Fluctuations, Foes & Flows: Solving Business Challenges for an Electronics & IT Solutions Provider

A Mid-Term report for the BDM capstone Project

Submitted by

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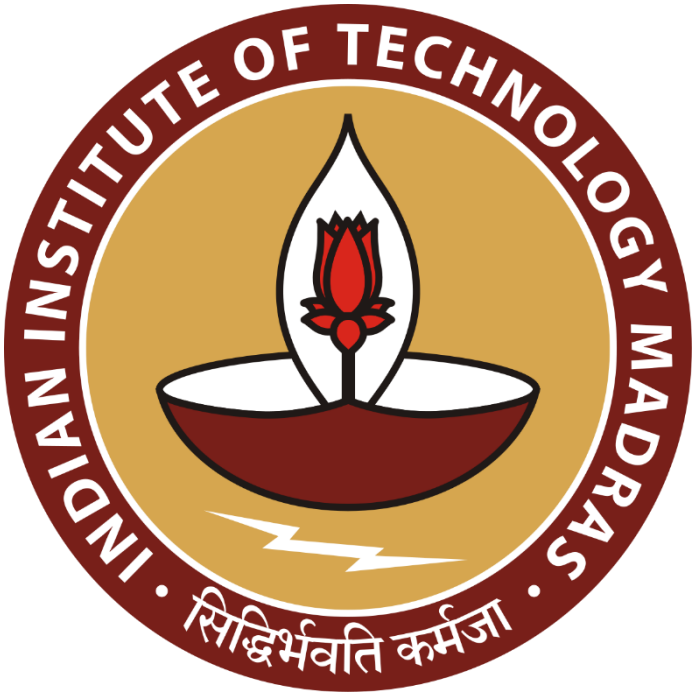

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Contents

1 Executive Summary

Silicon Systems is a Business-to-Business (B2B) company, registered under MSME, West Bengal and certified ISO 9001:2015 brand. It provides its products and services across a various category of products, with the major chunk of the business being related to IT products, followed by Electronics and Lab Equipment. Operating with a team of 10 employees headed by the sole proprietor Atanu Chowdhury, the firm generates a yearly revenue of around Rs. 5 crores.

Recently, the business has struggled with scalability, losses due to market fluctuations, heavy competition and certain slow-moving items. The business owner expects this project to arrive at feasible and viable solutions that will help the business solve its bottlenecks.

After multiple visits to the owner's office-cum-store, a clear understanding of the business was accumulated. Although the owner was initially hesitant to share business data, a thorough explanation of the project was sufficient to convince him to provide the relevant data. The data requested were Sales Data, Customer Data and Inventory Data, along with certain qualitative data. After persuasion, the owner agreed to provide Sales Data and Customer Data along with the required qualitative data asked for but refrained from sharing Inventory or any form of internal operations related data. For the purpose of the project Sales Data and Customer Data along with qualitative data would be sufficient.

Preliminary analysis of the provided data has revealed several insights including the market fit of Silicon Systems, dominant category of products, top selling and least selling items, top revenue generating and least revenue generating items, and customers potentially to be retained and customers that possibly might be lost.

The analysis thus far reveals few of the causes of the business problems and leads us to clues for further in-depth analysis and possible outcomes.

2 Proof of Originality of the Data

Following is a photo obtained from the owner's office-cum-store during one of the visits (rest of the photos can be found in the resources folder):

