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

Final 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: 11-07-2024

1 Executive Summary and Title

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

MachPhy is a startup company which aims to deliver medical products to isolated places in remote rural areas. Its products cater to a wide range of biomedical healthcare needs from ambient temperature refrigeration and deep freezing to cryogenic freezing. It also provides refrigerators & freezers. Despite facing challenges such as lack of identifying crucial insights, decline sales at times, slow rate in designing new products, founder remains optimistic and always welcomes new ideas and implementation techniques to sustain and grow in this sector.

I have started this project with raw data consisting tax invoices of sales done by MachPhy and receipts of purchases by MachPhy . Starting with data cleaning to concluding with the results I have followed several approaches to obtain reliable and efficient outcomes. After the mid term report I further done the data analysis in a two part way. As per the data collected I segregated the analysis into Sales and Purchase analysis.

Sales analysis consists of

1) Understanding the revenue trends
2) Customer Segmentation based on the
3) Geographic analysis
4) Product performance monitoring

Purchase analysis consists of

1) Cost trends
2) Supplier performance
3) Inventory turnover

Along with these I have done general and combined analysis by considering several aspects like Regional market penetration, new market acquisition capabilities etc., There had been a long discussion many times regarding these with the representatives that helped me to consolidate my ideas and gave me a clear view on what areas should I focus on to solve the problem statements of the project. This project aims to address the challenges by analyzing the sales and revenue data of around one year.

So at the end, in addition to the data driven decision making, I have done some research which can help provide some more recommendations. Hence this project aims to optimize the supply chain and production processes for revenue growth.

2 Detailed Explanation of Analysis Process

In this section, we outline the detailed process undertaken to analyze MachPhy's sales and purchase data. The analysis was guided by specific mottos aimed at uncovering opportunities, optimizing inventory, and leveraging past experiences for future growth. Each analysis method was tailored to achieve these goals effectively.

Analysis Method 1: Identifying/Uncovering the Hidden Opportunities in the Current Position

Motto: Identifying/Uncovering the hidden opportunities in the current position.

Approaches:

1. **Potential Market Identification:**
    - **Objective:** To discover untapped markets where MachPhy's products could be highly demanded.
    - **Process:**
        - Analyzed historical sales data to identify geographic regions and customer segments with growing demand but low current sales penetration.
        - Used demographic and economic data to identify regions with potential for growth.
        - Conducted competitor analysis to identify gaps in the market where MachPhy could offer unique value propositions.
    - **Outcome:** This approach helped pinpoint several regions and customer segments that have high potential but are currently under-served. By targeting these markets, MachPhy can significantly increase its market share.

2. **Season Opportunity Analysis:**

    - **Objective:** To understand seasonal demand fluctuations and capitalize on peak seasons.
    - **Process:**
        - Examined sales data to identify seasonal trends and peak sales periods.
        - Analyzed factors influencing seasonal demand, such as holidays, weather patterns, and special events.
        - Conducted surveys and gathered feedback from key customers to understand their seasonal needs and preferences.
    - **Outcome:** The analysis revealed specific periods, such as summer months and major holidays, where demand for cold storage products spikes. This insight allows MachPhy to strategically increase inventory and marketing efforts during these times to maximize sales.

Analysis Method 2: Analyzing Effective Ways to Adjust the Inventory

Motto: Analysing effective ways to adjust the inventory.

Process:

- **Objective:** To optimize inventory levels to meet demand without overstocking, thereby reducing costs and improving cash flow.
- **Steps:**
  - Conducted a historical sales analysis to determine average demand for each product.
  - Used predictive analytics to forecast future demand based on historical data, market trends, and seasonality.
  - Implemented inventory management techniques, such as Just-In-Time (JIT) and Economic Order Quantity (EOQ), to maintain optimal inventory levels.
  - Monitored inventory turnover rates to identify slow-moving items and prevent excess stock.

Outcome: By adjusting inventory based on precise demand forecasts and employing efficient management techniques, MachPhy can reduce holding costs, minimize waste, and ensure product availability during peak demand periods.

Analysis Method 3: Finding New Opportunities Based on Previous Experiences and Current Opportunities

Motto: Finding new opportunities based on previous experiences and current opportunities.

Process:

- **Objective:** To leverage historical data and current market trends to uncover new business opportunities.
- **Steps:**
  - Analyzed past sales data to identify successful products and strategies.
  - Conducted a SWOT analysis (Strengths, Weaknesses, Opportunities, Threats) to understand the company's position and potential areas for growth.
  - Identified current market trends and emerging opportunities through industry reports and market research.
  - Mapped previous successes to current market conditions to identify repeatable strategies and new product opportunities.

Outcome: This method helped identify several actionable opportunities, such as expanding successful product lines, entering new markets, and developing new products that align with current trends. By learning from past successes and adapting to current opportunities, MachPhy can continue to innovate and grow.

Conclusion

Through these detailed analysis methods, MachPhy has identified hidden opportunities, optimized its inventory management, and leveraged past experiences to uncover new growth opportunities. These insights provide a strategic roadmap for enhancing business performance and achieving sustained revenue growth.

