**Price Prediction and Demand Forecasting for a Small Fruit Shop**

**A Final report for the BDM capstone Project**

Submitted by

Name: Shaonkoli Saha

Roll number: 21f1001196



IITM Online BS Degree Program,

Indian Institute of Technology, Madras, Chennai

Tamil Nadu, India, 600036

**Contents**

[1 Executive Summary and Title 3](#_Toc164087285)

[2 Proof of Originality: 3](#_Toc164087286)

[3 Detailed Explanation of Analysis Process/Method 4](#_Toc164087287)

[1) Analysis of Buy and Sell Quantity 5](#_Toc164087288)

[2) Analysis of Wastage of each item 5](#_Toc164087289)

[3) Analysis of Sell Flow for each fruit 6](#_Toc164087290)

[4) Analysis of Profit and Loss 7](#_Toc164087291)

[4 Results and Findings 8](#_Toc164087292)

[1) Analysis of Buy and Sell Quantity 8](#_Toc164087293)

[2) Analysis of Wastage of each item 9](#_Toc164087294)

[3) Analysis of Sell Flow for each fruit 12](#_Toc164087295)

[4) Analysis of Profit and Loss 14](#_Toc164087296)

[5 Interpretation of Results and Recommendation 17](#_Toc164087297)

[1) Analysis of Buy and Sell Quantity 17](#_Toc164087298)

[2) Analysis of Wastage of each item 17](#_Toc164087299)

[3) Analysis of Sell Flow for each fruit 17](#_Toc164087300)

[4) Analysis of Profit and Loss 18](#_Toc164087301)

**Declaration Statement**

I am working on a Project titled “Price Prediction and Demand Forecasting for a small Fruit Shop”. I extend my appreciation to **Late Narayan Das**, for providing the necessary resources that enabled me to conduct my project.

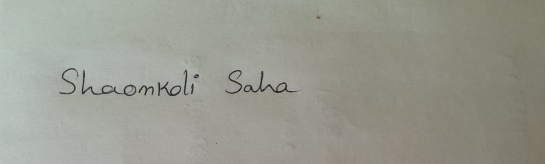
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered from primary sources and carefully analyzed to assure its reliability.

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 analytical procedures.

I am dedicated to adhering to the principles 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**)

Name: Shaonkoli Saha

Date: 15-04-2024

# Executive Summary and Title

The project focuses on a small fruit shop owned by Late Narayan Das located at Kalindi Housing Estate, Kolkata. He started his business on 15th April 2001. He is facing lesser profit from 23rd Oct 2020, when the market started settle down in new area.

The major business issues that the owner is facing are:

1. Lots of fruits are getting soured daily.
2. Number of buyers are lesser than other fruit shop.

The issues will be addressed by analyzing the data and will provide effective solution. I will provide this solution to Mr. Arnab Das, son of Late Narayan Das, so that it can help him to reduce the money blockage in terms of inventory. This will help the business to increase the profitability of the organization.

# Proof of Originality:

As part of proof of originality, I am providing the letter from the owner of the shop which he provided when we first met for the project talk.

A piece of paper with writing on it

Description automatically generated

# Detailed Explanation of Analysis Process/Method

To start the analysis process, let’s understand the statistics of the raw data available.

Data is available for 1 year (01-jan-2023 to 31-dec-2023) of buy and sell information of the fruit shop. The owner used to keep book as ledger. I took the information from the book and put it into excel.

The excel contains:

1. Buy Data: Owner buys inventory on Sundays. Buy Data sheet contains information like:
   1. When the product bought (Date)
   2. What product bought
   3. In which price the product bought
   4. Quantity of the product bought.
2. Sell data: Owner opens his shop daily morning. Sell Data sheet contains information like:
   1. When the product sold (Date)
   2. What product sold
   3. Average price the product sold.
   4. Quantity of the product sold.

Here I am analyzing the data for the problem “Lots of fruits are getting soured on daily basis”. For the analysis, I am using different functions of Excel.