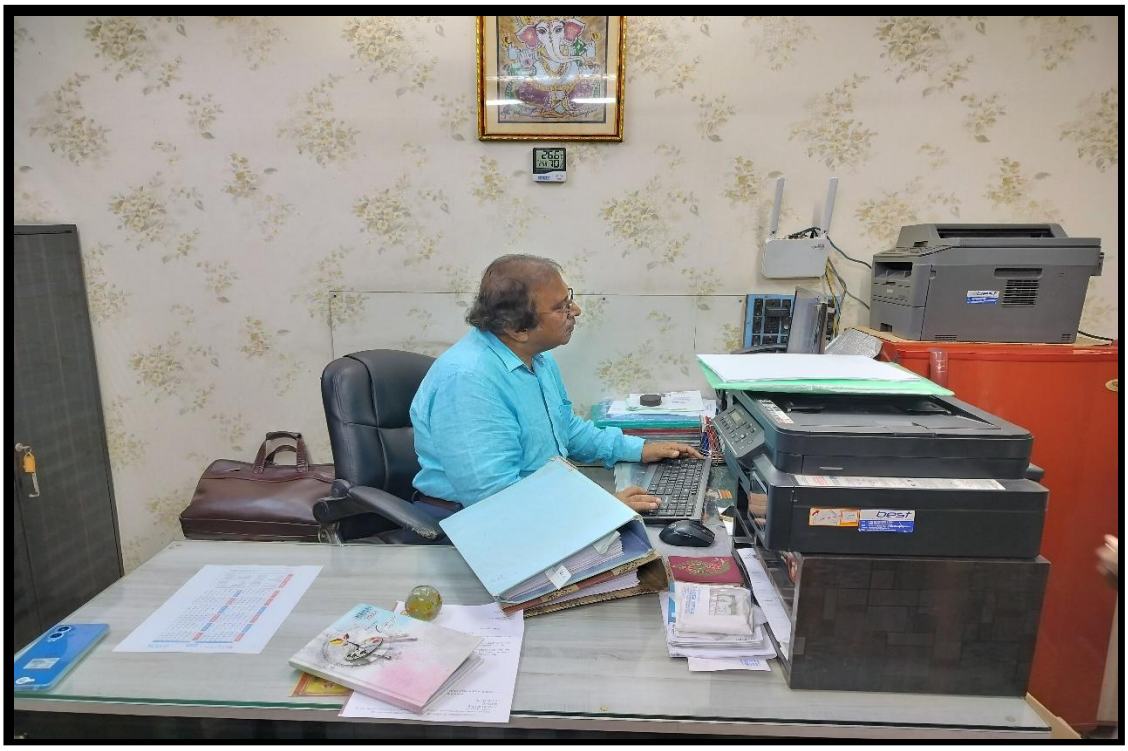


Fig. 2.1: Business Owner – Atanu Chowdhury

Resources for Proof of Originality can be found in the following links as follows:

- Video of Interaction between student and owner – Link to Interaction Video
- Pictures of the office-cum-store of the owner – Link to Pictures
- Video overview of the office-cum-store – Link to Video
- Letter from the business owner – Link to Letter PDF
- Dataset provided by the business owner – Link to Dataset Spreadsheet
- Processed dataset for the purpose of analysis – Link to Processed Data Spreadsheet
- All the resources compiled together can be found in this folder - Link to Folder

3 Metadata

3.1 Data Available

Fig 3.1: Sheets in Dataset Spreadsheet

The dataset spreadsheet "SiliconSystems_Dataset.xlsx" contains two sheets – SALES DATA and CUSTOMER DATA, as shown in Fig 3.1. The SALES DATA contains the exhaustive data of sales of Silicon Systems from July 1st, 2024, to December 31st, 2024. The CUSTOMER DATA contains the database of active customers of Silicon Systems and other related information.

3.2 Data Source

The data has been collected directly from the owner of the business Mr. Atanu Chowdhury. Silicon Systems maintains a detailed Sales Data spreadsheet of all the products sold daily and related information. It also maintains a database of active customers. These data have been directly provided for the purpose of the project in the form of Excel files. Necessary cleaning of these data is essential for analysis purposes.

3.3 Time Period of Data

The Sales Data ranges over a period of six months, from 1st July 2024 to 31st December 2024. Data has been retrieved only for these six months as it is essential to keep up with the latest trends in sales, as further historical data could produce anomaly in analysis. The Customer Database contains a list of active clients since 1st January 2011. Past data before this period were not recorded and are irrelevant since the business has lost their customers that existed before this period due to some unmentioned reason.

3.4 Features of Sales Data

Date	Vch/Bill No	Particulars	Item Details	Quantity	Price	Amount
01-07-2024	SS/00159/24-25	JHANKAR SAREE	LAPTOP LENOVO 81HNA01KIH I3/4/1/15.6/DOS	3	22550	67650
01-07-2024	SS/00160/24-25	EASTMAN HYDROQUIPMENTS PVT.LTD	DRUM BLADE CANON	4	700	2800
01-07-2024	SS/00161/24-25	WEST BENGAL COUNCIL FOR RABINDRA	IP BULLET CAMERA 50 MTRS	1	3900	3900
			DEVELOPER POWDER FOR PHOTOCOPIER MACHINE	5	5000	25000
01-07-2024	SS/00162/24-25	SIDDHIVINAYAK DEALCOM PRIVATE LTD	SOLAR PANEL PANASONIC	9	19400	174600

Fig 3.2: Sample of Sales Data

The features of Sales Data as shown in Fig 3.2 include:

- Date: Date on which the product was sold.

