Optimization of Supply Chain and Production Processes for Revenue Growth: A Data-Driven Approach

Mid Term report for the BDM capstone Project

Submitted by

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Contents

Declaration Statement

I am working on a Project titled “Optimisation of Supply Chain and Production Processes for Revenue Growth: A Data-Driven Approach”. I extend my appreciation to “MachPhy Cold Chain Solutions” , 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 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: 

Name: PONNADA NIRMAL DEEP

Date: 10-04-2024

1 Executive Summary and Title

MachPhy is a B2B company. As an extension to the "Executive Summary and Title" section of the proposal, where I mentioned the primary reasons to select MachPhy company which is a startup, data collection process, details about the products made by the company and more. This time I want to highlight how I modified the data, how I understand and analyze the data.

Understanding the data:

From the tax invoices of the purchase data from the company, I made excel sheets, SQL files to convert the data in a simple, understandable manner as well as ensure that the data should be with no redundancy.

I understand that there is a tool called PowerBi which is used for the visualization tasks. So I completed a course on PowerBi to make use of it for the next part of execution which is visualization of data.

Data Visualization:
Using PowerBi visualizations, I want to understand how the trends vary, how quickly they can change, and what are the factors that can influence this company the most. So by taking these points in mind I analyze the data.

Analyzing the data:

1) Analysis of Company wise revenue generation
    a) Customer name vs Sum of Total Bill Amount
    b) Item Description
    c) Sum of total bill amount
2) Monthly analysis
    a) [Month] VS ['Delivery State & Customer Name']
3) Analysis of State wise revenue generation & Product purchase
4) Monthly Analysis about number of customers, items purchased in that month, percentage of revenue made in that particular month.

Partial Results:

1) Machphy is a cold storage chain company but I found that the company is not performing well in the seasons(generally summer) where the products from this domain occupy the market.
2) Company is performing better in some unseason months than some of the favorable season months.

These results can be used to achieve the motto of this project " Optimisation of Supply Chain and Production Processes for Revenue Growth".

2 Proof of Originality of the Data

MachPhy Organization details:

MachPhy™ believes in providing cold-chain solutions with state-of-the-art technology for efficiency and the best user experience. They innovate, develop & customize products while delivering the best value to the customers. They have launched a range of products to plug the gap between cold chain storage and maintaining the longevity of samples. MachPhy™ ensures maintaining a consistent temperature at an affordable price, reliable and speedy handling of biologics and biopharma products. With low power consumption, backup with added security and traceability using IoT throughout, the customers can avail of hassle-free cooling solutions.

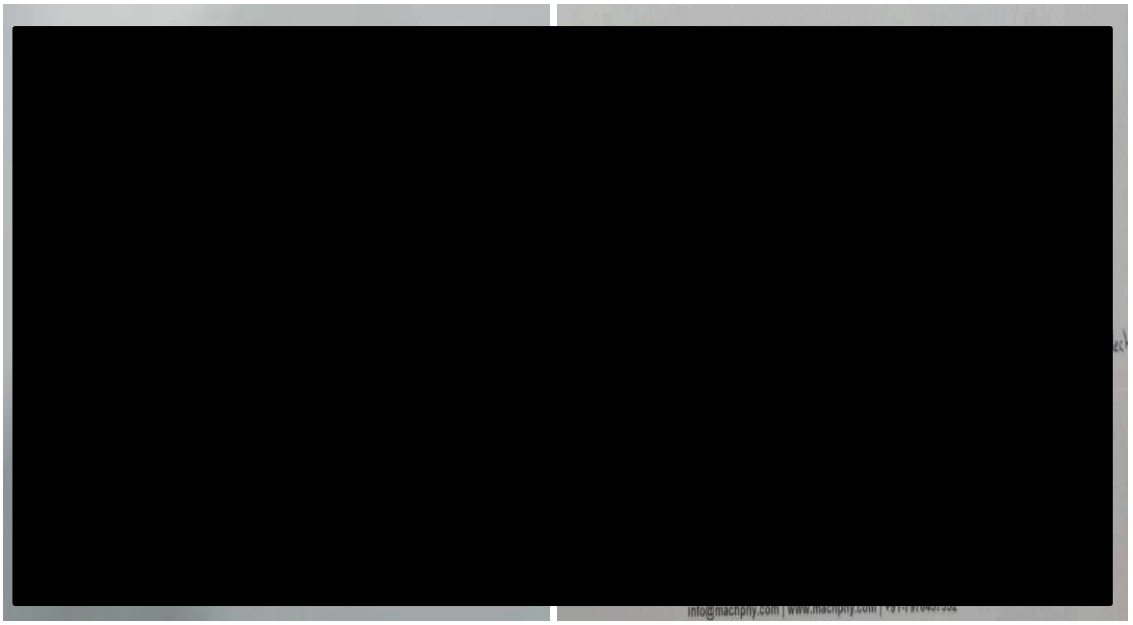
They also provide portable refrigerators & freezers. They believe in making cold chain leaner so we can collectively move forward with the target of a healthy nation with a better and more affordable standard of healthcare.