Reasons to choose Excel as analysis tool:

1. Data collection is easy. As part of data collection, I received a book from the business owner where daily selling information and weekly buying information were available. To upload those data into digital device, I found Excel as the most helpful tool.
2. Data cleaning is easy: While uploading the data, I observed that the owner restores his inventory on every Sunday. Also, the buying quantity measurement and selling quantity measurements were different for few fruits. Those buying information required update for easy analysis.
3. To analyze the data, I have created 2 more worksheets. One is for weekly selling data and another is for Profit/ Loss information.
4. As in raw data, I had weekly buying information and daily selling information, I needed to make both the information on same format. To do so, I prepared weekly selling information by aggregating weekly selling quantity from raw data.
5. In Profit/ Loss worksheet, I jotted down weekly profit or loss and wastage of each fruit. To do so, I take buy quantity, buy price, sell quantity, sell price, for each product on weekly basis in a single page.
6. Then by multiplying buy price and buy quantity, I got Inventory cost and by multiplying sell price and sell quantity, I got Income.
7. By subtracting Inventory cost from Income, I got Profit/ Loss for each product in a week.
8. By Subtracting sell quantity from buy quantity, I got wastage of each product.
9. I have used Excel pivot table for the analysis purpose.
10. I have used Excel charts options for pictorial representation.

## Analysis of Buy and Sell Quantity

For this analysis, I followed below steps:

1. Create a pivot table with Buy Data.
2. Select Fruits in Rows section and take the sum of quantity in values section. It will give sum of each product for the whole year from Buy Data.
3. Create a pivot table with Sell Data in the same worksheet where Buy Data Pivot table is created.
4. Select Fruits in Rows section and take the sum of quantity in values section. It will give sum of each product for the whole year from Sell Data.
5. Prepare a dataset with Fruits, sum of buy quantity and sum of sell quantity.
6. Use this data set for pictorial representation.
7. In the Results and Findings section, data and pictorial representation is available for this analysis. Data 1 and Pic 1.
8. Here clustered column charts are used. A clustered column chart is used to compare values across a few categories, which is the purpose of this analysis. Here also we are trying to compare buy and sell quantity of each fruit.

## Analysis of Wastage of each item

For this analysis, I followed below steps:

1. I prepared a worksheet which has weekly data for both buy and sell information.
2. The worksheet contains Week number, Fruits, buy price, buy quantity, sell price, sell quantity and wastage.
3. I have taken this information from Profit/ Loss data sheet.
4. Just jotted down the information to analyze data on weekly basis.
5. This data has the information, how many fruits are wasted on weekly basis.
6. Create a Pivot table with this information.
7. For first graph, I take the Fruits in Row section and Wastage in sum of wastage section. It will give sum of wastage of each product for whole year.
8. I choose clustered bar chart for the pictorial representation. This shows the wastage volume of each product.
9. To analyze the weekly information on wastage of each item, I followed below steps.
10. I choose 5 fruits for this analysis. Banana, Apple, Coconut, Guava and Pineapple.
11. I create 1 table where Week number is available, and wastage of each fruit is available in a column on weekly basis.
12. I consolidated the information in a single graph to understand the trend.
13. I choose line graph for analyzing this data. It helps to understand how different fruits have different trend of wastage of fruit.
14. It also shows that, few fruits are not available for all the year. Those are season fruits and wastage is lesser than other fruits.
15. In the Results and Findings section, data and pictorial representation is available for this analysis. Data 2, Pic 2, Data 3, Pic 3.