- Vch/Bill No: Unique voucher or bill number for the sale.
- Particulars: Name of client to which product was sold.
- Item Details: Detailed description of the product sold.
- Quantity: Quantity of units of product sold.
- Price: Price of 1 unit of the product (in Rs.).
- Amount: Total cost of all units of product sold (Quantity multiplied by Price, in Rs.).

3.5 Features of Customer Data

Client Name	Industry	Sector	First Purchase	Total Purchases
PRASANTA CHANDRA MAHALANOBIS MAHAVIDYALA	Education	Government-aided	22-08-2011	441
EASTMAN HYDROQUIPMENTS PVT.LTD	Manufacturing	Private	09-02-2012	318
WEST BENGAL COUNCIL FOR RABINDRA	Education	Government-aided	13-05-2014	336
NETAJI NAGAR COLLEGE FOR WOMEN	Education	Government-aided	15-09-2014	376

Fig 3.3: Sample of Customer Data

The features of customer data as shown in Fig 3.3 include:

- Client Name: Name of the client (Institution or Business name).
- Industry: The industry to which the client belongs.
- Sector: The sector of the client (Public, Government-aided, Private, etc.).
- First Purchase: Dates on which clients made their first purchase from Silicon Systems.
- Total Purchases: Total number of purchases (in terms of number of bills) made by the client since their first purchase.

4 Descriptive Statistics

- Python was used for generating descriptive statistics using Pandas Data Frame.
- Date columns have been excluded for the purpose of descriptive statistics.

4.1 Descriptive Statistics for Sales Data

	count	mean	std	min	25%	50%	75%	max
Quantity	499.00	12.80	15.00	1.00	4.00	8.00	17.00	152.00
Price	499.00	5881.51	12207.70	5.00	400.00	1700.00	4300.00	78500.00
Amount	499.00	44992.42	137625.93	5.00	2399.88	11900.00	39000.00	2276500.00

Fig 4.1: Descriptive statistics of numerical columns in Processed Sales Data

- Fig 4.1 describes the statistical values of numerical columns in Processed Sales Data.

- It is observed in Fig 4.1 that the average unit of quantity per order is around 13 whereas the median unit of quantity per order is around 8. The minimum order quantity in a single order was 1 whereas the maximum order quantity in a single order was 152.
- It is evident from Fig 4.1 that the average order price of one unit of products is somewhat around Rs. 5,881.5 while the median order price of one unit of products is around Rs. 1,700. The minimum price of one unit of product is Rs. 5 whereas the maximum price of one unit of product is Rs. 78,500.
- It is inferential from Fig 4.1 that the average order value or the average amount of orders is around Rs. 44,992.5 while the median is around Rs. 11,900. The minimum amount was found to be Rs. 5 whereas the maximum amount turned out to be Rs. 22,76,500.

	count	unique	top	freq
Vch/Bill No	453	453	SS/00159/24-25	1
Particulars	453	20	BANARHAT KARTIK ORAON HINDI GOVT.COLLEGE	34
Item Details	499	110	MONITOR TFT 18.5" LG	15

Fig 4.2: Descriptive statistics of categorical columns in Processed Sales Data

- Fig 4.2 describes the statistical values of categorical columns in Processed Sales Data.
- From Fig 4.2, it shall be noted that there are 453 unique bill records in the dataset.
- Fig 4.2 also suggests that over the last six months, BANARHAT KARTIK ORAON HINDI GOVT. COLLEGE has been the top client for Silicon Systems in terms of the number of bills generated for individual clients.
- The fact that MONITOR TFT 18.5” LG is the top selling SKU (Stock Keeping Unit) over the last six months, purely based on their number of appearances in sale vouchers, is also evident from Fig 4.2
- More in-depth analysis is required to derive absolute conclusions regarding products and categories.

