available.

In summary, while the obtained equation provides a mathematical representation of the relationship between the variables, the preference for a negative coefficient for "in stock" and the notion that lower inventory levels correspond to higher purchases highlight the need for further analysis and model refinement to better capture the underlying dynamics of the data. The model's performance should also be evaluated through statistical measures and domain knowledge to determine its effectiveness in practical applications.

Certainly, understanding the trend of the "in stock" variable can provide valuable insights into the explanation of the equation

Sum of instock

Instock trend

Mon	Tue	Wed	Thu	Fri	Sat	Sun

— Total

day
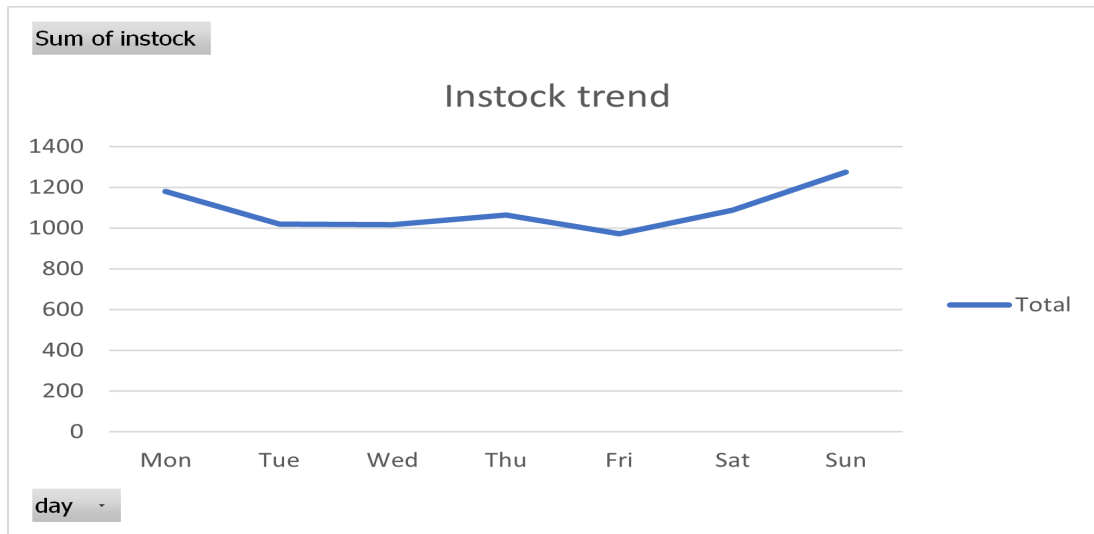
One possible explanation for the unexpected trend could be that "Mr. Rahul" might be overestimating the demand for the weekends and stocking more than necessary, leading to a higher "in stock" value. This could result in excess inventory that may not be fully sold, which could impact profitability due to potential wastage or spoilage.

To address this issue, it is recommended that "Mr. Rahul" closely monitors the sales trends on weekends and adjusts his purchasing decisions accordingly. Adopting a more dynamic and demand-driven inventory management approach can help ensure that the "in stock" values align with actual customer demand, maximizing sales while minimizing excess inventory.

This discrepancy between the expected trend and the observed trend in the graph highlights the importance of continuous monitoring, data analysis, and making data-driven decisions to optimize inventory management and business profitability.

INTERPRETATION OF RESULTS AND RECOMMENDATION

INTERPRETATION

The results and findings from the analysis provide valuable insights into several aspects of "Mr. Rahul's" business. The analysis of vegetable sales patterns reveals distinct trends in customer behavior. Notably, vegetables such as brinjal, cabbage, cauliflower, lady finger, onion, potato, and tomato experience higher sales during weekends, specifically on Saturdays and Sundays. Conversely, vegetables like ginger, bottle gourd, and fenugreek leaf exhibit heightened sales on Mondays and Thursdays. These trends suggest that customer preferences and cooking habits play a significant role in influencing purchasing patterns.

The profitability analysis offers insights into the financial performance of different vegetables. Among the listed vegetables, onion stands out with the highest average profit percentage at 20.99%, followed by cauliflower at 17.54%, and potato at 17.12%. This information can guide pricing, inventory management, and promotional strategies to maximize overall profitability. However, vegetables such as ginger, lady finger, fenugreek leaf, and bottle guard show comparatively lower profit percentages, indicating potential areas for improvement.