## Analysis of Sell Flow for each fruit

For this analysis, I followed below steps:

1. I added one column in the Sell data which is day of the week. To get that, I used TEXT function in excel on date column and text format “dddd”.
2. Now with all the information of sell data, create a pivot table.
3. In the pivot table, I used Fruits in Rows section, Day of week in column section and Sum of quantity in values section.
4. I choose clustered column chart for the graph. As it shows, sell of each product on each day of the week.
5. It also shows that, few fruits are sold all days of the week whereas few are sold only few days.
6. This is because, fruits keep fresh for few days only. Some fruits keep fresh for 4 days, some for 6 days and some for 7 days.
7. Created another data set for weekly sell flow for few fruits like Apple, Coconut, Mango, Muskmelon and Pomegranate.
8. For this I took sell information of each day of the week for these 5 fruits.
9. Create a pivot table.
10. In the pivot table, I took Fruits is Rows section, Day of the week in column section and Sum of selling quantity in values section.
11. I choose line chart for the graphical representation as I am showing the flow of the product on a week.
12. This shows that, few fruits are not selling few days of the week. Whereas, selling of some products are high on Sunday as that is inventory restoration day and decreasing as the day increases.
13. In Results and Findings section, data and pictorial representation is available for this analysis. Data 4, Pic 4, Data 5 and Pic 5.

## Analysis of Profit and Loss

For this analysis I followed below steps:

1. Take Fruits, Inventory Cost, Income, Profit/ Loss from Profit/ Loss worksheet.
2. Create a pivot table with these data.
3. In the pivot table, use Fruits in Rows section and Sum of Inventory Cost, Sum of Income and Sum of Profit/ Loss in Values section.
4. For first graph, I took Fruits, Inventory cost and Income.
5. I choose clustered bar chart for the graph. It shows comparison between Inventory cost and Income for each product.
6. For the second graph, I took Fruits and Profit/ Loss.
7. I choose column graph for graphical representation, as it shows total amount of profit and loss for each product.
8. In Results and Findings section, data and pictorial representation is available. Data 6, Pic 6, Data 7 and Pic 7.
9. We can observe that, the owner is making loss in 1 product which is Apple. For others most of the products have very minimal profit.

# Results and Findings

## Analysis of Buy and Sell Quantity

1. Here is the data used for this analysis.

|  |  |  |
| --- | --- | --- |
| **Fruits** | **Buy Quantity** | **Sell Quantity** |
| apple(kg) | 1060 | 725 |
| banana(piece) | 6360 | 3969 |
| ber(kg) | 90 | 79 |
| Black Grapes(kg) | 50 | 42.5 |
| coconut(piece) | 2650 | 1953 |
| Green Grapes(kg) | 180 | 147 |
| Guava(kg) | 40 | 35 |
| mango(kg) | 180 | 150 |
| mousambi(piece) | 6360 | 4386 |
| Muskmelon(piece) | 195 | 161 |
| orange(piece) | 4320 | 2561 |
| Papaya(kg) | 425 | 311 |
| Pineapple(piece) | 450 | 275 |
| Pomegranate(kg) | 180 | 112 |
| Watermelon(piece) | 200 | 191 |
| yam bean(kg) | 420 | 350 |

Data 1

1. Pictorial representation of the data.

Pic 1

## Analysis of Wastage of each item

1. Data for total wastage of each product.

|  |  |
| --- | --- |
| **Fruits** | **Wastage** |
| apple(kg) | 307 |
| banana(piece) | 2256 |
| ber(kg) | 6 |
| Black Grapes(kg) | 7.5 |
| coconut(piece) | 654 |
| Green Grapes(kg) | 35 |
| Guava(kg) | 5 |
| mango(kg) | 30 |
| mousambi(piece) | 1789 |
| Muskmelon(piece) | 34 |
| orange(piece) | 1434 |
| Papaya(kg) | 114 |
| Pineapple(piece) | 175 |
| Pomegranate(kg) | 68 |
| Watermelon(piece) | 25 |
| yam bean(kg) | 47 |