4.2 Descriptive Statistics for Processed Customer Data

	count	mean	std	min	25%	50%	75%	max
Total Purchases	20.00	295.40	159.49	52.00	133.00	327.00	428.25	490.00

Fig 4.3: Descriptive statistics of numerical columns in Processed Customer Data

- Fig 4.3 describes the statistical values of numerical columns in Processed Customer Data.
- Fig 4.3 leads us to the conclusion that since 2011, the average number of total purchases across all customers is around 295 whereas the median is around 327. The maximum number of orders by a single customer is 490 whereas the minimum is 52.

	count	unique	top	freq
Client Name	20	20	PRASANTA CHANDRA MAHALANOBIS MAHAVIDYALA	1
Industry	20	6	Education	11
Sector	20	2	Government-aided	10

Fig 4.4: Descriptive statistics of categorical columns in Processed Customer Data

- Fig 4.4 describes the statistical values of categorical columns in Processed Customer Data.
- The count of Client Name in Fig 4.4 is suggestive of the fact that Silicon Systems currently have 20 active clients who are in regular business with the firm.
- Fig 4.4 is inferential of the fact that Silicon Systems' clients majorly belong to the Education Industry.
- Government-aided institutions are the majority among the clients of Silicon Systems, as is visible in Fig 4.4.
- The dominance of an Industry or a Sector, in Fig 4.4, is purely in terms of number of clients belonging from that Industry or Sector and not on their purchasing quantities and amounts. Hence, further analysis is needed to arrive at concrete conclusions.

5 Explanation of Analysis Processes and Methods

- Preliminary analysis of data has been performed so far.
- The preliminary analysis of data has been explained in detail in the subsequent sections.
- While preliminary analysis provides certain ideas and clues on solving the problem statements, in-depth analysis is required to arrive at end-point conclusions and provide recommendations to solve the problems.
- In-depth analysis of data will be performed and provided in the subsequent submission stages.

5.1 Data Preprocessing

- Before beginning the analysis, it is important to clean the data and do necessary processing in order to arrive at a useful endpoint.
- The first step of preprocessing done on the data was assigning correct datatypes – Short Data to Date column, Integral Number to Quantities, Currency (in Rs.) to Price and Amount in the SALES DATA. Similar preprocessing was also performed on First Purchase (short date) and Total Purchases in CUSTOMER DATA.
- In the SALES DATA, several orders had multiple items under one Vch/Bill No. For such occurrences, the date, bill number and particulars name were kept empty in the original dataset. For such occurrences, the same date, bill number and particulars name have been assigned to avoid any anomalies during analysis, as these empty cells might have otherwise been considered as null values.
- New columns were introduced in the datasets as and when required for the purpose of analysis, as has been defined in the subsequent sections.

5.2 Industry Analysis

- It is important to analyze the split of business across the industries that Silicon Systems serve in order to find out the dominant industries and the industries where the business is lagging behind to find customers.
- This will enable the business to recognize areas where it might potentially lose customers and also the ones where it is expected to retain them.
- It will also enable the business to decide whether it is appropriate to introduce and market their slow-moving items in a particular industry.
- It has been observed that Silicon Systems has been doing business with clients from Education, IT, Retail, Wholesale and Manufacturing industries.
- A pivot table was constructed from the CUSTOMER DATA in order to find out the dominance and submissive nature of industries, as shown in Fig 5.1.
- A pie chart was constructed based on this pivot table to clearly indicate the result of this analysis.

Row Labels	Count of Client Name	Sum of Total Purchases	Sum of Number of Purchases in Last 6 Months	Sum of Amount of Purchase in Last 6 months
Education	11	3828	237	₹ 97,67,556.07
Finance	1	141	16	₹ 7,43,076.49
IT	1	341	28	₹ 8,26,746.92
Manufacturing	2	427	53	₹ 30,43,600.44
Retail	4	1104	90	₹ 69,34,550.42
Wholesale	1	67	29	₹ 11,35,685.51
Grand Total	**20**	**5908**	**453**	**₹ 2,24,51,215.85**

