

Optimizing Inventory Management and Supply Chain Efficiency to Minimize Dead Stock and Reduce Breakage

A Mid Term Report for the BDM Capstone Project

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1 Executive Summary

Spillatter is a trading firm based in Kolkata, which deals in high quality restaurant crockery, serve ware, cutlery and barware. I have identified the following problems which the firm is facing and have collected data accordingly:

1. Accumulation of dead stock
2. Losses faced due to breakage of goods while transportation

To tackle these issues, the sales and purchase invoices were collected for the period July 2024 to December 2024 (6 months), cleaned and organized into Microsoft Excel spreadsheets. The data collected was used to compute key features like loss due to breakage per order, monthly sales and breakage per shipment which are crucial to understand the aforementioned problems in detail. On computing the descriptive statistics, it was found that there is high variance in key features such as loss and quantity indicating variation in orders and potential inefficiencies in packaging. Another interesting observation was that the mean sales is greater than the median sales which suggests that there are a few sales points which inflate the average. This implies that most of the company's product do not sell in high quantities which justifies the accumulation of dead stock.

ABC analysis has been used to identify the high revenue products which would help the company to identify their most profitable products and thus monitor their inventory levels on a priority basis. Bar charts and Excel function like MAX and SORT have also been used to identify the products which are popular among clients. Demand forecasting has also been performed to predict the sales of the company which will help to decide the inventory levels accordingly and in such a manner that it should be profitable for the company. After performing analysis, I have been able to identify the most selling products of the company which will help to decide the inventory levels. I have also been able to identify some of the major reasons contributing to breakage during transportation such as inefficient packaging.

2 Proof of Originality of Data

Authorization Letter from Company:

https://drive.google.com/file/d/1ZXi7Q6pSF5cUTNh_3ju_KXoQaIxoyHe2/view?usp=sharing

Images of Office / Servicescape:

<https://drive.google.com/drive/folders/1cD3ORafAT3JMANV8rAkDYnBtHLvK5o0p?usp=sharing>

Vide Interaction with Owner:

https://drive.google.com/file/d/1ZE07SmKBhT7b9QEV8E_1IpkehyawqKJJ/view?usp=sharing

Link to data collected: [Data](#)

3 Metadata

Link to Excel sheet with analysis:

<https://docs.google.com/spreadsheets/d/1rVJBCEJG3Ydzf4g423COnRVWDMklCk8-/edit?usp=sharing&ouid=111809023545961421534&rtpof=true&sd=true>

The Excel sheet named **Analysis.xlsx** contains the following sheets: -

1. IncomingGoodsBreakageAnalysis

This sheet contains the transportation information for the goods which the company has purchased.

It consists of the following columns:

- I. Date: Date on which the company has received the delivery of their purchased goods
- II. Transporter: Name of the transporting service used for delivery of purchased goods
- III. Product: Name of the purchased product
- IV. Quantity: How many units of any particular product are purchased
- V. Rate: Price per unit of a product
- VI. Net Amount: Total value of the purchase order
- VII. Breakage (30%): Number of items damaged during transportation (close to 30% as specified by the company)
- VIII. Loss due to Breakage: Losses faced by the company due to damaged goods

2. OutgoingGoodsBreakageAnalysis

This sheet contains the transportation information for the goods which the company sends to its customers. It consists of the following columns:

- I. Buyer: Name of the buyer
- II. Product: Name of product purchased by the buyer
- III. Quantity: How many units of any given product are purchased
- IV. Rate: Price per unit of a product
- V. Net Amount: Total value of a particular product ordered (unit price * quantity)
- VI. Packaging Cost (Entire Order): For any given order, this the amount spent by the company on packaging
- VII. Breakage while transportation (~2%): Number of items damaged during shipping to client (close to 2% as specified by the company)
- VIII. Loss: Loss faced by the company due to breakage of a item
- IX. Net Loss: Total loss faced by the company in an order due to breakage while transportation

3. DeadStockAnalysis

In this sheet, I have calculated the total sales for every month which will be used for demand forecasting. The sales data is for the months July 2024 – December 2024. It consists of the following columns:

Date: Contains the date of sales in dd-mmm-yy format

Sales in INR: sales on the given date per order

4 Descriptive Statistics

I was provided with the sales and purchase invoices of the company for the period July 2024 to November 2024. All the required information like product name, rate, quantity ordered was transferred to Excel sheets and the net amount for any given product, the total order value, how many items were damaged during transit and loss due to breakage were computed. All the calculations and analysis are done excluding the taxes to be paid. The collected data has been segregated into 3 sheets namely IncomingGoodsBreakageAnalysis, OutgoingGoodsBreakageAnalysis and DeadStockAnalysis where each sheet contains the data for analyzing a certain aspect of the problems the company is facing.