Data 2

1. Pictorial representation of total wastage of fruits

Pic 2

1. Weekly data for 5 fruits chosen for the analysis.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Week | Apple | Banana | Coconut | Guava | Pineapple |
| Week1 | 4 | 57 | 24 |  |  |
| Week2 | 4 | 43 | 22 |  |  |
| Week3 | 3 | 45 | 22 |  |  |
| Week4 | 0.5 | 48 | 18 |  |  |
| Week5 | 3 | 46 | 4 |  |  |
| Week6 | 6 | 36 | 19 |  |  |
| Week7 | 7 | 34 | 10 |  |  |
| Week8 | 6.5 | 37 | 18 |  |  |
| Week9 | 5.5 | 26 | 17 |  |  |
| Week10 | 10.5 | 34 | 17 |  |  |
| Week11 | 9 | 33 | 13 |  |  |
| Week12 | 7.5 | 37 | 19 |  |  |
| Week13 | 6 | 38 | 15 |  |  |
| Week14 | 9 | 35 | 17 |  |  |
| Week15 | 5 | 41 | 16 |  |  |
| Week16 | 8.5 | 43 | 17 |  |  |
| Week17 | 4.5 | 39 | 9 |  |  |
| Week18 | 8 | 49 | 11 |  |  |
| Week19 | 6 | 52 | 19 |  |  |
| Week20 | 8 | 47 | 5 |  |  |
| Week21 | 6.5 | 41 | 13 |  |  |
| Week22 | 6 | 36 | 16 |  |  |
| Week23 | 6 | 54 | 12 |  |  |
| Week24 | 7.5 | 34 | 13 |  |  |
| Week25 | 5.5 | 49 | 7 |  |  |
| Week26 | 6.5 | 32 | 12 |  |  |
| Week27 | 3.5 | 29 | 2 |  | 8 |
| Week28 | 5 | 27 | 19 |  | 7 |
| Week29 | 6.5 | 40 | 13 |  | 10 |
| Week30 | 6.5 | 36 | 7 |  | 10 |
| Week31 | 3 | 54 | 14 |  | 9 |
| Week32 | 3 | 49 | 11 | 1.5 |  |
| Week33 | 3 | 47 | 4 | 1 |  |
| Week34 | 7 | 47 | 11 | 0 |  |
| Week35 | 5 | 47 | 13 | 2.5 |  |
| Week36 | 4 | 39 | 8 |  | 11 |
| Week37 | 6.5 | 40 | 13 |  | 10 |
| Week38 | 5.5 | 41 | 15 |  | 9 |
| Week39 | 4.5 | 40 | 12 |  | 11 |
| Week40 | 8 | 51 | 14 |  | 11 |
| Week41 | 8 | 55 | 9 |  | 13 |
| Week42 | 6.5 | 54 | 15 |  | 12 |
| Week43 | 7 | 55 | 7 |  | 14 |
| Week44 | 7 | 58 | 0 |  | 12 |
| Week45 | 7.5 | 57 | 10 |  | 10 |
| Week46 | 6 | 51 | 0 |  | 7 |
| Week47 | 5 | 48 | 15 |  | 6 |
| Week48 | 5 | 49 | 6 |  | 5 |
| Week49 | 5.5 | 47 | 16 |  |  |
| Week50 | 5 | 45 | 21 |  |  |
| Week51 | 7 | 43 | 8 |  |  |
| Week52 | 7 | 41 | 6 |  |  |