Interaction with the MachPhy representatives:

https://drive.google.com/file/d/1C6ic[redacted]
ing

Non-Disclosure Agreement with the company:

https://drive.google.com/file/d/1Mc[redacted]
ng



2.1 Signed NDA between the student and the company

3 Data Description

3.1 Metadata

3.2 Descriptive Statistics

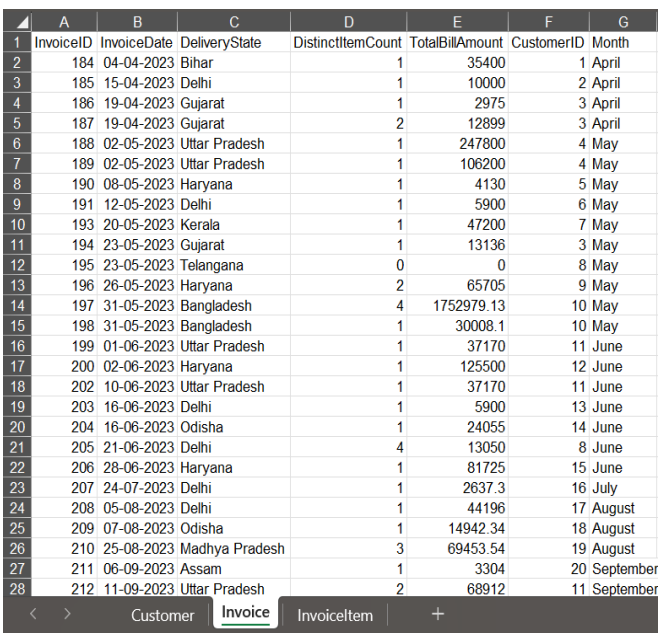
Metadata

Invoices I received from the company include Customer company details, items and at what quantity they purchased, product's HSN/SAC number, GST details, Order shipping details, sales person details, terms and conditions, and some more. From all these details to make SQL and excel files I selected some of the parameters which are helpful for analyzing the data further.

I converted the data into 3 sheets Customer, Invoice, InvoiceItem in the excel workbook. Let's understand the metadata. In "Customer" sheet there are 25 customers and each customer is assigned with the CustomerID, in "Invoice" sheet there are 7 columns and I mentioned about the details of the purchases based on the invoice number this sheet has the columns InvoiceID, InvoiceDate, DeliveryState, DistinctItemCount, TotalBillAmount, CustomerID, Month, in "InvoiceItem" there are 4 columns, InvoiceID, ItemDescription, Quantity, ShippingCharges in this sheet InvoiceID + ItemDescription act as primary key because details are mentioned by about each item bought with the same InvoiceID. This is the data about the data given by the company.