The sheet named DeadStockAnalysis contains data taken from the sales invoices of the company. It contains only 2 columns namely date and total sales. This has been further modified to compute the monthly sales.

<i>Sales</i>	
Mean	255391.35
Standard Error	54306.03815
Median	161860.5
Mode	#N/A
Standard Deviation	242863.9858
Sample Variance	58982915595
Kurtosis	0.182006362
Skewness	1.107709187
Range	787422
Minimum	10418
Maximum	797840
Sum	5107827
Count	20

Table 1: Descriptive Statistics for dead stock analysis

A large range and standard deviation indicate high variation in sales values. A low value for kurtosis indicates that the distribution of sales over time is not highly peaked or heavily tailed. The descriptive statistics reveal high sales variability and a positively skewed distribution, both of which contribute to the risk of overstocking and dead stock accumulation. This is because the mean sales are greater than the

median which means that a few sales points are inflating the mean which is an indication that most of the products do not sell as per the company's expectations. Thus, if the company stocks up their inventory based on the mean, it will lead to overstocking of low-selling products. This indicates that the company overstocks its inventory levels which leads to accumulation of dead stock.

The sheet named IncomingGoodsBreakageAnalysis is used to compute the loss due to breakage of goods during transportation from the manufacturers to the company. During this transit, there is ~30% breakage of goods as identified by the company.

<i>quantity</i>		<i>rate</i>		<i>net amount</i>		<i>breakage(30%)</i>	
Mean	389.7368421	Mean	225.1578947	Mean	43034.84211	Mean	116.9210526
Standard Error	164.4140552	Standard Error	49.49489094	Standard Error	17917.1049	Standard Error	49.32421655
Median	100	Median	122	Median	9600	Median	30
Mode	18	Mode	370	Mode	#N/A	Mode	5.4
Standard Deviation	716.6642513	Standard Deviation	215.7432278	Standard Deviation	78098.84961	Standard Deviation	214.9992754
Sample Variance	513607.6491	Sample Variance	46545.14035	Sample Variance	6099430311	Sample Variance	46224.68842
Kurtosis	4.880991813	Kurtosis	1.743042479	Kurtosis	5.525288682	Kurtosis	4.880991813
Skewness	2.401569392	Skewness	1.551332446	Skewness	2.496434983	Skewness	2.401569392
Range	2436	Range	745	Range	277950	Range	730.8
Minimum	6	Minimum	25	Minimum	2880	Minimum	1.8
Maximum	2442	Maximum	770	Maximum	280830	Maximum	732.6
Sum	7405	Sum	4278	Sum	817662	Sum	2221.5
Count	19	Count	19	Count	19	Count	19

Table 2: Descriptive statistics for analysis of loss due to breakage for incoming goods

The above statistics highlight high variability in breakage along with high skewness and outliers in losses due to breakage. This suggests that a few shipments disproportionately contribute to losses. Improving packaging and facilitating safer delivery routes can help to tackle this problem.

The sheet named OutgoingGoodsBreakageAnalysis is used to compute the loss due to breakage of goods during transportation from the company to the buyers. During this transit, there is ~2% breakage of goods as identified by the company. The high variation in quantity, net amount and loss suggests variability in orders and potential inefficiencies in packaging. The highly skewed distribution in quantity and loss indicates that there are occasional losses in high quantities which emphasize the need for improved packaging techniques and handling strategies to minimize breakage during transit and loss due to breakage.

5 Detailed Explanation of Analysis Methods

Data Cleaning:

Sales and purchases invoices were extracted from PDFs and formatted to Excel spreadsheets. Duplicates and errors were removed and all the financial data was converted into Indian Rupees (₹). Loss due to breakage was rounded to whole numbers for accuracy, while taxes and shipping costs were excluded.