3 Results and Findings

❖ Potential Market Identification

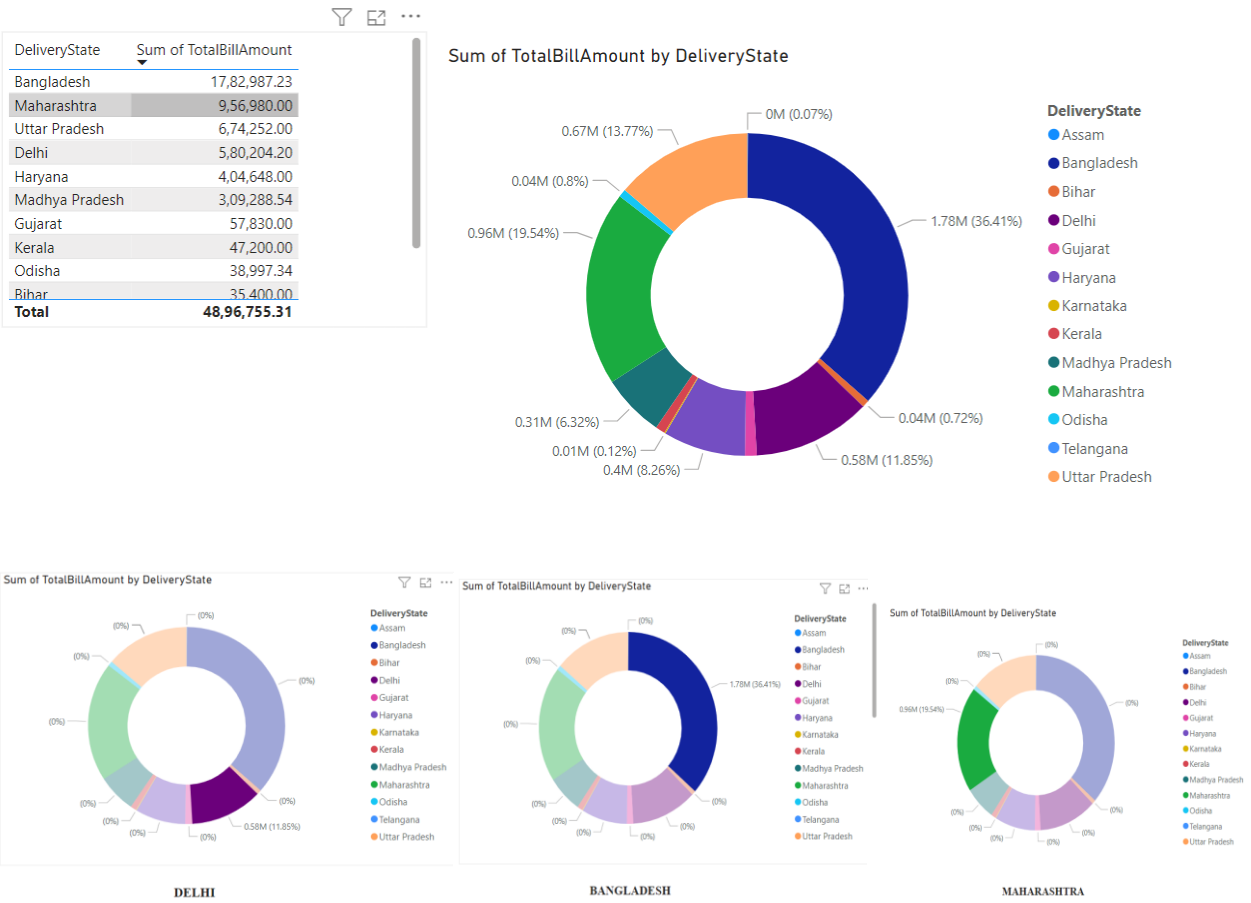
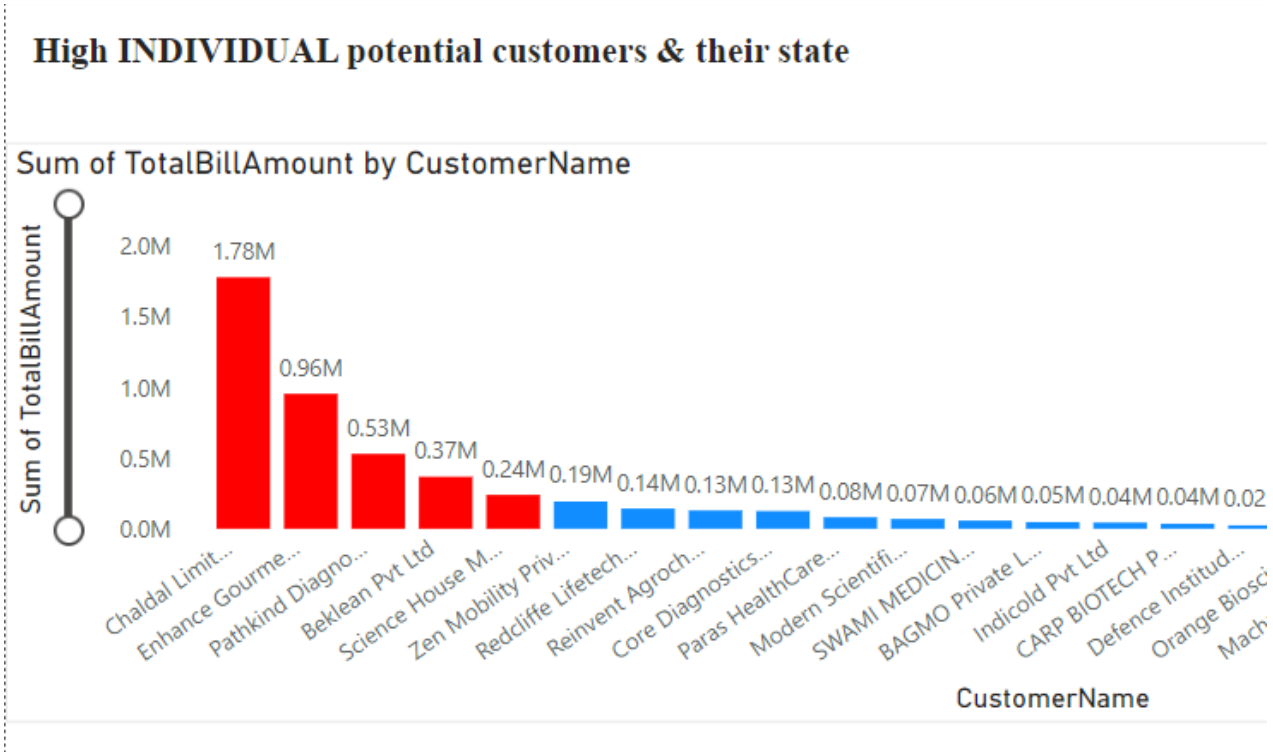


Fig: An overview of the revenue distribution among states

This shows how the revenue is distributed among different states, which also reflects that Bangladesh, Maharashtra, UttarPradesh, Delhi, Haryana states are making majority portions.

- Analysis using revenue generating capability of a customer:



	A	B
1	**CustomerName**	**State/Country**
2	Chaldal Limited	Bangladesh
3	Enhance Gourmet Foods Pvt Ltd.	Maharastra
4	Pathkind Diagnostics Pct Ltd.	UttarPradesh
5	Beklean Pvt Ltd.	Delhi
6	Science House Medicals Pvt Ltd (Bharat Lab)	Madhya Pradesh

Fig: Potential Customer Identification

For the identification of potential customers, a threshold value of 2 Lakhs has been established. Any customer generating revenue exceeding 2 Lakhs for MachPhy is classified as a potential customer.

The accompanying graphs illustrate these potential customers. There are a total of five potential customers, each hailing from different states. This significant discovery indicates that potential customers are geographically dispersed rather than concentrated in a single area. Consequently, these customers can serve as pivotal centers for expanding our business within their respective states.