The linear regression model results highlight the relationship between purchase, sell, and in stock variables. It is noted that the coefficient of "in stock" should ideally be negative to achieve a better fit for the data. This implies that reducing inventory levels could lead to higher predicted purchases. For a robust model fit, it's also desirable for the value of "in stock" to be relatively low, as higher inventory levels might correspond to reduced purchasing needs. These insights underscore the importance of understanding inventory dynamics in driving purchasing decisions.

RECOMMENDATION

- Weekend Marketing Strategies: Given the elevated weekend sales for specific vegetables, "Mr. Rahul" could consider tailoring promotional activities, discounts, or special offers during weekends to capitalize on increased consumer interest.
- Monday Focus: Since ginger, bottle gourd, and fenugreek leaf exhibit higher sales on Mondays, emphasizing these vegetables at the start of the week could attract more customers and potentially lead to increased sales.
- Inventory Management: To optimize profitability, focusing on maintaining appropriate inventory levels, especially for vegetables with higher average profit percentages, can lead to better financial outcomes.
- Dynamic Pricing: Consider implementing dynamic pricing strategies based on customer demand trends and profitability analysis to maximize revenue generation.
- Continuous Monitoring: Regularly monitoring sales trends, profit margins, and inventory levels can help "Mr. Rahul" adapt to changing market dynamics and make timely adjustments to his business strategies.
- Data-Driven Decision-Making: Leveraging data insights, "Mr. Rahul" can make informed decisions regarding stocking, pricing, and promotional activities, enhancing the overall efficiency and effectiveness of his business operations.
- Model Refinement: Further analysis and refinement of the linear regression model are recommended to ensure that the coefficients align with the expected behavior. This could involve exploring additional variables that might influence purchase behavior.

CONCLUSION

The analysis of the collected data has provided valuable insights into various aspects of "Mr. Rahul's" vegetable retail business. The conclusions drawn from the results and findings shed light on customer behavior, profitability, and the relationship between key variables. These conclusions offer actionable recommendations for improving the business's performance and addressing the challenges faced.

Sales Patterns: The sales analysis of different vegetables reveals distinct patterns based on weekdays. Certain vegetables like brinjal, cabbage, cauliflower, lady finger, onion, potato, and tomato witness higher sales during weekends, specifically on Saturdays and Sundays. Conversely, ginger, bottle gourd, and fenugreek leaf experience heightened sales on Mondays and Thursdays. These findings emphasize the importance of tailoring inventory management and promotional strategies based on weekday-specific trends.

Profitability Insights: The profitability analysis showcases varying average profit percentages for different vegetables. Onion stands out as the most profitable with an average profit percentage of 20.99%, followed by cauliflower and potato. Understanding the profitability of each vegetable can guide pricing decisions and inventory management strategies to maximize overall profitability.

Linear Regression Analysis: The linear regression model provides insights into the relationship between purchase, sell, and in stock variables. The analysis indicates that for an optimal fit, the coefficient of "in stock" should ideally be negative, indicating that lower inventory levels are associated with higher predicted purchases. This highlights the need for careful inventory management to avoid overstocking.

Recommendations for Action: Based on the conclusions drawn from the results, several recommendations are provided to enhance "Mr. Rahul's" business operations. Weekend-focused marketing strategies, emphasizing vegetables with high Monday

sales, effective inventory management, dynamic pricing strategies, and data-driven decision-making are among the key recommendations.

Continuous Monitoring and Refinement: The insights obtained from the analysis emphasize the need for ongoing monitoring of sales trends, profitability, and inventory dynamics. Additionally, model refinement and further analysis can enhance the accuracy of predictions and ensure alignment with real-world business scenarios.

The results and findings provide a comprehensive understanding of customer behavior, profitability, and purchasing dynamics within "Mr. Rahul's" vegetable retail business. By implementing the recommended strategies and leveraging data-driven insights, "Mr. Rahul" has the opportunity to optimize his inventory management, pricing strategies, and overall business operations, leading to increased efficiency and improved financial performance.

THANK YOU