Data 3

1. Pictorial representation of 5 fruits chosen for the analysis.

Pic 3

## Analysis of Sell Flow for each fruit

1. Day wise sell for each product

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Fruits | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
| apple(kg) | 160 | 106 | 81.5 | 76 | 51.5 | 52 | 198 |
| banana(piece) | 1286 | 854 | 583 |  |  |  | 1246 |
| ber(kg) | 26.5 | 12.5 | 7 |  |  |  | 33 |
| Black Grapes(kg) | 12 | 9 | 3.5 |  |  |  | 18 |
| coconut(piece) | 280 | 271 | 271 | 287 | 291 | 266 | 287 |
| Green Grapes(kg) | 45 | 26.5 | 24 |  |  |  | 51.5 |
| Guava(kg) | 9.5 | 6 | 5.5 | 4.5 |  |  | 9.5 |
| mango(kg) | 44 | 30 | 25 |  |  |  | 51 |
| mousambi(piece) | 725 | 654 | 554 | 519 | 578 | 456 | 900 |
| Muskmelon(piece) | 35 | 21 | 20 | 21 | 19 |  | 45 |
| orange(piece) | 447 | 433 | 434 | 419 | 394 |  | 434 |
| Papaya(kg) | 46 | 56 | 52 | 58 | 53 |  | 46 |
| Pineapple(piece) | 54 | 45 | 46 | 40 | 43 |  | 47 |
| Pomegranate(kg) | 16 | 17.5 | 16 | 16 | 14.5 | 16.5 | 15.5 |
| Watermelon(piece) | 33 | 24 | 24 | 23 | 26 | 27 | 34 |
| yam bean(kg) | 40 | 46 | 49 | 48 | 52 | 49 | 66 |

Data 4

1. Pictorial representation of sell for each product.

Pic 4

1. Data for weekly sell flow of each product for 5 fruits.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Fruits** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Saturday** | **Sunday** |
| apple(kg) | 160 | 106 | 81.5 | 76 | 51.5 | 52 | 198 |
| coconut(piece) | 280 | 271 | 271 | 287 | 291 | 266 | 287 |
| mango(kg) | 44 | 30 | 25 |  |  |  | 51 |
| Muskmelon(piece) | 35 | 21 | 20 | 21 | 19 |  | 45 |
| Pomegranate(kg) | 16 | 17.5 | 16 | 16 | 14.5 | 16.5 | 15.5 |

Data 5

1. Pictorial representation of weekly sell flow of each product for 5 fruits.

Pic 5

## Analysis of Profit and Loss

1. Data of Inventory cost and Income for each product.

|  |  |  |
| --- | --- | --- |
| **Fruits** | **Inventory Cost** | **Income** |
| apple(kg) | 150800 | 146600 |
| banana(piece) | 16224 | 19920 |
| ber(kg) | 4950 | 8400 |
| Black Grapes(kg) | 4650 | 6375 |
| coconut(piece) | 31200 | 58380 |
| Green Grapes(kg) | 9180 | 14500 |
| Guava(kg) | 1520 | 2800 |
| mango(kg) | 10080 | 15000 |
| mousambi(piece) | 49920 | 66765 |
| Muskmelon(piece) | 5850 | 11270 |

Data 6

1. Pictorial representation of Inventory cost and Income for each product.

Pic 6

1. Data for Profit/ Loss

|  |  |
| --- | --- |
| **Fruits** | **Profit/Loss** |
| apple(kg) | -4200 |
| banana(piece) | 3696 |
| ber(kg) | 3450 |
| Black Grapes(kg) | 1725 |
| coconut(piece) | 27180 |
| Green Grapes(kg) | 5320 |
| Guava(kg) | 1280 |
| mango(kg) | 4920 |
| mousambi(piece) | 16845 |
| Muskmelon(piece) | 5420 |
| orange(piece) | 6060 |
| Papaya(kg) | 10430 |
| Pineapple(piece) | 5350 |
| Pomegranate(kg) | 1140 |
| Watermelon(piece) | 4750 |
| yam bean(kg) | 13400 |

Data 7

1. Pictorial representation of Profit/ Loss

Pic 7

# Interpretation of Results and Recommendation

## Analysis of Buy and Sell Quantity

We can clearly see from the data, as well as from the graph that, sell quantity are always less than buy quantity, which indicates that there is wastage of inventory. This difference is very large for few products like apple, banana, mousambi, orange.

Recommendation is that to buy those fruits in lesser quantity. More information is available in the next section.

## Analysis of Wastage of each item

We can clearly see from the first data, as well as from the first graph that, all the products got wasted in some volume. Whether it is less or more. Few products have very high volume of wastage.