Demand Forecasting:

This refers to the process of predicting the future demand using historical data, allowing businesses to optimize inventory levels and avoid overstocking or shortages. Short term demand forecasting is done usually for a period of lesser than 12 months to inform day to day operations. For the analysis, the monthly sales of the company were computed in Rupees (₹) for the period of July 2024 – November 2024 and the Forecast sheet of the Analysis Tool Pak add-in in Excel was used to forecast the total sales of the company from the period of January 2025 – May 2025. Demand Forecasting has been used to predict the sales of the company which will give an idea of how much sales the company is expected to make in the forecast period based on the collected data and thus allow them to stock up their inventory levels accordingly. In reactive inventory management, the inventory is restocked only when the inventory levels are low leading to stockouts or overstocking due to a lack of future demand insights. Short term demand forecasting uses historical sales data to understand their sales patterns over time which allows them to prepare in advance for the upcoming time period. In competitor-based forecasting, all predictions are made based on the trends of competitor companies. This may be very harmful for the company as they miss out on the patterns observed in their companies and aligned with their business strategies. Using short term demand forecasting allows the company to understand the patterns observed in their company thus minimizing the risk and maximizing profitability which is much safer as compared to competitor-based forecasting.

The main objective of using short term demand forecasting is to predict the sales of the company based on past sales trends which will help to identify the months expecting high sales and allow the company to restock their inventory accordingly thus preventing accumulation of dead stock.

ABC Analysis:

This method classifies products into three categories namely A, B and C based on revenue contribution to prioritize stock management. The significance of each category is as follows: -

Category A: High value items with low volume

Category B: Moderate value items with moderate value

Category C: Low value items with high value

In ABC analysis, the products are grouped according to their quantity, rate and net amount and their percentage contribution to the total revenue is computed to identify the products which have highest contribution to the total revenue in terms of quantity or more often net amount.

By using ABC analysis to classify the items, companies can identify their most and least valuable products respectively and hence stock their inventory accordingly. ABC analysis is a better choice than pareto analysis and cost benefit analysis as it provides a structured classification for inventory and resource management.

While Pareto analysis follows the 80/20 rule (80% of the revenue comes from 20% of the products), it does not categorize the products into distinct groups unlike ABC analysis making it more actionable for inventory control and decision making. Cost benefit analysis evaluates the products based on profitability and associated costs but lacks a systematic approach to inventory classification. ABC analysis focuses directly on revenue contribution which helps in effective stock management while cost benefit analysis is more suited for investment decisions.

The main objective of using the ABC analysis is to identify their most profitable and least profitable products along with their inventory volumes which will enable optimal and profitable stocking of the inventory and minimizing the accumulation of dead stock.

Identification of region wise breakage:

The main purpose of this analysis was to identify the distribution of region-wise breakage. To begin, sample sales were chosen from all the invoices such that every region of the country (north, east, west and south) is present. The total quantity ordered, net worth of the order and breakage (with ~2% breakage per order) were computed and plotted in Excel to visualize the region-wise breakage.

The main objective of using this method is to identify how the breakage varies with regions which can help to understand discrepancies such as inefficient packaging routes and poor packaging methods for long routes.

Revenue Contribution Analysis:

This method was used to identify the products which are actually contributing to the revenue of the company. It also helped to identify the products which contribute minimally or do not contribute at all to the revenue which is dead stock for the company. For identifying revenue contribution of products, the different products across all orders were taken along with their net amount which was used to compute the net revenue. Using this, the revenue contribution of each product was identified.

6 Results and Findings

Demand Forecasting: The net sales per month was computed and was used to perform demand forecasting using the “Forecast” feature in Excel which gave the following predictions:

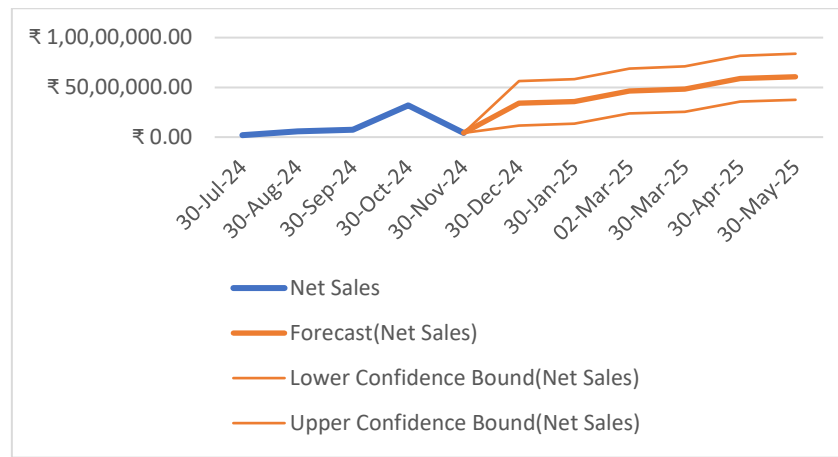


Fig 1: Demand Forecasting to predict sales

The company has the highest sales during the month of October which is the festive season with major festivals like Diwali. This may be attributed to factors such as high footfall at restaurants and resorts with many offers going on. There is an increase in sales from July to October followed by a sudden dip in November with the mean sales at ₹10,21,565.40 and a standard deviation of ₹10,97,398.22. The high variation is due to the sudden spike in sales during the festive season in the month of October. There is a drastic reduction in sales during November due to the fact that the month of November is usually an off-season for such purchases.

ABC analysis was performed for all the products sold during the period of July 2024 to December 2024 and it was found that there are no products which contribute significantly to the sales with the highest contribution to the sales being 3%. This is because all products have a different name based on various characteristics like color and shape because of which they cannot be classified into a certain category easily. Since ABC analysis could not be performed effectively, pivot tables were used to find out the high-revenue and low-revenue products. The table was sorted in descending order using the SORT function in Excel and it was found that items like plates and platters contribute significantly to the revenue ($\geq ₹50,000$).

1. Loss due to breakage was computed for incoming as well as for outgoing goods.

For incoming goods, the delivery is made through a third-party organization wherein the suppliers send their goods to the third party which then transports it to the company warehouse. The loss due to breakage was plotted against the total order value for 5 different transporters and it was found that Unilever Overseas and China Manufacturer show higher losses due to breakage as compared to the other transporters. This can be attributed to mishandling of the goods during transportation which is not in the hands of Splatter as they cannot intervene in the operations of the transportation company. On an average, the loss is approximately 3.33% of the total order value.

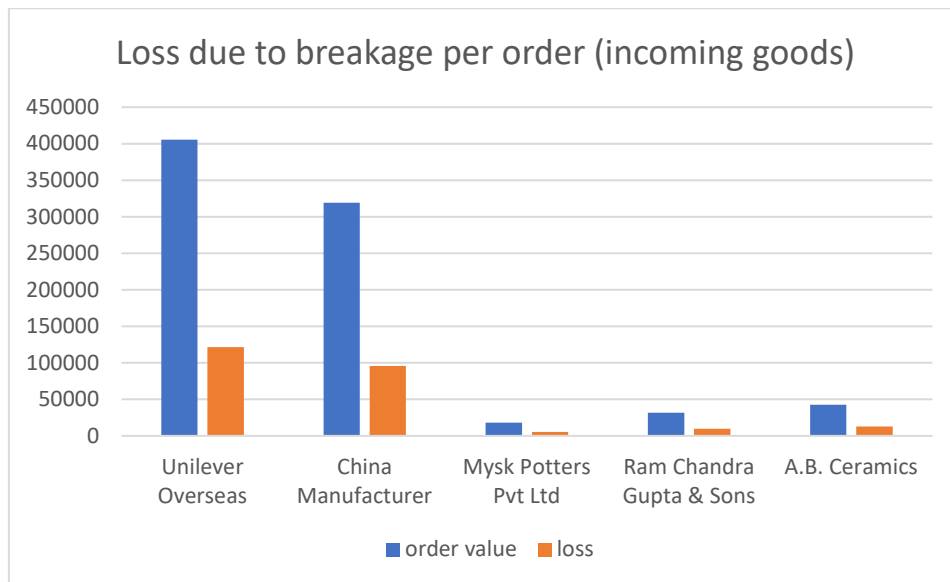


Fig 2: Comparison of loss due to breakage for incoming deliveries

For outgoing goods (which are sent to the buyer by the company), the loss due to breakage accounts for 2% of the order value. Here, the breakage is very less when compared to incoming goods, as the packaging is done by the company before shipping it.