	A	B	C	D
1	InvoiceID	ItemDescription	Quantity	ShippingCharges
2	184	20Ltr Customise Bag	6	0
3	185	DATA LOGGER	1	0
4	186	7L temperature display bag	1	0
5	187	15L temperature display bag	1	0
6	187	Cyanoform + PCM Pouches 200ml	1000	0
7	188	Double chamber bag with Temperature Display	140	0
8	189	Double chamber bag with Temperature Display	60	0
9	190	7 Liter Bag Bio-sure	1	0
10	191	Cyanoform + PCM Pouches	1000	0
11	193	Cold Chain Box	10	0
12	194	Double Chamber Bag With Temperature	5	0
13	195	T - 10 PCM: 1.2lt Thermal Panel	150	0
14	196	Sample Insulated Hot/Cold Box for 5 to 10 degrees operation	1	0
15	196	Low temperature PCM cassettes for chilled 5operation	20	2000
16	197	Additional wheel attachment trolley forboxes	5	0
17	197	PCM Plate ChargerPCM Plate Charger (Frozen) for 10 boxes	2	0
18	197	50 Liter Box	5	0
19	197	50 Liter Bag	5	80259.61
20	198	IoT Devices for data collection & impact study (Mobile Charger, Wire (Copper))	15	0
21	199	Cyanoform + PCM Pouches	10000	0
22	200	Double Chamber Bag With Temperature Display	50	0
23	202	Cyanoform + PCM Pouches	10000	0
24	203	Double Chamber Bag with temperature display	1	0
25	204	15L temperature display bag	2	0
26	205	T-10 PCM	24	0
27	205	HS01 PCM	87	0
28	205	26N PCM	6	0

Customer | Invoice | InvoiceItem | +



	A	B	C	D	E	F	G
1	InvoiceID	InvoiceDate	DeliveryState	DistinctItemCount	TotalBillAmount	CustomerID	Month
2	184	04-04-2023	Bihar	1	35400	1	April
3	185	15-04-2023	Delhi	1	10000	2	April
4	186	19-04-2023	Gujarat	1	2975	3	April
5	187	19-04-2023	Gujarat	2	12899	3	April
6	188	02-05-2023	Uttar Pradesh	1	247800	4	May
7	189	02-05-2023	Uttar Pradesh	1	106200	4	May
8	190	08-05-2023	Haryana	1	4130	5	May
9	191	12-05-2023	Delhi	1	5900	6	May
10	193	20-05-2023	Kerala	1	47200	7	May
11	194	23-05-2023	Gujarat	1	13136	3	May
12	195	23-05-2023	Telangana	0	0	8	May
13	196	26-05-2023	Haryana	2	65705	9	May
14	197	31-05-2023	Bangladesh	4	1752979.13	10	May
15	198	31-05-2023	Bangladesh	1	30008.1	10	May
16	199	01-06-2023	Uttar Pradesh	1	37170	11	June
17	200	02-06-2023	Haryana	1	125500	12	June
18	202	10-06-2023	Uttar Pradesh	1	37170	11	June
19	203	16-06-2023	Delhi	1	5900	13	June
20	204	16-06-2023	Odisha	1	24055	14	June
21	205	21-06-2023	Delhi	4	13050	8	June
22	206	28-06-2023	Haryana	1	81725	15	June
23	207	24-07-2023	Delhi	1	2637.3	16	July
24	208	05-08-2023	Delhi	1	44196	17	August
25	209	07-08-2023	Odisha	1	14942.34	18	August
26	210	25-08-2023	Madhya Pradesh	3	69453.54	19	August
27	211	06-09-2023	Assam	1	3304	20	September
28	212	11-09-2023	Uttar Pradesh	2	68912	11	September