- Analysis using the collective customer power:

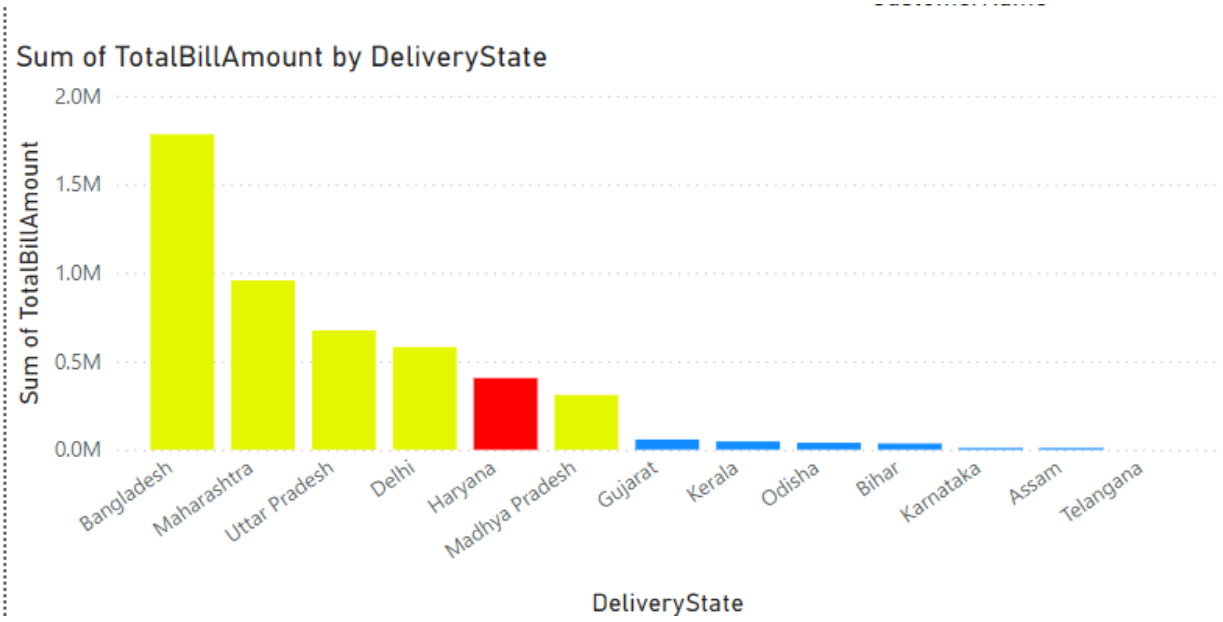


Fig: High contributing state identification

This analysis is conducted on a state-by-state basis, aggregating all customers within each state.

I have found that there are almost no change between the states from which the potential customers are and the states which generate considerable revenue share EXCEPT a state “HARYANA”. So in haryana there are numerous small customers collectively generate revenue surpassing that of states with potential customers. This disparity is visually evident in the graph provided below.

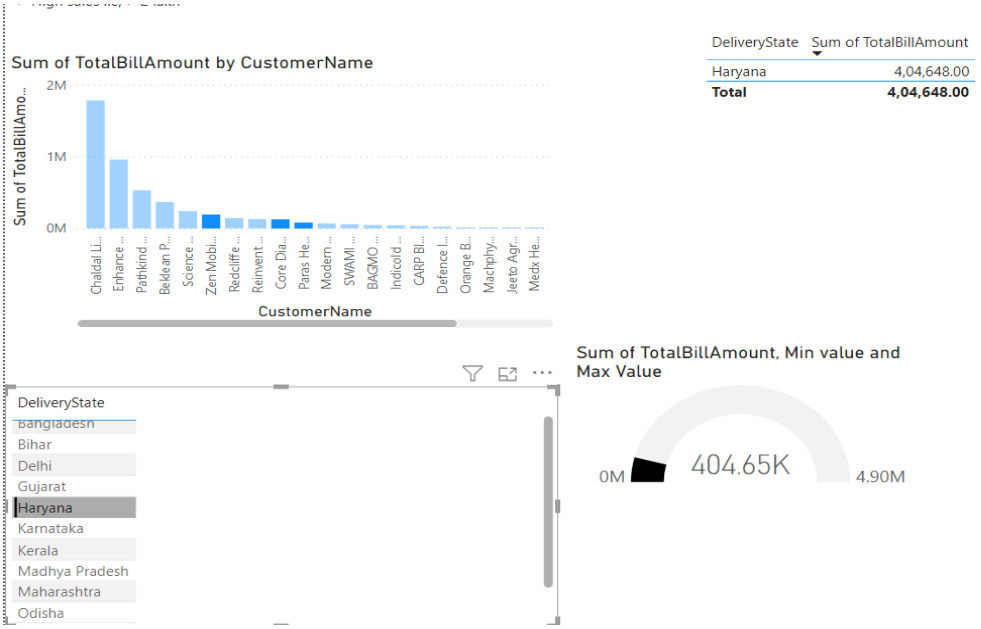


Fig: Revenue distribution among customers within Haryana state

Revenue share distribution among potential states:

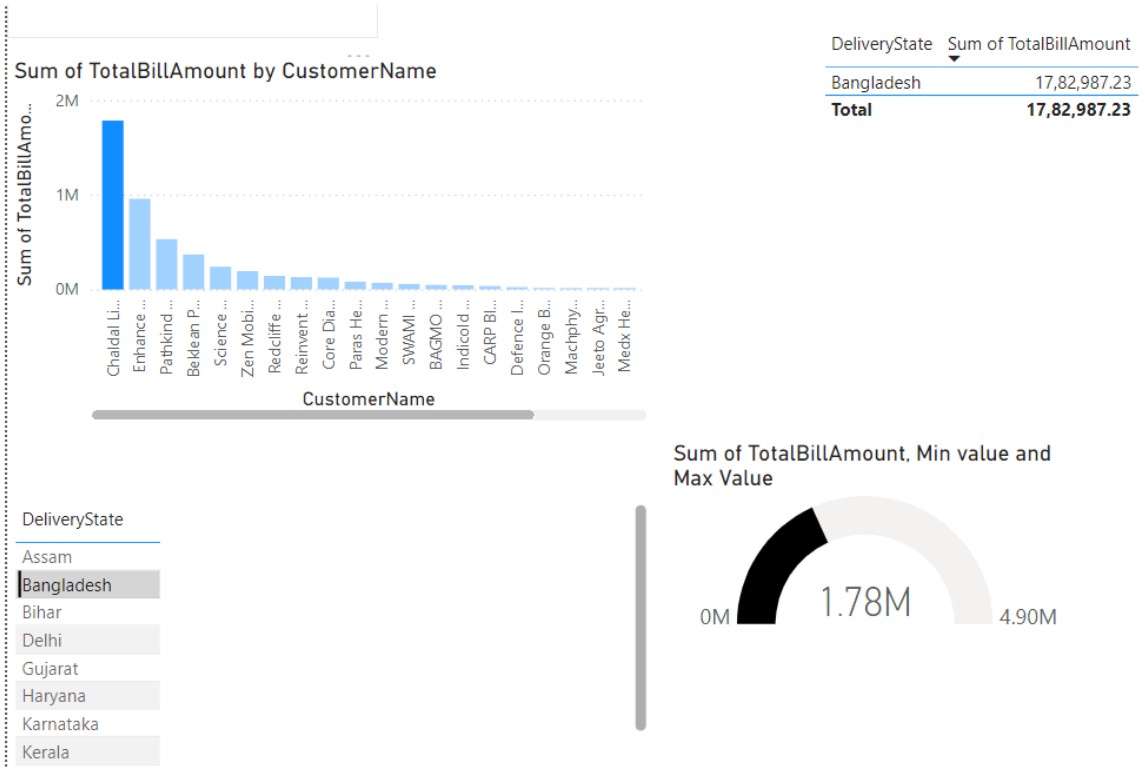


Fig: Revenue distribution among customers within Bangladesh.