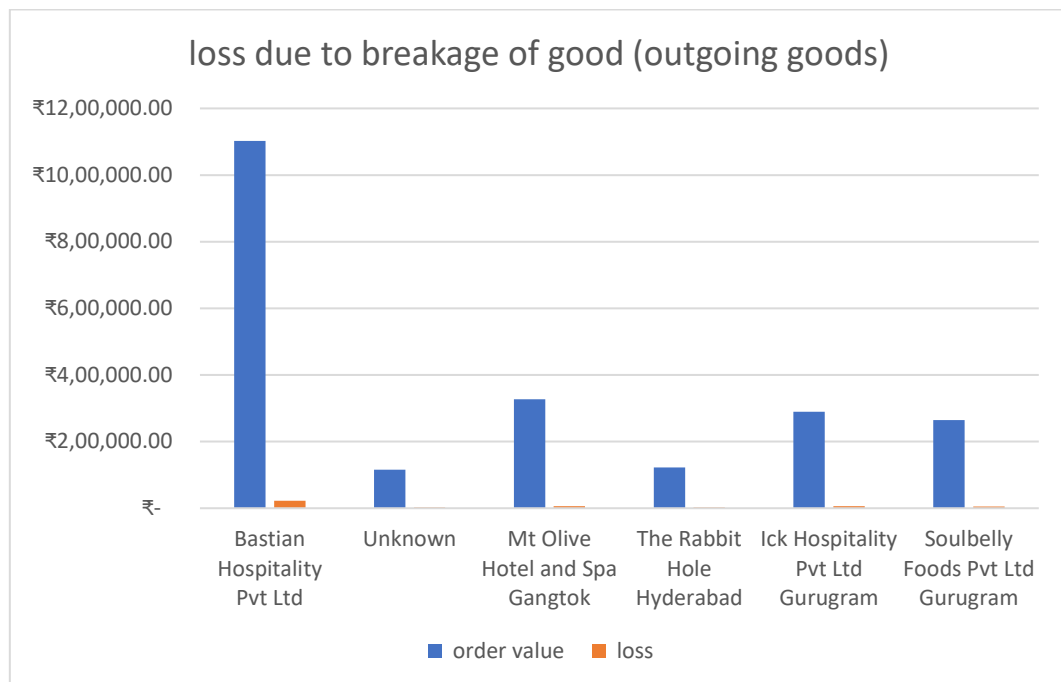


Fig 3: Comparison of loss due to breakage for outgoing deliveries

Since this does not provide much insight into the cause of the problem, a Google form was sent to the company. The questions and responses are present in the given link: [Questionnaire](#)

Based on the responses, it can be seen that although the loss due to breakage does not have a significant impact on the company, they have to replace the damaged goods which is a loss for them.

To have a further understanding of why the goods are damaged during transportation, I had several conversations with the company through telephonic conversations as well as in-person meetings and took notes. It was found that the breakage is higher during the festive season and also for long distance deliveries. This is majorly due to the following reasons: -

- When the goods are to be transported over long distances, there is frequent loading and unloading of the goods which increases the chance of damage.
- Another contributor to breakage of goods over long distance deliveries is poor route planning. The orders are sometimes transported through routes which have bad roads and uneven terrain which can cause great damage the products.
- During festive season, there is high demand for these products due to which there is added pressure on the company to make deliveries on time. The company receives many orders during the festive season due to which they sometimes rush their packaging process which is unable to protect the goods to be delivered. The vehicles may be overloaded during these peak times which also leads to breakage of goods.

Identification of region-wise breakage: Another important result was the distribution of region-wise breakage of goods. For this, some of the clients were chosen in a manner such that there is a client from every region (North (N), East (E), West (W) and South (W)) of the country. The net worth of the orders, order size and breakage were plotted using custom charts and pivot tables in Excel (Fig 4).

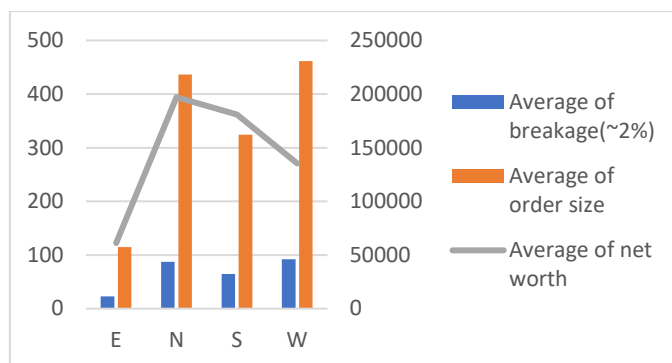


Fig 4: Distribution of region-wise breakage

This analysis helped to identify that the order size is large as compared to the eastern region and the breakage is also significantly higher in these regions. This may be the result of poor packaging methods for such orders which are not durable in the long term this leading to damage of products when they are being shipped over longer distances.

