

Data Driven Analysis of Mercurius Enterprises

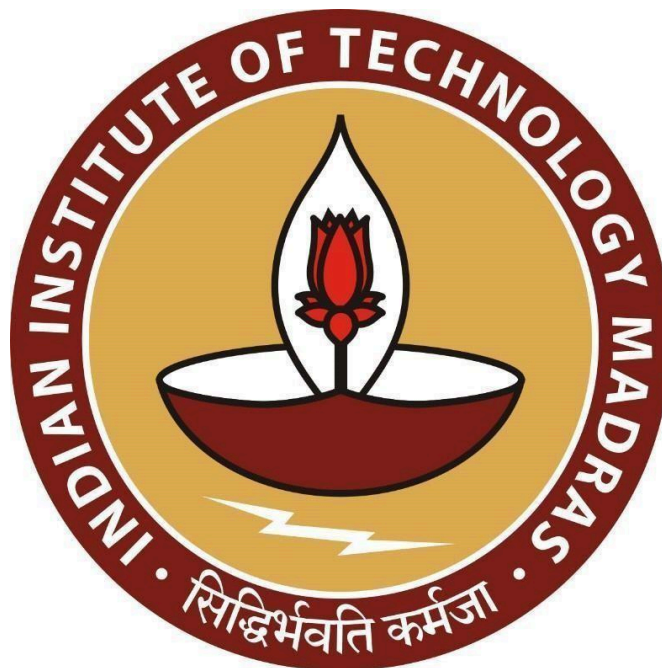
A Proposal report for the BDM capstone Project

Submitted by

Name: Aaditya Uday

Ghaisas

Roll number: 23f1002315



IITM Online BS Degree Program,
Indian Institute of Technology, Madras,
Chennai Tamil Nadu, India- 600036

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Declaration Statement

I am working on a Project titled “Data Driven Analysis of Mercusius Enterprises”. I extend my appreciation to **Mercurius Enterprises**, 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 analysed to assure its reliability.

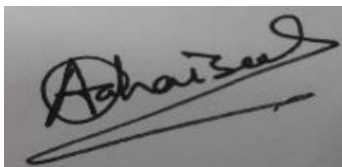
Additionally, I affirm that all procedures employed for the purpose of data collection and analysis have been duly explained in this report. The outcomes and inferences derived from the data are an accurate depiction of the findings acquired through thorough analytical procedures.

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 fulfilment in the BS Degree Program offered by IIT Madras. The institution does not endorse any of the claims or comments.

Signature of Candidate:

A handwritten signature in black ink, appearing to read 'Aaditya Uday Ghaisas', written over a horizontal line.

Name: Aaditya Uday Ghaisas

Date: 3/11/2024

1) Executive Summary and Title

This project focuses on the **Data Driven Analysis of Mercusius Enterprises**.

The business that I am working with is Mercurius Enterprises which is a small-scale business based in Shimpoli, Mumbai-400092. It is mostly a B2G business which provides hospitals with medical equipment used during surgery and also some general products. Its main products are balloons and heart stents which are used during heart surgery. Some general products include nasal prongs, HME filter, micro infusion set, Hale Ciser, 3 way stop cock and masks. However, the revenue generated and overdependence on one hospital has led to a lot of issues for the owner. Other problems include a very competitive market and thin margins over the products. The business does not seldomly but faces monetary issues at times which has been a huge headache for the owner.

This project aims to streamline the business' revenue management by implementing data-driven analysis techniques. This project aims to carry out an in-depth analysis of sales and expense records to identify possible leakages such as unreceived receivables, waste produced from operations, or low-performing product lines that may be causing leakage. I would like to think about measures like optimized payment cycles as well as expense reduction strategies. On the other hand, focus on diversifying the clientele through targeted marketing, through networking, and also enhancing the product portfolio for potential hospital clients, thus avoiding being overly dependent on any few. For optimizing payment cycles, you can perform accounts receivable aging analysis to identify overdue payments and clients prone to delays. These are my few thoughts on going about the project.

Ultimately, this initiative will help the business enhance financial efficiency, preserve capital, and strengthen its foundation.