Finding: This is the only intenaitonal trade MachPhy did in this financial year, so complete revenue is centered on a single customer.

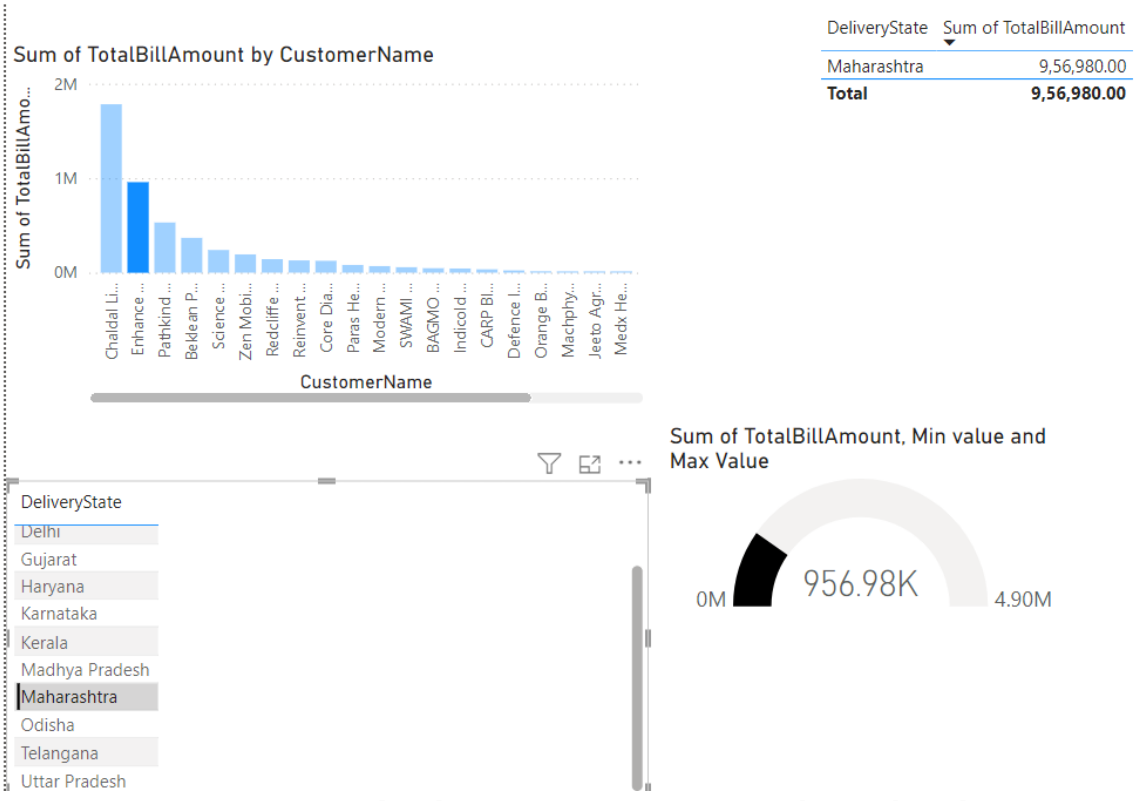


Fig: Revenue distribution among customers within Maharashtra state

Finding: This is a local trade but the problem here is all the revenue is handled by a single company Enhance Gourmet Foods Pvt Ltd.,

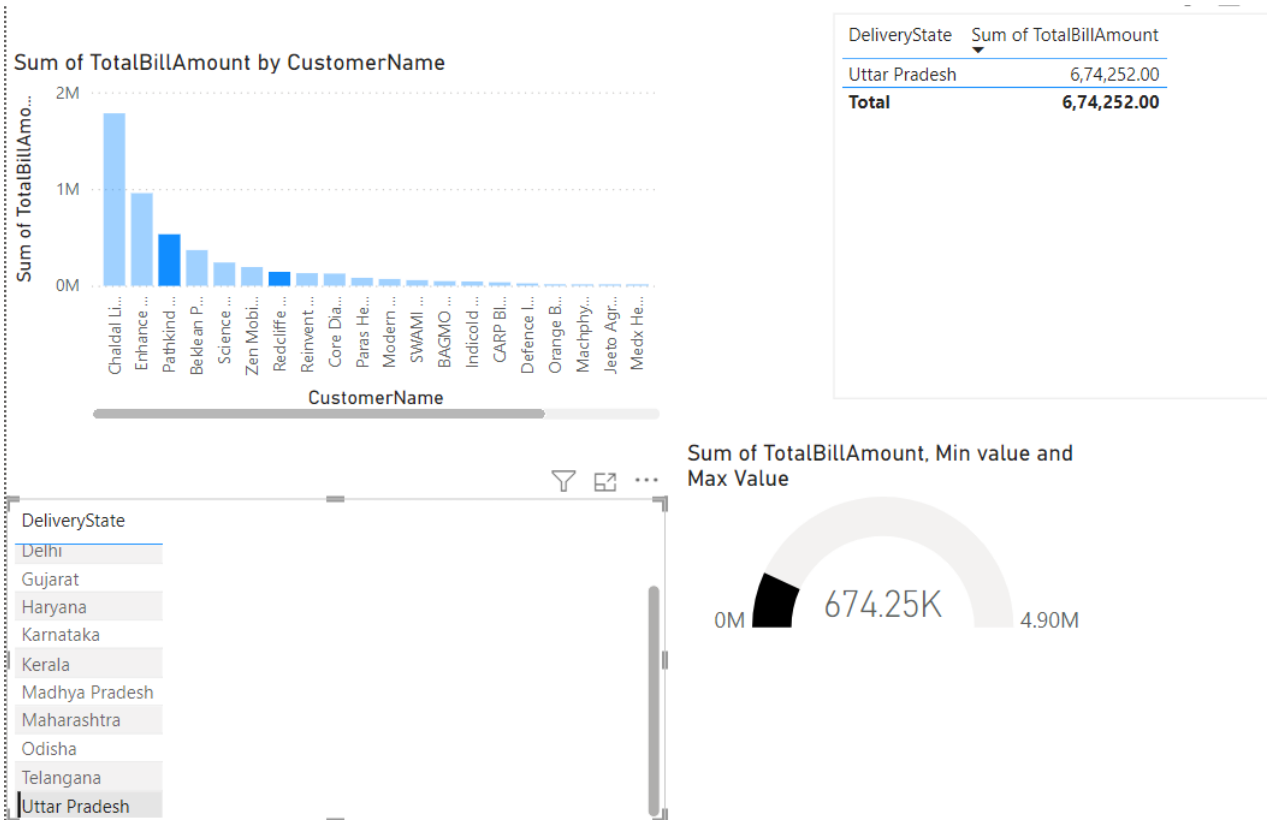


Fig: Revenue distribution among customers within Haryana state.