Revenue Contribution Analysis: The revenue contribution of each product to the net revenue from July to November was computed for 200 different products which were sold during this period. It was found

that Rainforest Serving Plate and Dessert Dawn Collection are the products with the highest revenue contribution with 3% contribution to the total revenue. Out of the remaining 198 products, only 66 products contribute to the total revenue. Other products have 0% contribution to the total revenue indicating that these products are not bestsellers and thus lead to accumulation as dead stock.

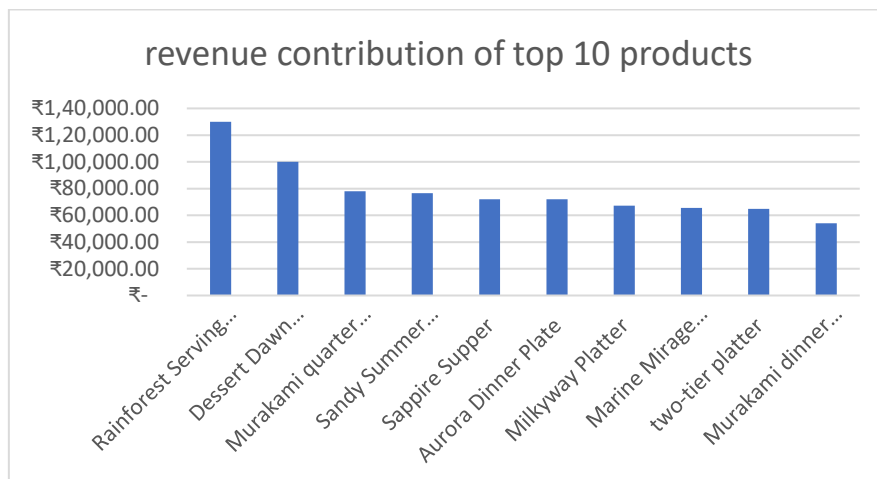


Fig 5: Revenue contribution of 10 highest selling products

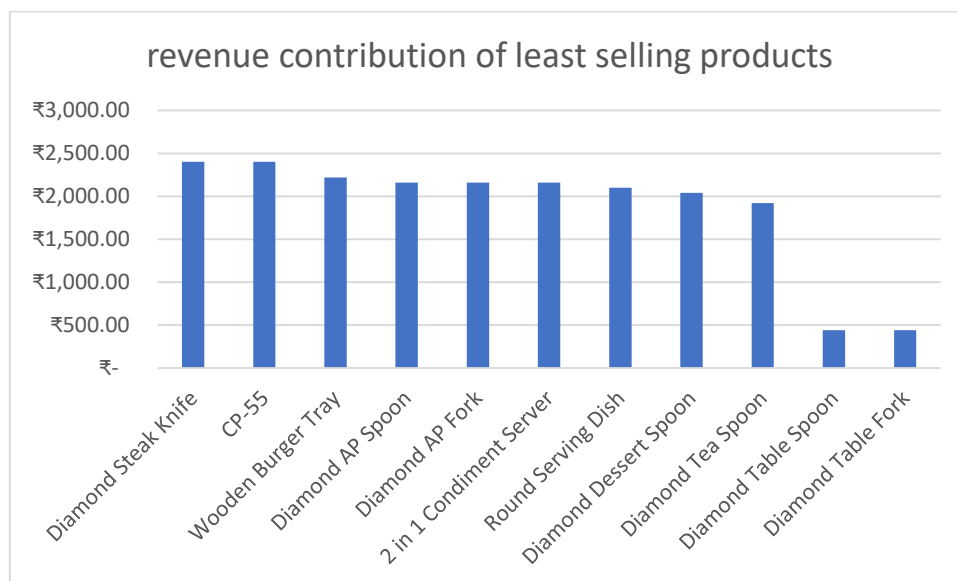


Fig 6: Revenue contribution of least selling products

The above charts imply that the business relies on a large number of low selling products as out of 200 products, 132 do not contribute to revenue (obsolete or dead stock) thus occupying capital and storage space. Even the top contributing products contribute only 3% to the revenue which indicates a lack of strong product differentiation based on market demand. This indicates that a major portion of inventory is stocked with products which are obsolete for generating revenue and become dead stock with time.