2) Proof of originality of the Data-



Figure 1- Letter of authenticity of data



Figure 2- Shop



Figure 3- Shop side view

Link containing more photos of the hospital-

<https://drive.google.com/drive/folders/1qHFeu07sDE97XprMyGCL0VCGbbP-xBJE>

Repository containing Code for Data, Survey and Data Wrangling-

<https://drive.google.com/drive/folders/1IUQAW8y3rTOXbAHnF6YKCPoIMS8Rblbi>

Google Drive Link of Video Interaction with the Founder-

<https://drive.google.com/drive/folders/1IUQAW8y3rTOXbAHnF6YKCPoIMS8Rblbi>

3) Metadata and Descriptive Statistics-

Metadata-

- **Date** (Type: object or date)
 - **Info:** The billing date.
 - **Potential Use:** Can be used as an input to do time series analysis.
- **Party Name** (Type: object)
 - **Info:** The
 - **Potential Use:** Useful for managing supplier relations and analysing quality issues.
- **Item Name** (Type: object)
 - **Info:** Name of the product .
 - **Potential Use:** Helps analyse admission timelines and inpatient service patterns.
- **Quantity** (Type: numeric)
 - **Info:** Number of products in that bill across that Item Name
 - **Potential Use:** Helps me track the quantity of the product ordered.
- **Price** (Type: numeric)
 - **Info:** Price of 1 quantity of that particular Item
 - **Potential Use:** Can be used in amount calculation.
- **Amount** (Type: numeric)
 - **Info:** Total cost of Item in that Particular Bill. It is quantity*price .
 - **Potential Use:** Can be used to calculate total revenue.
- **Party Type** (Type: object)
 - **Info:** It contains information whether the Party is Government or Private Hospital. It was not present originally in the dataset. This column was created for ease of analysis.
 - **Potential Use:** Useful for categorizing the number of orders from each category and also track the revenue generated from each column.
- **Month** (Type: object)
 - **Info:** It contains the month in which the product was billed.
 - **Potential Use:** Useful for data analysis.It was not present originally in the dataset.
This column was created for ease of analysis

□ **DATA WRANGLING & ANALYSIS REPO-**

<https://drive.google.com/drive/folders/1UQAW8y3rTOXbAHnF6YKCPoIMS8Rblbi>

DESCRIPTIVE STATISTICS-

The bar graph represents the revenue for the months between February and September. In this bar graph, variations can be seen among the different months. The peaks are for March and May, which may be a demand period or an operational strategic impact. The sharp decline noticed in April may be due to seasonality, client deferment, or even operational inefficiency. Revenue stabilizes during June, July, and August, showing consistent performance as well as the reliable operations of the company during the mid-year period; however, there is a one percent decline in September, which may indicate either a post-peak slowdown or the effects of end-of-quarter trends.