Customer | Invoice | InvoiceItem

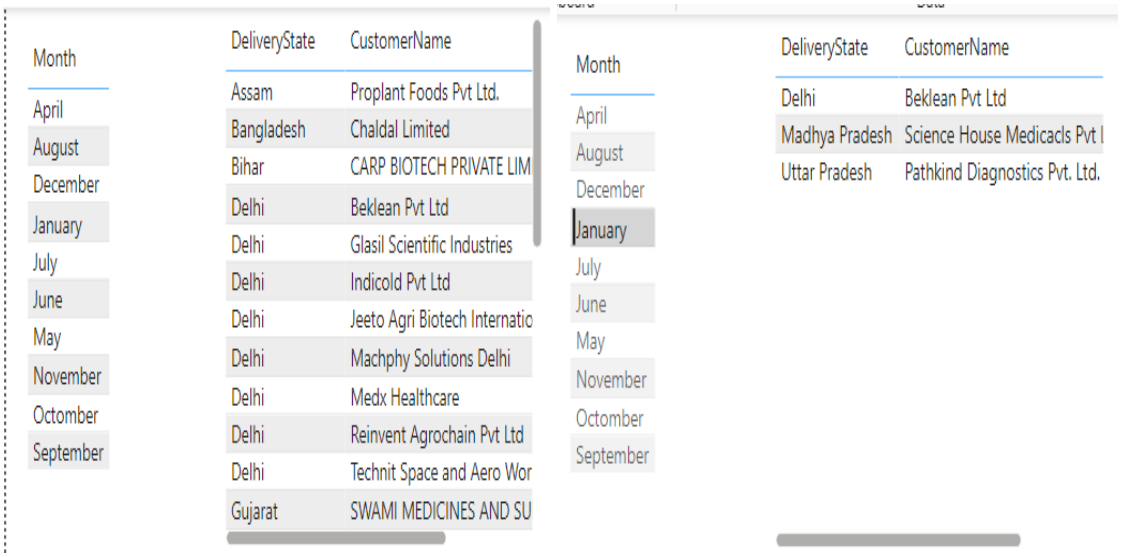
	A	B
1	CustomerID	CustomerName
2	1	CARP BIOTECH PRIVATE LIMITED
3	2	Jeeto Agri Biotech International
4	3	SWAMI MEDICINES AND SURGICALS
5	4	Pathkind Diagnostics Pvt. Ltd.
6	5	Medanta Institute of Education & Research
7	6	Medx Healthcare
8	7	BAGMO Private Limited
9	8	Machphy Solutions Delhi
10	9	Zen Mobility Private Limited
11	10	Chaldal Limited
12	11	Redcliffe Lifetech Private Limited
13	12	Core Diagnostics Pvt. Ltd.
14	13	Technit Space and Aero Works Pvt. Ltd.
15	14	Defence Institude of Physiology and Allied Sciences
16	15	Paras HealthCare Pvt Ltd
17	16	Glasil Scientific Industries
18	17	Indicold Pvt Ltd
19	18	Orange Bioscience
20	19	Modern Scientific Corporation
21	20	Proplant Foods Pvt Ltd.
22	21	Science House Medicacls Pvt Ltd (Bharat Lab)
23	22	Reinvent Agrochain Pvt Ltd
24	23	Enhance Gourmet Foods Pvt Ltd.
25	24	Predlabs Pvt Ltd
26	25	Beklean Pvt Ltd
27		
28		

Customer | Invoice | InvoiceItem

3.1.1 Snapshots of the data

Descriptive Statistics

Descriptive Statistics focuses on summarizing and describing the main features of the dataset. Common methods of descriptive statistics include 1) Frequency distributions 2) Measures of central tendency, dispersion 3) Summary statistics.