Finding: Uttar Pradesh comes under the safe cover section for MachPhy as the revenue is not handled by a single party and also the state contains potential customer.

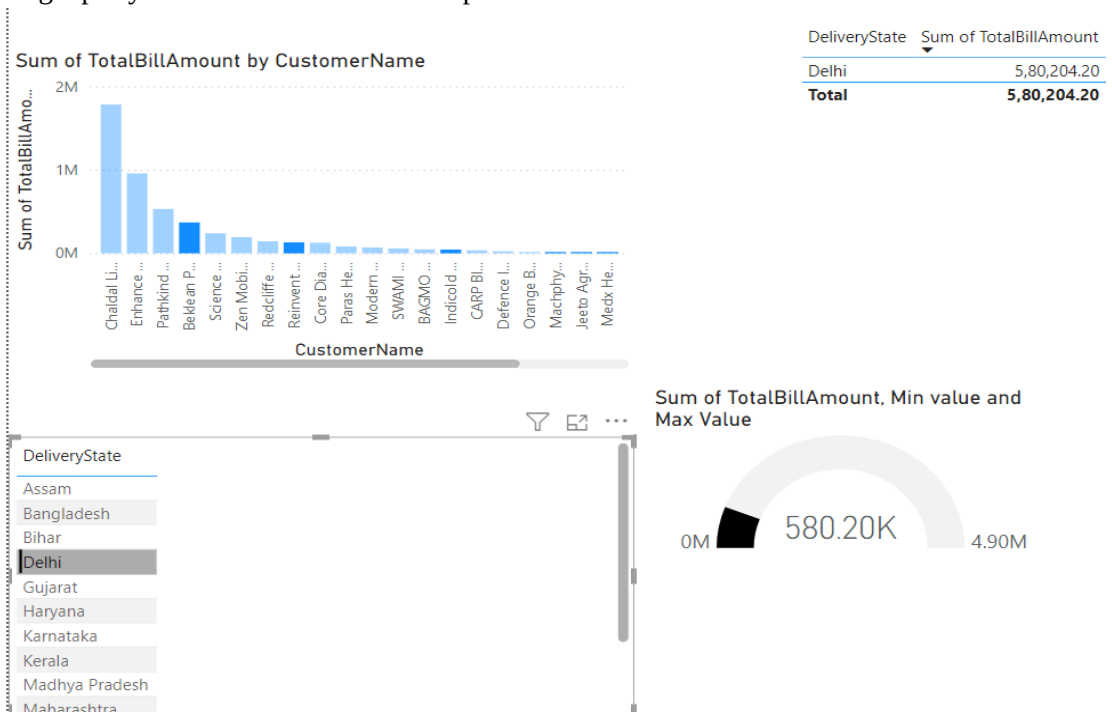


Fig: Revenue distribution among customers within Delhi.

Finding: MachPhy has 2 branches in Bhubaneswar and Delhi. So being a local company performs better in this area with a potential customer and a large number of companies taking share in revenue from this area.

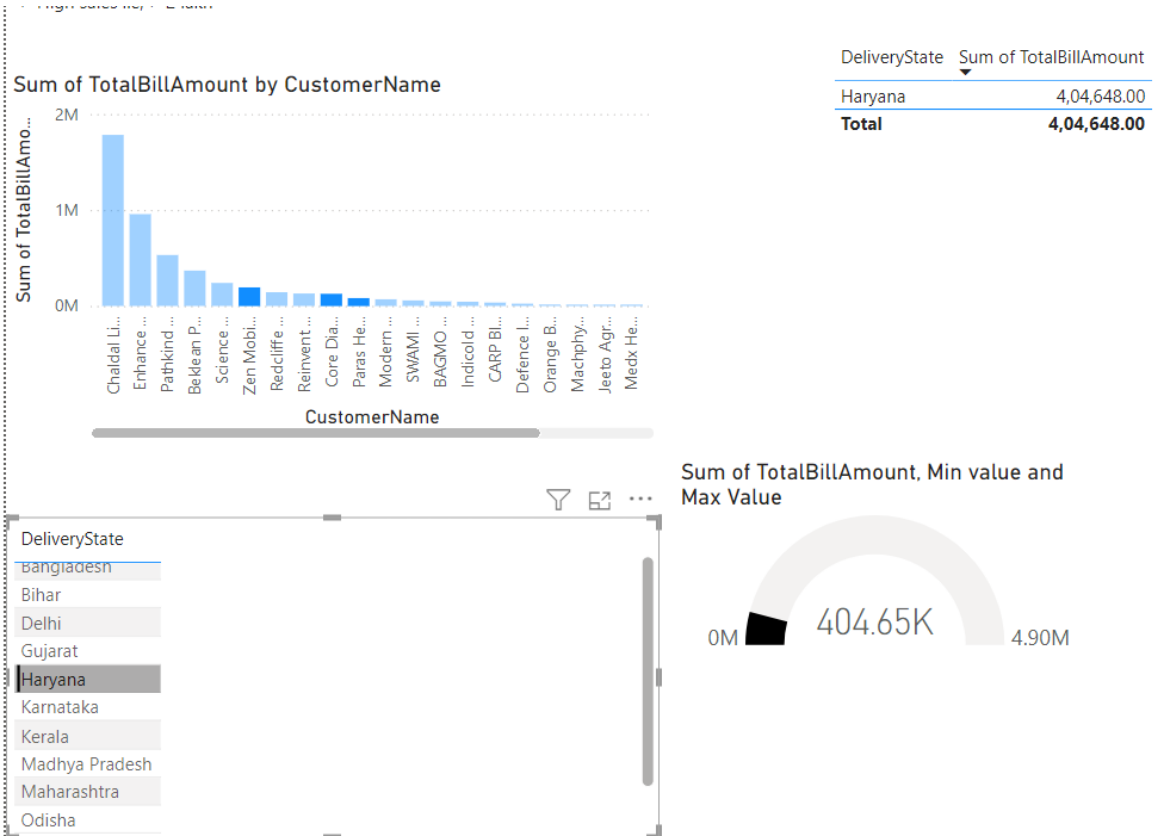


Fig: Revenue distribution among customers within Haryana state

Finding: Haryana state turned out to be the crutial section to examine as there are no potential customers from the state but collectively making more than the potential market state Madhya Pradesh.