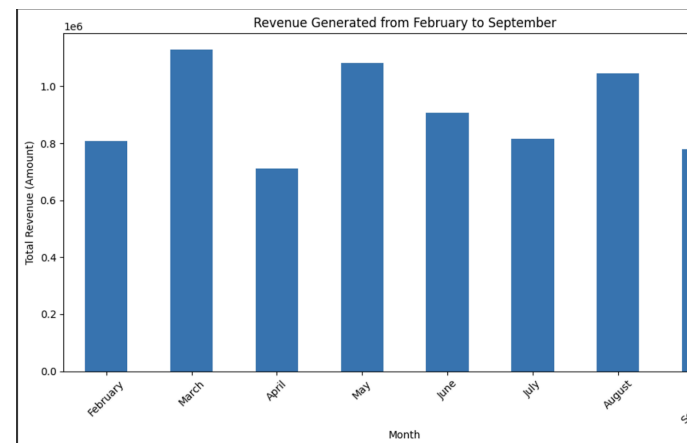


Figure 4- Revenue generated over the period of analysis

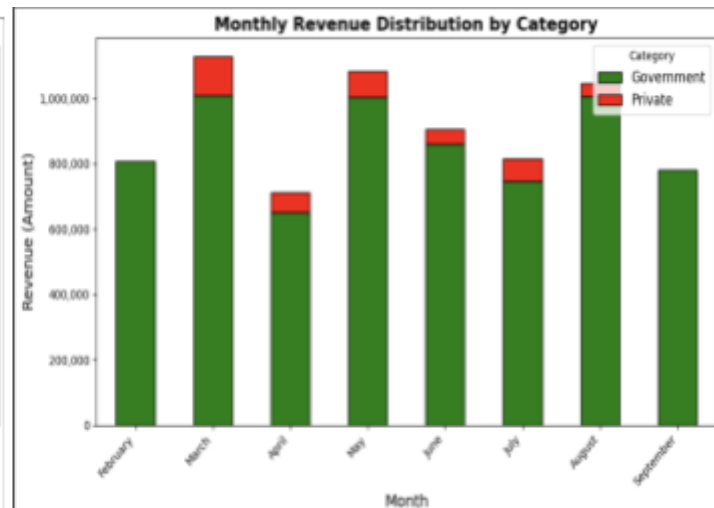
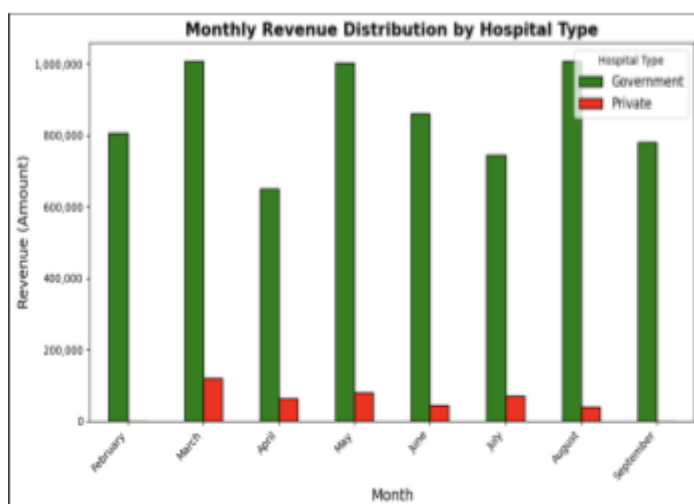


Figure 5, 6- Revenue generated by Government and Private Hospitals

Government revenue is always leading every month. It is more stable and consistent. Private revenue is smaller, but some big contributions are shown in March, May, and August, which means there might be opportunities for growth in the private sector. Total revenue shows a decline in April, which may indicate inefficiencies or seasonal effects, whereas August shows balanced performance with high private sector engagement.

Strengthen financial resilience by focusing on growing private sector partnerships that reduce reliance on government contracts and stabilize revenues during slower months.