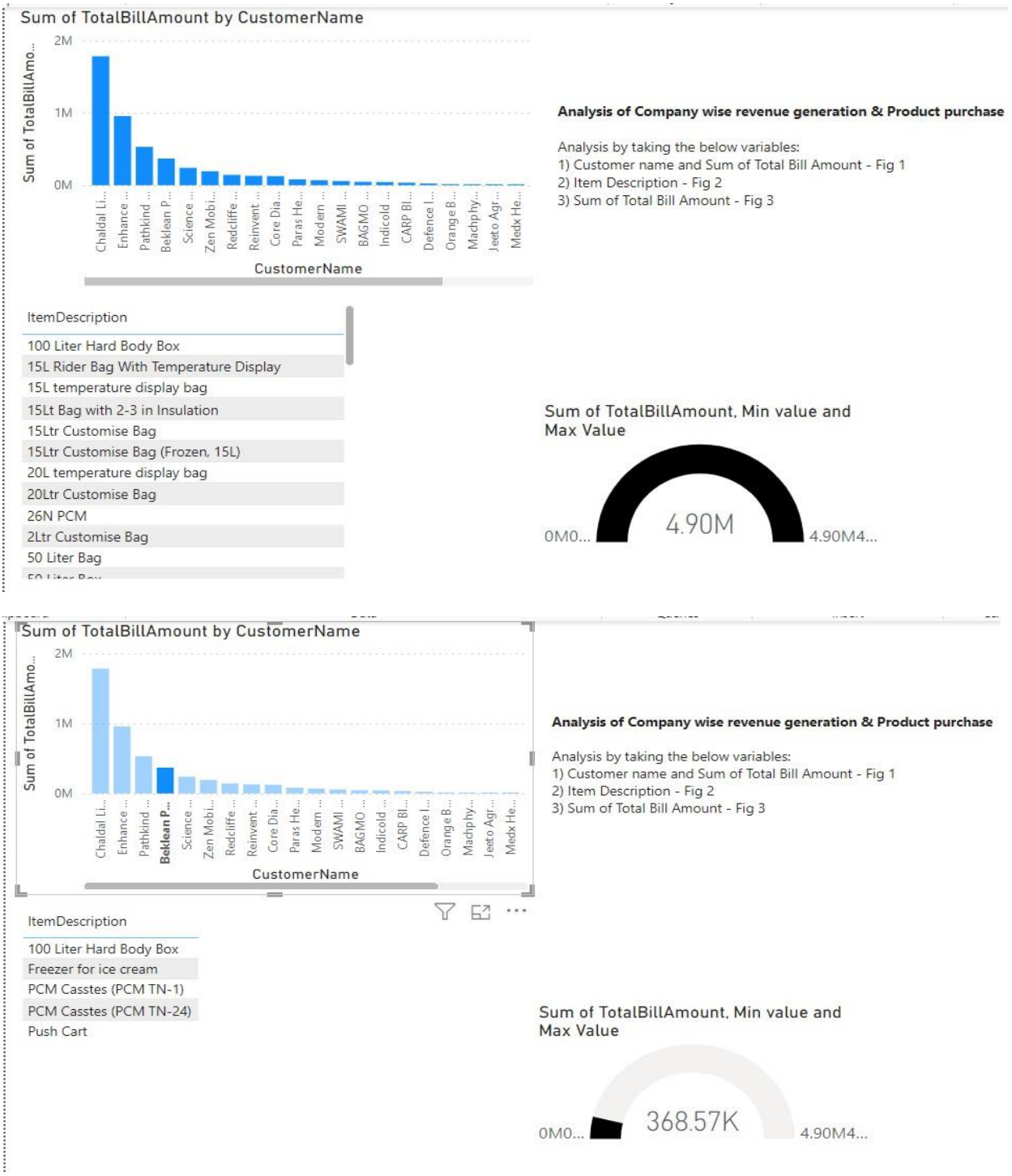
Month
April
August
December
January
July
June
May
November
Octomber
September

DeliveryState	CustomerName
Assam	Proplant Foods Pvt Ltd.
Bangladesh	Chaldal Limited
Bihar	CARP BIOTECH PRIVATE LIM
Delhi	Beklean Pvt Ltd
Delhi	Glasil Scientific Industries
Delhi	Indicold Pvt Ltd
Delhi	Jeeto Agri Biotech Internatio
Delhi	Machphy Solutions Delhi
Delhi	Medx Healthcare
Delhi	Reinvent Agrochain Pvt Ltd
Delhi	Technit Space and Aero Wor
Gujarat	SWAMI MEDICINES AND SU