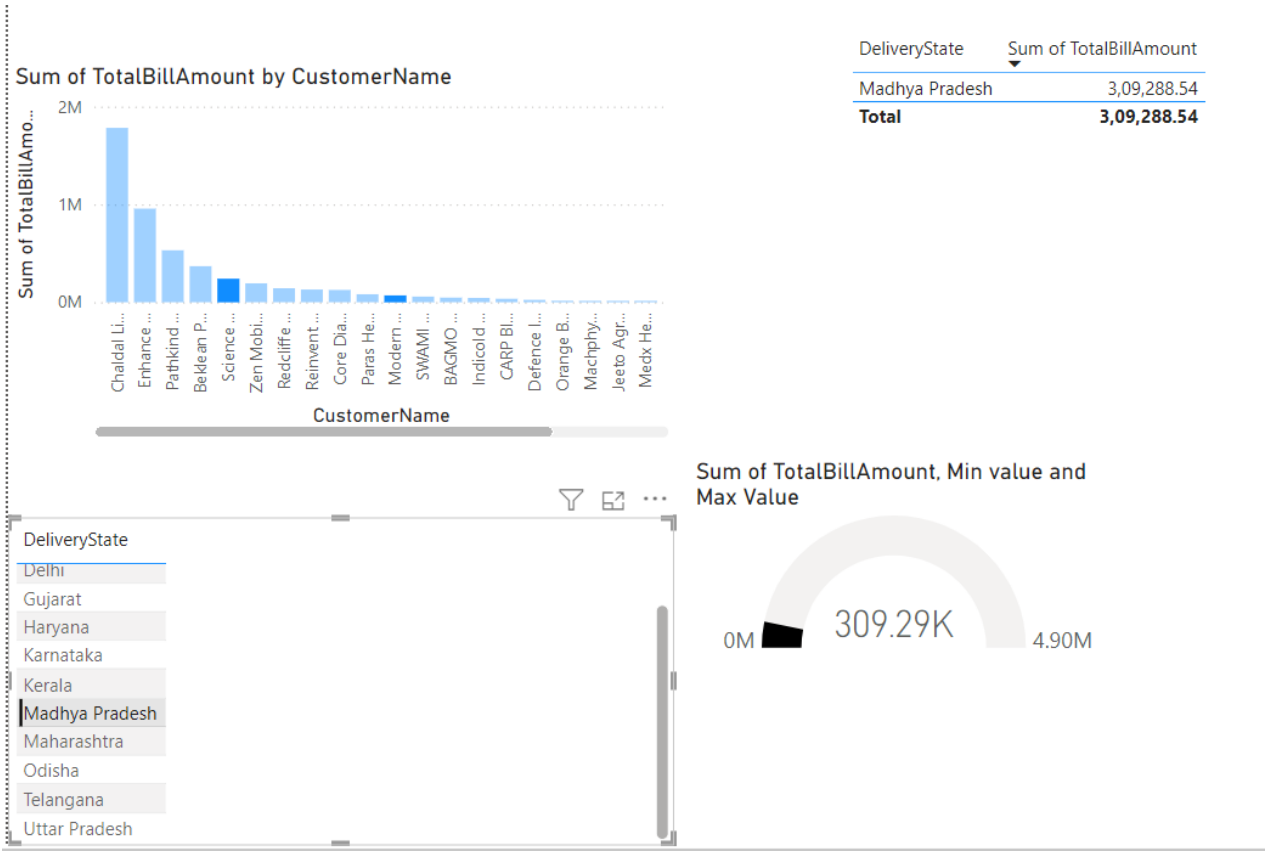


Fig: Revenue distribution among customers within Madhya Pradesh state.

Finding: Madhya Pradesh state has a potential customer and it also turned out to be a potential state with revenue scattered around multiple parties.

********** How potential customer's presense deviate the state revenue**********

1) Bangladesh (international) and maharastra (national), revenue from these two states are generated by single cusomter
    a. Pros: We can turn this situation to a win-win opportunity by making long term deals with discounts by having a discussion with the single potential customers
    b. Cons: Always relaying on the single customer is not beneficial
    Generating high revenue from a state indicating the demand at that place. So make these states to note for expanding number of customers
2) Madhya Pradesh, this state has a potential customer but on more analysing I have understand that there are several other customers in this region but they are not making a remarking shift in the collective statewide revenue. So rather than just expanding the number of customers its better to make a long term bonds with the potential customer so that revenue from that state won't get affected.

    Madhya Pradesh: Bharat Labs(potential) -> 2.4 L
    Bharat Labs(potential) + Others -> 3.1 L
    Difference: 0.7 L

We understand there is no considerable shift by the customers other than potential customer, so better to make deals with the potential customer rather than spending time and resources to reach new customers.

3) HARYANA, I want to stress the significance of this state because this is the only state which became a part of potential region without having potential customer so this will be the only region which can be a constant source for MachPhy even a customer back off.

4) UP, Delhi, these are the regions where other customers rather than potential ones making a significant impact on the collective state revenue. This indicates the scope of gathering number of new customers.

Extracted information from graphs & data

UP: Pathkind(potential) -> 5.3 L
Pathkind(potential) + Others -> 6.75 L
Difference: 1.44 L

Delhi : Beklean Pvt Ltd-> 3.7 L
Beklean Pvt Ltd + Others -> 5.8 L
Difference: 2.1 L

❖ SEASON OPPURTUNITY ANALYSIS

Month	Sum of TotalBillAmount
May	22,73,058.23
November	11,41,708.82
January	6,93,072.08
June	3,24,570.00
December	1,33,252.00
August	1,28,591.88
September	72,216.00
October	66,375.00
April	61,274.00
July	2,637.30
Total	**48,96,755.31**

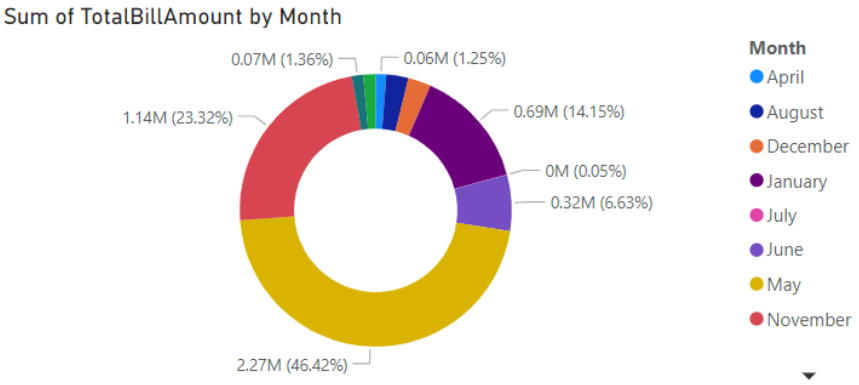


Fig: Monthly revenue share

Previous analysis step is completely based on the MachPhy data, this analysis is based on the MachPhy data along with the data I got during the interactions with MachPhy representatives. From the discussions I understood that summer season is highly profitable for them. So I have classified year to seasonal and unseasonal periods.

Seasonal period: March, April, May, June
Unseasonal period: Remaining months.
They have mentioned that during the unseasonal period mostly they try to manufacture the products.

Lets understand the available data before comparing it with the data from the interaction with the MachPhy company.