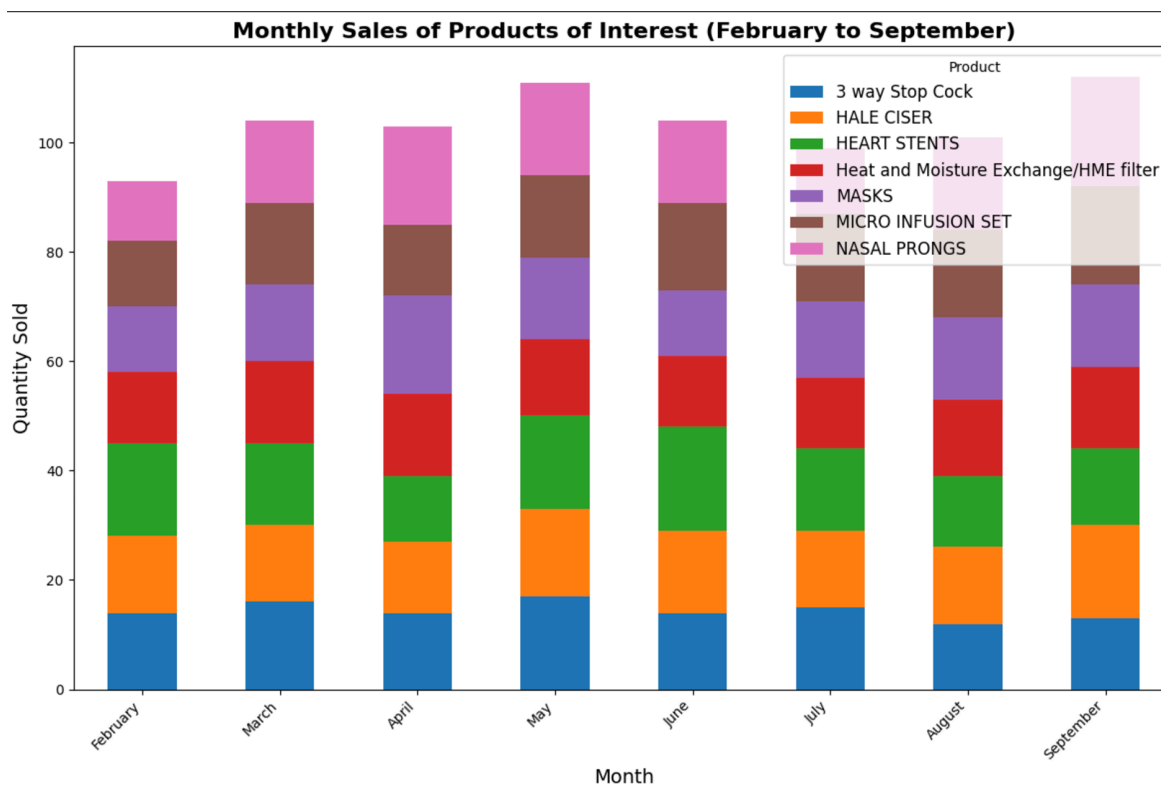


Figure 7- Sales of top 7 products in each month of analysis

The bar graphs depict monthly sales figures of specific products from February to September and reveal the trend in performance history of these products. Heart stents come out as the leading product every year by high sales with specific peaks in months like February, May, and June owing to their heavy consumption during health engineering processes. Masks show the same stable performance, but the sales shoot up at this time in September, likely indicating something seasonal or situational-increased health care for example or environmental conditions causing more demand.

Microinfusion sets hold their ground without strain throughout the time, cementing their state as things patients use steadily by hospitals during operations. Likewise, heat and moisture exchanged (HME) filters have moderate sales, stable enough to give importance in routine medical applications. Nasal prongs are among those that had their progress down in the middle of the year but recorded a significant recovery in September, suggesting a recovery in demand for this product. Products like the 3-way stopcocks and Hale cisers have a relatively stable market with minor fluctuations over the year, thereby indicating a low but constant usage pattern.

These trends show that different products have varying demand dynamics. For example, heart stents and masks need to be stocked during the peak months, while products such as HME filters and micro infusion sets prove to be very stable income generators. Demand forecasting and stock level optimization will improve operational efficiencies while making revenues more predictable through well-targeted strategies.

Column	Mean	Median	25%	50%	75%	Variance	Std. Dev.	Count
Qty.	1.110698	1.0	1.0	1.0	1.0	3.543871e+00	1.882517	1346
Amount	7828.110390	115.0	27.0	115.0	7500.0	61279312.28062346	7828.110390	1346
Price	5408.446315	115.0	27.0	115.0	7500.0	6.139522e+07	7835.510095	1346

Figure 8- Descriptive Statistics Table

4) Detailed Explanation of Analysis Process/Method-

I began this project with a thorough data wrangling phase using pandas to transform an initially messy dataset into a clean, structured format ready for analysis. The data included an excel sheet of transaction records provided by the owner of the Enterprise each with its own inconsistencies and missing values. I cleaned the rows with `cleaned_data = data.dropna(how='all')` which basically drops all the rows which has all the columns as NaN. Then I used `columns_to_ffill = ['Bill No.', 'Date', 'Party Name']` `cleaned_data[columns_to_ffill] = cleaned_data[columns_to_ffill].ffill()` to replace all the NULL values with value from the previous row.

Then I created 2 new columns namely “Party Type” and “Month”. Party Type has data values of 2 types Government and Private which indicate whether the Party Name is a government Hospital or a private one. The I used a bit of regex and pandas function (`cleaned_data['Month'] = pd.to_datetime(cleaned_data['Date'], format='%m-%d-%Y', errors='coerce').dt.month`) to make the dates in correct format.

The next thing I did was to remove the rows which had irrelevant data by using `iloc`. I also dropped unnecessary columns like “Bill No.” and “Batch No.”

In the Exploratory Data Analysis (EDA) phase, I used functions like `df.describe()` for statistical summaries and plotted various graphs to identify the trend and data. EDA revealed several important trends, such as seasonal spikes in sales of top 7 products as shown by Fig 9.