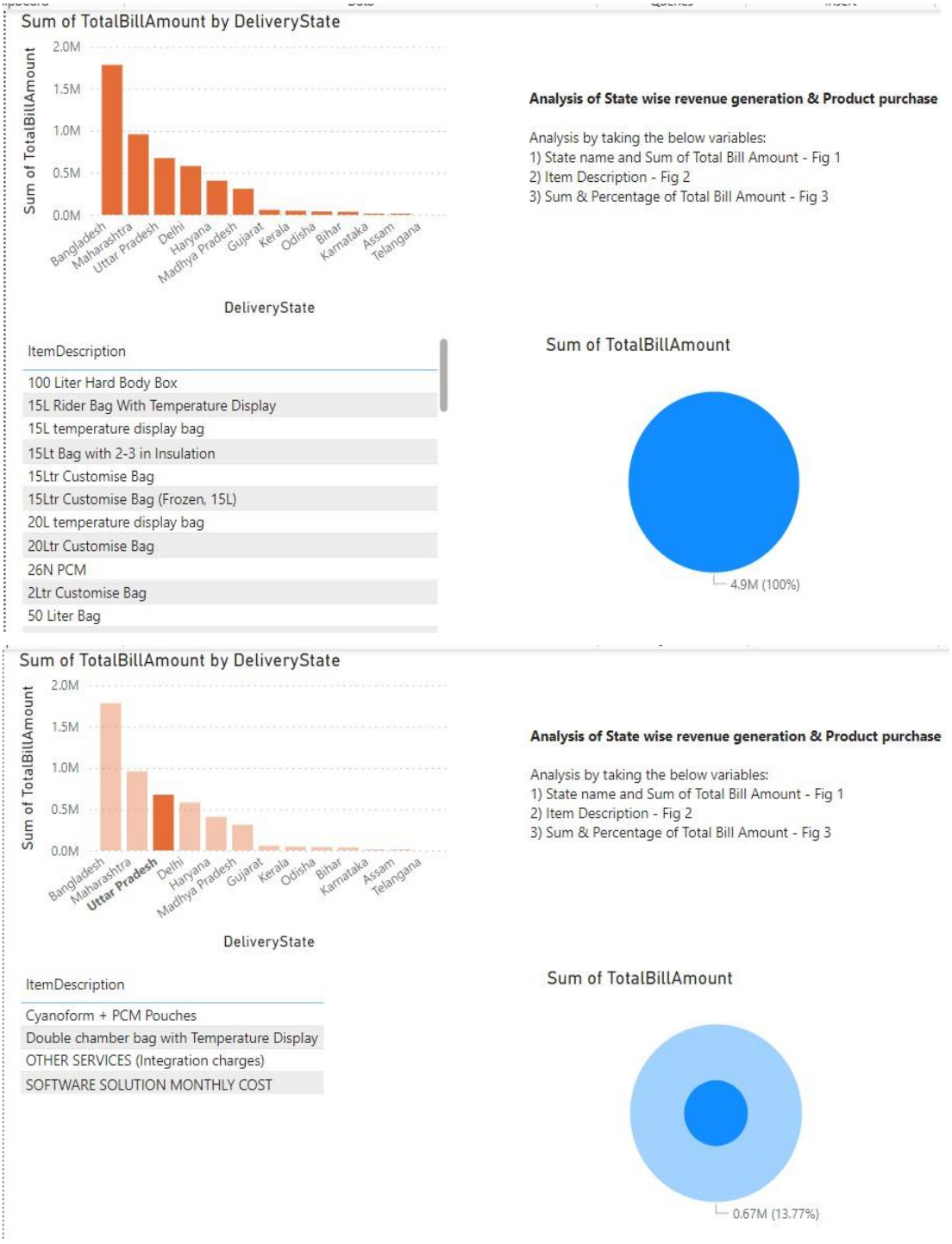
Month
April
August
December
January
July
June
May
November
Octomber
September

DeliveryState	CustomerName
Delhi	Beklean Pvt Ltd
Madhya Pradesh	Science House Medicacls Pvt l
Uttar Pradesh	Pathkind Diagnostics Pvt. Ltd.