Month	MonthNumber
January	1.00
February	2.00
March	3.00
April	4.00
May	5.00
June	6.00
July	7.00
August	8.00
September	9.00
October	10.00
November	11.00
December	12.00

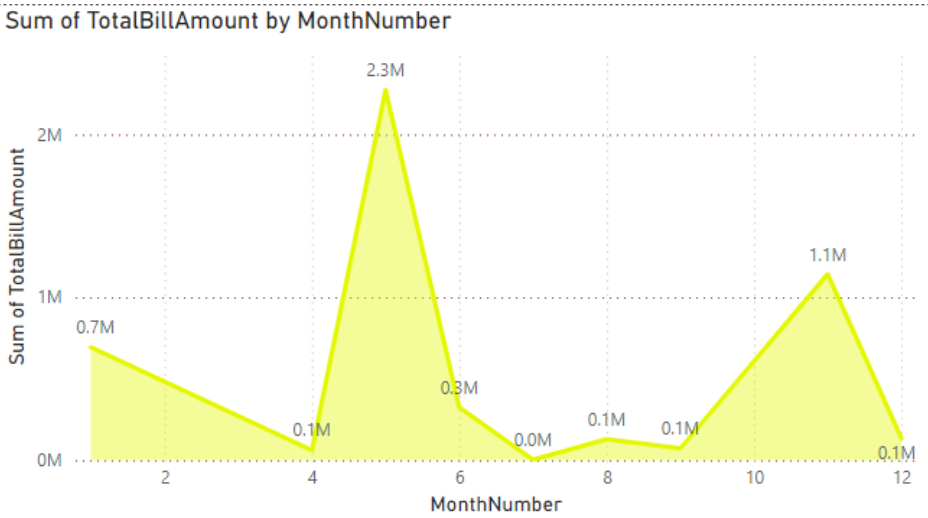


Fig: Showing monthly revenue share

The information from the interactions and the data observed are vary a bit, seasonal months like May, June show a better-sales but not in April. At the same time we can observe some better sales during non-seasonal months like January, November. I want to find out whether April month is a feasible period or not. Lets note this point for further analysis.

- We have analyzed the sales data, lets also understand the purchase data and try to fetch some useful insights

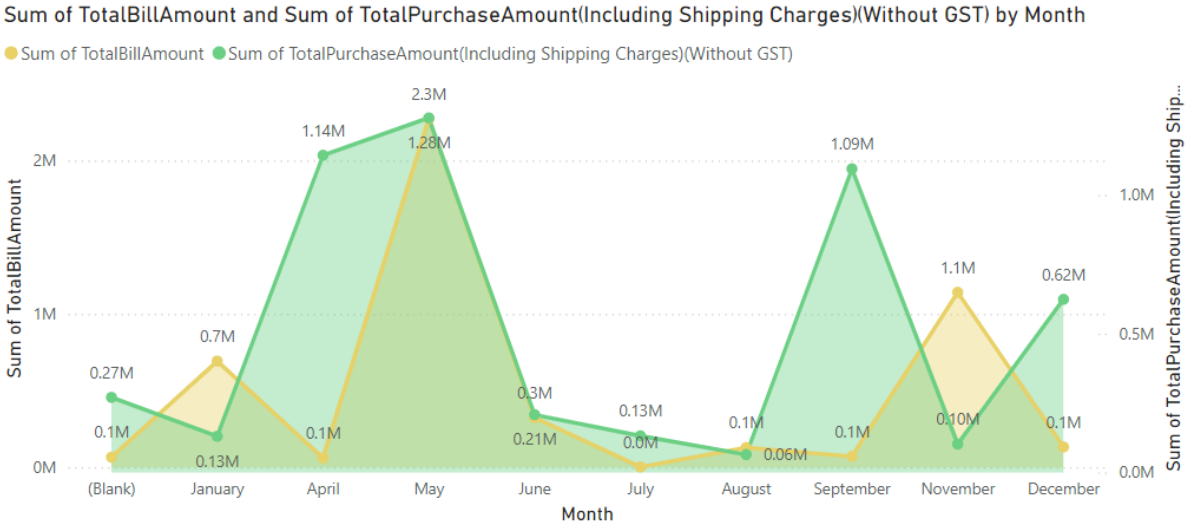


Fig: Monthly wise comparison of sales and purchase data

Details observed from above information(FINDINGS):

- Seasonal months – May, June are balanced well between sales and purchases

- I have understand that there are two kinds of anomalies can be found from above
    - 1) High Purchase and Low sales
        - April - Seasonal month
        - September – Unseasonal month
    - 2) Low Purchase and High sales
        - November – Unseasonal month
        - January - Unseasonal month

As a result of the above Season Oppurtunity Analysis month April has the highest capabilities to generate more revenue followed by an unseasonal opportunity month September.

❖ Effective way of Optimizing inventory adjustment

For this part I have thoroughly analyzed the data with several mottos but I can conclude that adjusting inventory on a monthly basis is more prudent than making product-specific or customer-specific adjustments. A clearer understanding of optimization arises from monthly assessments rather than cross-analyzing vendor-customer interactions also.

Finding:

- Above Season opportunity analysis also give us one of the main outcomes for this project.

    There are 4 different points that reflect abnormal results than expected. Those are January, April, September, November. In these months there are unadjusted levels of Purchases and Sales, so these are the potential marks to be noted where the inventory need to be adjusted foe effective results.

4 Interpretation of Results and Recommendation

The target is to optimize the supply chain and production processes for revenue growth.

- Potential customer identification:

How a firm's revenue can be influenced will be decided by these big players in the sales data, so I highlight these influencial customers and apply strategies based on the purchasing patterns from sales data.

By examining the sales data threshold value is set as 2 Lakhs, that filter outs 5 potential customers for MachPhy.