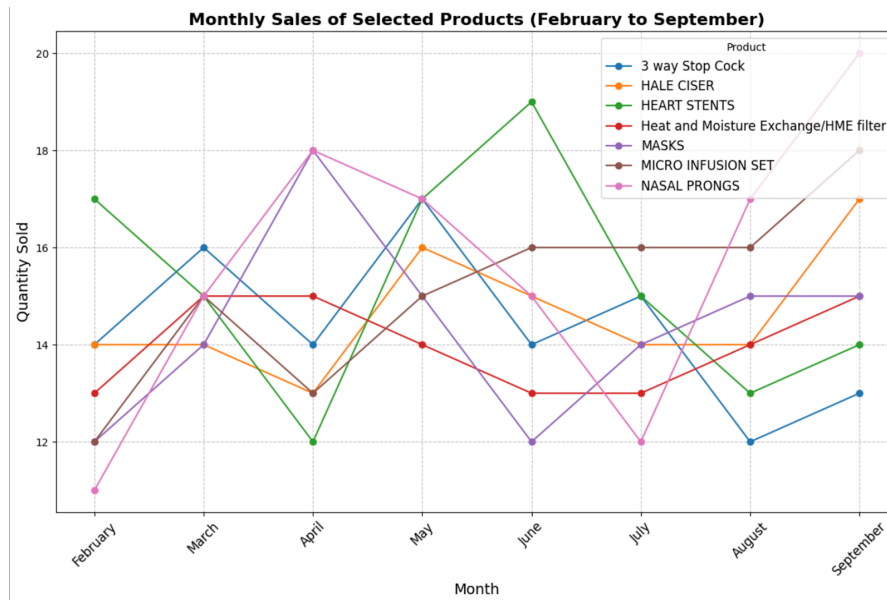


Figure 9- Sales of top 7 products over the analysis period

The line chart plots the monthly sales trends for different products from February through September, highlighting major ups and downs and trends. Heart stents have extreme variations, peaking in May and having low demand in the other months; thus, they suggest fluctuating or seasonal demand. Masks also have a high fluctuation in sales but show a steep increase in September, which suggests greater seasonal demand, possibly health or environmental-related. Nasal prongs decline during the mid-year period but then recover well by September, implying a rebound in demand. Micro infusion sets have relatively stable sales throughout the months, and this may suggest that there is constant usage in the hospitals. HME filters have moderate and constant sales during the period, hence, it is likely a product with stable demand. Hale cisers and 3-way stop cocks show minimal fluctuations that indicate consistent though low sales volumes. These trends are such that market conditions and seasonal fluctuations vary, which creates an opportunity for accurate demand prediction and efficient inventory management. Such products as heart stents and masks have potential for improved stock ordering based on high demand fluctuations, while products such as micro infusion sets and HME filters tend to have a fixed sales potential. Such a well-researched strategy could, therefore, help the company

get a grip on its stock as well as ensure predictable sales volume.

5) Results and Findings-

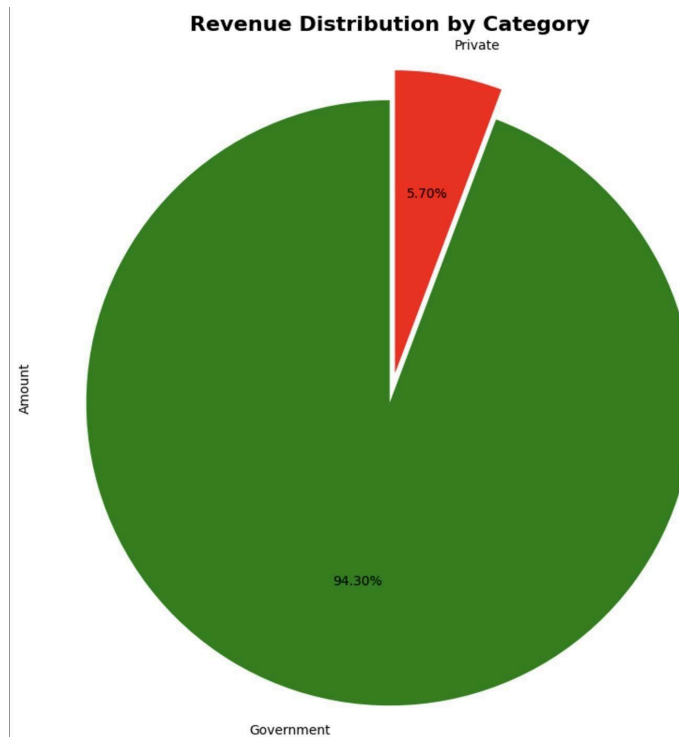


Figure 10- Revenue distribution

The pie chart shows a strong reliance on government contracts, which account for 94.3% of total revenue, while private clients only contribute 5.7%. This stark contrast highlights a significant dependence on government funding, which can pose serious risks to the business's financial stability and growth prospects. A sudden policy shift, budget reduction, or loss of a contract could severely impact operations, leaving the business vulnerable to potential revenue drops. This scenario should encourage the owner to think about diversifying the client base to reduce reliance on government contracts. By increasing engagement with the private sector through targeted marketing, strategic partnerships, or product diversification, the business can mitigate risks and establish a more balanced revenue stream. Building a broader client network can strengthen resilience and ensure long-term sustainability, safeguarding against external challenges.