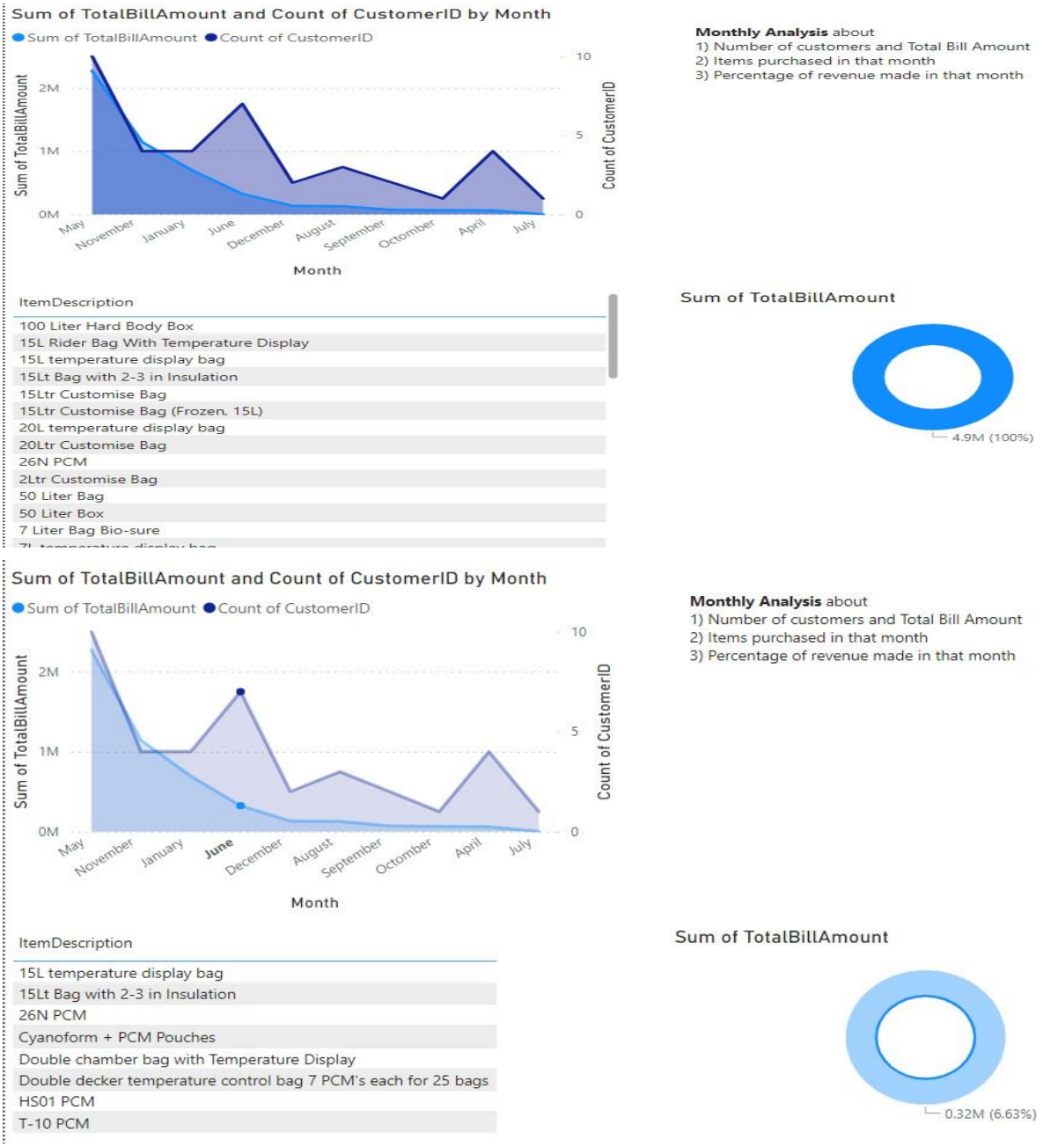
3.2.1 Monthly Analysis { [Month] VS[‘Delivery State’ and ‘CustomerName’] }



3.2.2 Analysis of Company wise revenue generation & Product purchase details.



3.2.3 Analysis of State wise revenue generation & Product purchase



3.2.4 Monthly Analysis using time series plots to check company performance in favorable seasons.

These techniques are used to gain insight into the characteristics of the data and summarize the information in a meaningful way for interpretation and decision making.

4 Detail Explanation of Analysis Process/Method

Given data is just tax invoices which consists of many unwanted sections, I selected the sections which can be subjected to perform analysis. At this stage of the project I prefer to visualize the data to observe patterns, detect outliers. To carry out this task I have chosen PowerBi, a Microsoft developed data visualization tool. This tool is very handy to make graphs, tables although it took me some effort to understand advanced options like drill through, creating new measures, etc.

I have gathered data of 10 months from April 2023 to January 2024. My primary goal is to make the data non redundant, to clinch this point I made databases in the MYSQL, created tables by verifying all the Normal Forms at each step and ultimately succeeded in making data non redundant. This data is converted into an excel workbook consisting of three sheets Customer, Invoice, InvoiceItem.

In the analysis process, primarily I want to analyze the data taking time as the pivot because the results of this company are dependent on the seasons. At the next step I will analyze by looking at the product as a pivot. Time series analyzation produced some peculiar results to consider. Below I will explain in which manner I used this data in time series to get the results.

1) Simple Monthly Analysis: To check what products were sold in a selected month and to whom those were sold.
2) Analyzing customer wise revenue generation and trend of purchase: Machphy being a B2B company we have the customers at the compatible range to analyze. So trends are made to evaluate the customers like how much they have spent, on what products they frequently tend to purchase
3) Analyzing state wise revenue generation: In our country we have a wide range of climates at the same time, even if it is summer temperatures vary in many regions. So I think about state wise contribution to the company. Results showed that northern states of India are contributing the most in the company revenue. There can be several reasons for this 1) Company is situated in Delhi and Bhubaneswar. 2) Comfortable situations in the current market or insufficient management of inventory (project motto).
4) Monthly revenue generation based on number of customers, purchase capabilities of the customers: Trends here should be make note of as there are
    a) Months where more customers but less revenue
    b) Less Customers more revenue
    c) Similar range of customers & revenue
    d) Better results in unfavour season but deeply low results in favorable conditions.