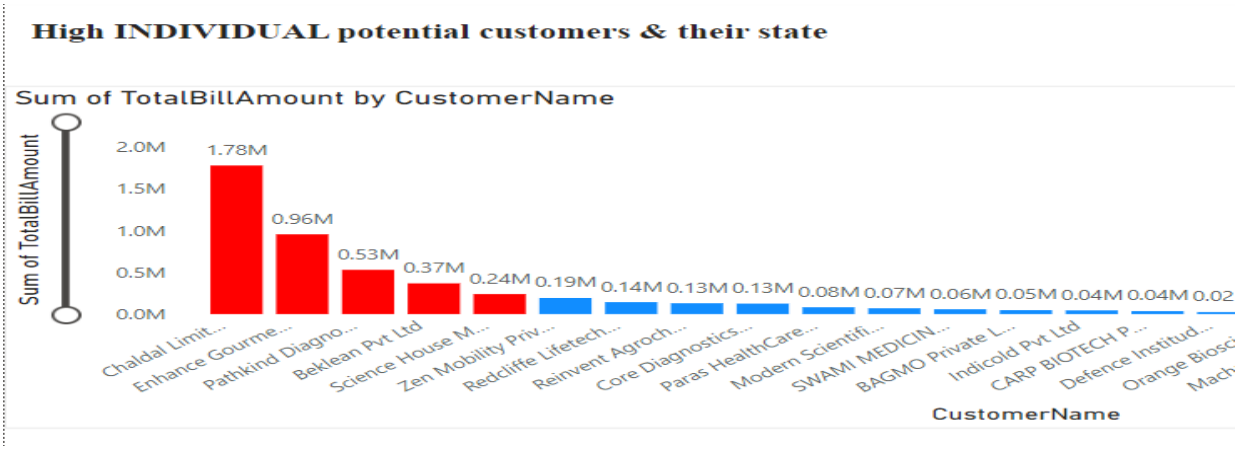
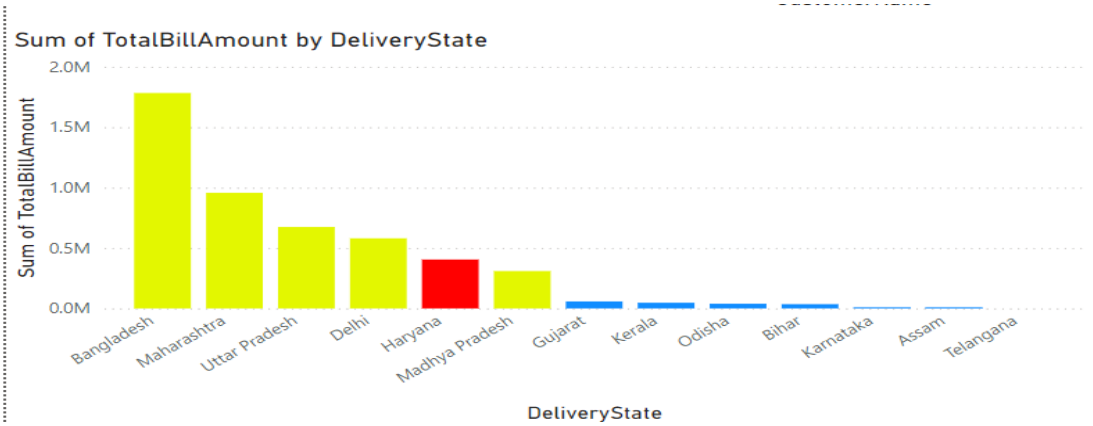


Fig: Potential Customers

It was found out that each potential customer is from different state.

- Potential market identification:

Being in the market for several years MachPhy has established its branches to almost every state in northern part of India. It is essential to identify the potential markets where company is dominating. A threshold value is set based upon the sales data, there are 6 states that have fallen into this category those are Bangladesh, Maharashtra, Uttar Pradesh, Delhi, Haryana, Madhya Pradesh.



Potential state is defined based on the collective performance of the customers from a state but not just by a potential customer from a state.

- Interpretation of Results – Part 1:

Strategies to follow for each different category

Category 1: Bangladesh and Maharashtra are significant potential markets, each currently served by a single customer who also appears on our list of potential customers. This reliance on a single customer per region poses substantial risks. Given the large business scope in these areas, it is imperative to actively market the products even to broader audience.

Recommendation: We should aim to encourage small and emerging customers by offering targeted incentives and promotion because it is essential to avoid any monopolistic behaviour and MachPhy should fully make use of the potential of these markets by expanding the customer base and reaching out to as many clients as possible.

Category 2: Uttar Pradesh and Delhi are key regions with a significant number of potential customers, as well as existing customers who collectively have a substantial impact on state revenue.

Recommendation: Given the diverse customer base in these areas, it is crucial to ensure that our products remain consistently available and do not go out of stock. Therefore always maintain optimized inventory levels in these regions, it is essential to meet the demands of various customer categories effectively.

Category 3: Haryana is the only potential state which has no potential customer, so there is a need to find some potential customer as well as its crucial to hold the existing customers as they collectively making the huge impact on whole sales data.

Recommendation:

1) Enhance customer retension: Before the identificastion of potential customers (just for this region) introduce loyality rewards to enhance the customer retention.

   Expand distribution channels: As there are multiple customers ensure that the products are easily accessible through various distribution channels, this will enhance increase the customer service interactions which is needed for this kind of regions

Category 4: Maharashtra is a state where there are several non potential customers but these are not making much impact in making the state a potential market.

Recommendation: So discuss win-win strategies like long term deal bonds at discounted price with the potential customers to not loose this potential market.

- Interpretation of Results – Part 2:

Seasonal Opportunity Analysis

Upon conducting a monthly analysis of sales and purchases to identify seasonal growth opportunities, several anomalies were observed:

- **High purchase, low sales**: April (seasonal month) and September (non-seasonal month)
- **Low purchase, high sales**: November and January (non-seasonal months)

Recommendations:

1. **April: Enhance Seasonal Sales Strategies**
    - Despite being a seasonally favorable month, April experiences low sales. I recommend MachPhy to focus on increasing sales during this period. Approach customers who typically make purchases in other seasonal months (May, June) and encourage them to make early purchases in April by offering incentives such as significant increases in loyalty points, minor discounts, or complimentary transportation.
2. **September: Capitalize on Non-Seasonal Opportunities**
    - September, a non-seasonal month, presents a unique opportunity with high purchase activity. To maximize this potential, ensure that inventory levels are adequately maintained to prevent stockouts. Being prepared to meet demand in this off-peak period can significantly enhance our market presence and customer satisfaction.

Effective way of Optimizing inventory adjustment:

Out of all types of analysis, I manifest that implementing inventory adjustments predicated on a monthly temporal framework is more judicious than adjustments I executed on a product-specific or customer-specific basis. A more lucid comprehension of optimization emerges from a month-based analysis rather than a cross-analysis of vendor-customer interactions.

Recommendation: Based on the identified anomalies, I recommend the following seasons for focused inventory management, those are April, September, November, January. By focusing on these specific months, MachPhy can enhance its inventory management strategy, ensuring product availability and capitalizing on seasonal and non-seasonal demand patterns.

- Interpretation of Results – Part 3:

Finding new opportunities based on previous experiences and by analyzing current market scenario:

After keen analysis on the data by framing different mottos, at an overview level I have understood that being a B2B company company is gaining small profit margins.
I have done this section with the combination of data collected from MachPhy and research on market opportunities for a cold chain solutions. MachPhy till now focuses only in making and delivering the products supportive to pharma sector but for a cold chain business next profitable sector to pharmacy is agriculture. In India generally three crop seasons

Season	**Harvesting month**
Rabi	April-June
Kharif	September-October
Zaid	July

Recommendation:
So I recommend MachPhy to follow below strategies to convert themselves from B2B to B2C.

1) Previously discussed as April is having a large scope in B2B here also we can get potential market in April as its one of the bigger crop time.
2) Remaining months like June, July, October these are neither high purchasing nor high sales period in B2B. But in B2C for these months, there is a scope to rise the revenue for MachPhy

- Note: September will be a game changer non seasonal market if the inventory is adjusted in B2B + managing the market in B2C section.

I will suggest this evidence-based recommendations which are derived from MachPhy's data analysis and are designed to address the identified problem statements effectively, driving sustainable business growth and competitive advantage.

Data related in this project: [redacted]