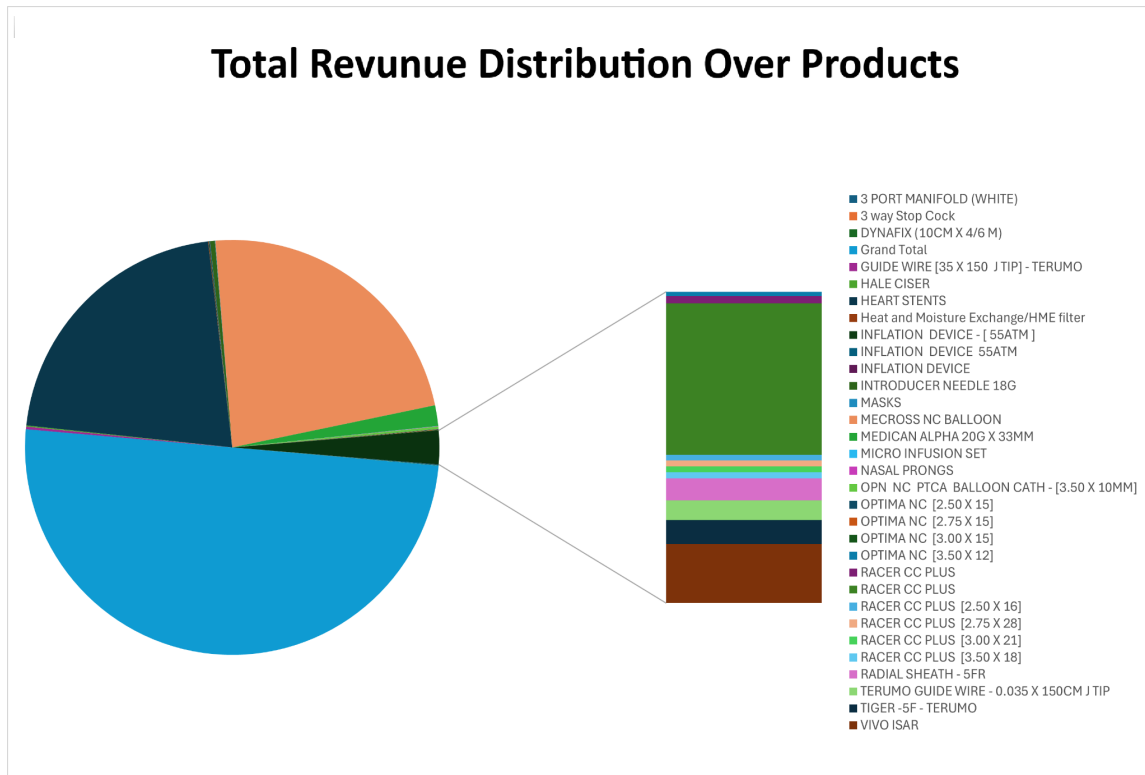


Figure 11- Revenue distribution by products

The analysis of the revenue distribution reveals a significant dependency on a few high-performing products, with one product (highlighted in blue) contributing the largest share to total revenue. This dominant product generates a disproportionately high portion of revenue, while the remaining products, such as heart stents, micro infusion sets, and inflation devices, contribute minimal shares. This revenue concentration poses a risk to the business, as any decline in demand or disruption in the supply chain for the dominant product could lead to substantial financial instability. Additionally, the minimal contribution of other products indicates underutilized revenue potential. The lack of diversification limits the ability to mitigate risks and capitalize on broader market opportunities. To address these issues, it is imperative to implement a diversification strategy. The business should invest in promoting and scaling the sales of underperforming products through targeted marketing, customer outreach, and product bundling strategies. Identifying new markets or segments where these products can be introduced is also crucial. By balancing the revenue contributions across a broader range of products, the business can reduce dependency on a single product and create a more sustainable and resilient revenue model, ensuring long-term growth and stability.