So I the results showed up in this analysis definitely taken to note as these will boost up the process to achieve the goal of the project - "Optimization of supply chain and production process for Revenue Growth"

5 Results and Findings

Generally companies under the cold chain domain consider summer to be a favorable market. But there are some trends which don't suit this idea.

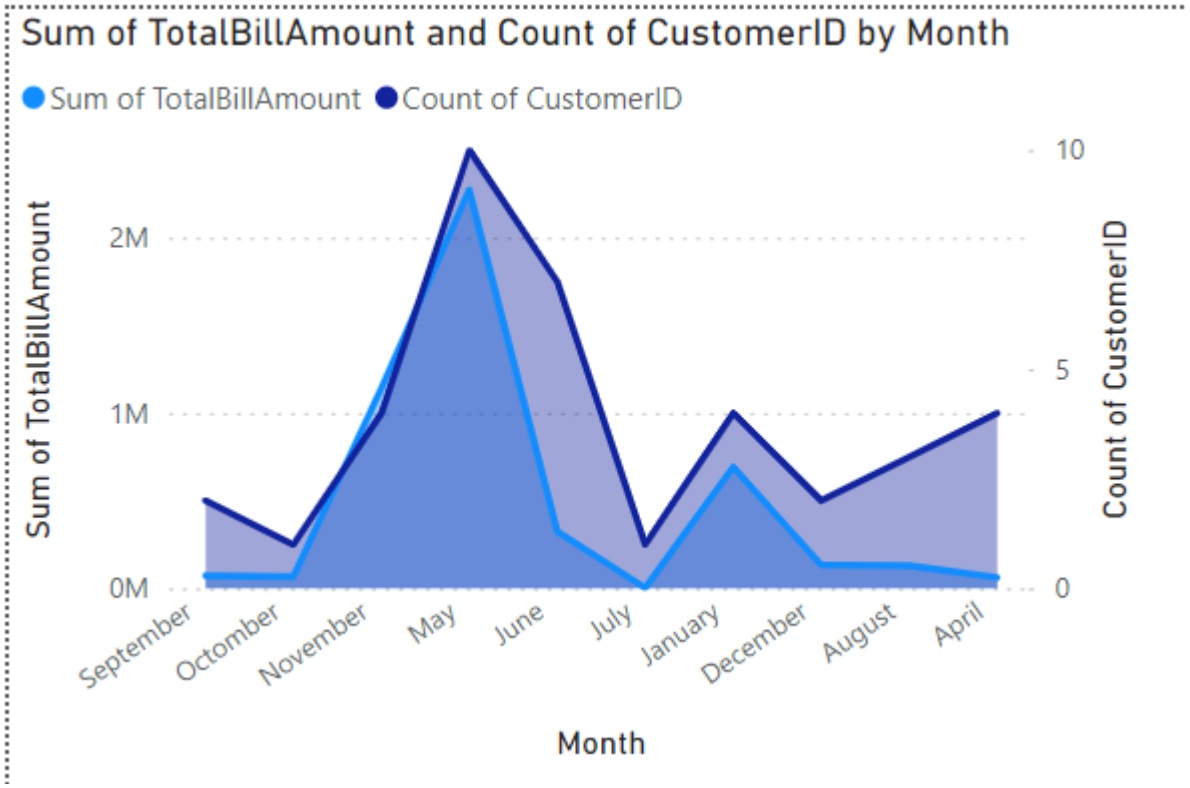
1) As expected, the company marked the highest revenue in the May month. But there are certain points to bring our focus on
    a) Company generated same revenue in both the favour months April and Unfavorable months January.
    b) We also observed a local peak in the January month.

    By taking these points I will further analyze what are the reasons behind these abnormal trends.

2) I also found that in this company breaks the general perception of more customers, more revenue
    a) Because both January and April generated almost the same revenue but January has more customers than April.
    b) General perception also comes true in some months like October, July.

    I will focus on whether season or customers or specific customer requirement, or

    What else could be the reasons for these unexpected trends?



Supporting image