From the second graph, we see that few fruits are season fruits, available only for few weeks of the year like Guava, Pineapple. Few fruits are available all the time in the year like Banana, Apple, Coconut.

The fruits which are wasted in huge amounts like Banana, Coconut, Orange, Mousambi, the owner can buy lesser volume of these products.

|  |  |  |  |
| --- | --- | --- | --- |
| Fruit | Wastage Quantity | Buy Quantity | Percentage wastage |
| banana(piece) | 2256 | 6360 | 35% |
| coconut(piece) | 654 | 2650 | 25% |
| mousambi(piece) | 1789 | 6360 | 28% |
| orange(piece) | 1434 | 4320 | 33% |

Data 8

This table shows the wastage and buy volume of above-mentioned fruits and percentage of wastage. By this analysis, the recommendation is to buy these 4 fruits about 20% less than previous. This will reduce the wastage of product followed by more profit.

## Analysis of Sell Flow for each fruit

As we observed that, few fruits can not be sold all days of the week. Below table has information about which fruits keep fresh for how many days.

|  |  |
| --- | --- |
| Fruits | Keep Fresh For |
| apple(kg) | 7 |
| banana(piece) | 4 |
| ber(kg) | 4 |
| Black Grapes(kg) | 4 |
| coconut(piece) | 7 |
| Green Grapes(kg) | 4 |
| Guava(kg) | 5 |
| mango(kg) | 4 |
| mousambi(piece) | 7 |
| Muskmelon(piece) | 6 |
| orange(piece) | 6 |
| Papaya(kg) | 6 |
| Pineapple(piece) | 6 |
| Pomegranate(kg) | 7 |
| Watermelon(piece) | 7 |
| yam bean(kg) | 7 |

Data 9

Here we identify that, only apple, coconut, mousambi, pomegranate, watermelon and yam bean keep fresh for 7 days. These fruits can be sold all days of the week. But Banana, Ber, Black Grapes, Mango, Green Grapes, these keep fresh only for 4 days.

In the second analysis, few products are selling in same rate in all days of the week. Whereas few products can sell for few days of the week.

The recommendation is, if the owner buy those products twice a week and buy half volume each time what he buys once. In this way, his product will be fresh for all the day of the week and wastage will be less followed by more profit.

## Analysis of Profit and Loss

Here we can see that, only one product is in loss which is apple. Most of the products have very less profit. To mitigate this issue, I did some market survey. There I found that Mr. Das was selling his product on high range of the market price. Below table mentioned the market price and Mr. Das’s selling price of each product.

|  |  |  |  |
| --- | --- | --- | --- |
| **Fruits** | **Selling Price** | **Market Low Price** | **Market High Price** |
| apple(kg) | 200 | 120 | 240 |
| banana(piece) | 5 | 4 | 5 |
| ber(kg) | 100 | 75 | 120 |
| Black Grapes(kg) | 150 | 120 | 150 |
| coconut(piece) | 30 | 20 | 35 |
| Green Grapes(kg) | 100 | 70 | 110 |
| Guava(kg) | 80 | 60 | 80 |
| mango(kg) | 100 | 30 | 120 |
| mousambi(piece) | 15 | 10 | 17 |
| Muskmelon(piece) | 70 | 50 | 75 |
| orange(piece) | 10 | 5 | 12 |
| Papaya(kg) | 80 | 30 | 80 |
| Pineapple(piece) | 80 | 40 | 80 |
| Pomegranate(kg) | 150 | 80 | 150 |
| Watermelon(piece) | 50 | 30 | 70 |
| yam bean(kg) | 80 | 30 | 90 |

Data 10

The recommendation is:

1. To buy more season fruits and sell them in lower price.
2. Also as recommended earlier to restore the inventory twice a week so that fresh product will be available with the owner for all days of the week.
3. Also, we have identified that the owner was selling the fruits on same rate for all the days of the week. The recommendation is to sell not so fresh fruits in lowest price f the market. So that wastage of product will be less, and profit will be high.