Fig 5.1: Pivot Table for Industry-wise Split

5.3 Category Analysis

- Category Analysis is essential to identify the category of products that contribute to a larger proportion of the business and the ones that are not revenue-generating enough.
- Category Analysis will help Silicon Systems identify the dominating category, the items under which could be stocked in larger quantities whereas the lesser contributing category of items may not be stocked in larger quantities to optimize inventory.
- This will also help the business reach an optimum inventory management system which would help them avoid losses due to market fluctuations.
- For this purpose, first a pivot table was created from the raw data to obtain the names of all the specific items and then category was assigned to them among IT, Electronics, Lab Equipment and Service, after consultation and discussion with the business owner. This has been shown in Fig 5.2.
- Once the pivot table was created in a sheet, a new column "Category of Product" was introduced, and VLOOKUP function of Excel was used to automate the assigning of category for each order in the SALES DATA. The formula has been shown in Fig 5.3.
- The processed sales data was then used to create another pivot table with the category, their count of order, their total count of quantities sold and amount of revenue generated from these categories, which was then used to plot bar charts accordingly.

Item Details	Product	Category
A.C. ELECTRONICS MILIVOLTMETER SES	MULTIVOLTMETER	Lab Equipment
ANNUAL MAINTENANCE SERVICE	SERVICE	Service
ANTI VIRUS	ANTIVIRUS	IT
ANTI VIRUS QUICK HEAL INTERNET SECUR. PR	ANITIVIRUS	IT
ANTI VIRUS QUICK HEAL TOTAL SECURITY	ANITIVIRUS	IT
ASSEMBLED DESKTOP PC	DEKSTOP	IT
BATTERY FOR NOTEBOOK	BATTERY	Electronics

Fig 5.2: Categorization and Product Description Sample

```
=VLOOKUP(F2,CATEGORISATION!$A$2:$C$110,3)
```

Fig 5.3: Formula used for applying VLOOKUP for Category

5.4 Product Analysis

- With the business having varied number of SKUs for similar product items, analysis of products gets difficult.
- To handle such a situation, a pivot table was created from SALES DATA to extract the names of individual SKUs. Then, specific SKUs were assigned generic product names to reduce huge amount of variation in data and arrive at certain degree of generalization. This is represented in Fig 5.2. The formula used has been shown in Fig 5.4

- This would make analysis of certain products with various SKUs easier since analysis of individual SKUs is no longer required for every specific item. Analysis of the product would be sufficient.

```
=VLOOKUP(F2,CATEGORISATION!$A$2:$C$110,2)
```

Fig 5.4: Formula used for applying VLOOKUP for Product

5.5 Monthly Analysis of Customers

- Monthly analysis of customers is needed to identify the customers that have been consistent with their purchase over the months. Such customers could be considered as loyal customers who are not expected to part ways with Silicon Systems.
- If a drop in purchase orders is seen in a customer, the business might have a possibility of losing such a customer.
- For this purpose, a new column was introduced named “Month” which contains the month of purchase. This will make the time series analysis of purchase easier compared to dealing with specific dates. The formula used for this purpose has been shown in Fig 5.5.
- Line Chart was plotted to visualize the trend among customers.

```
=TEXT(A2,"mmmm")
```

Fig 5.5: Formula used for extracting month name from dates

6 Results and Findings

6.1 Industry Analysis Results

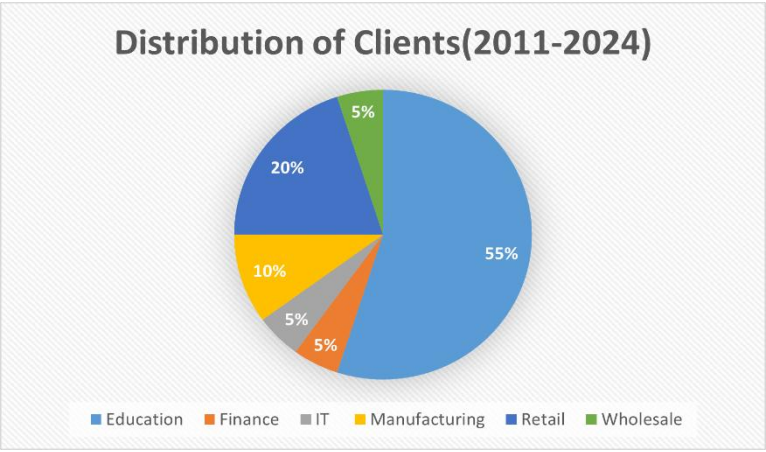


Fig 6.1: Pie chart to show the distribution of clients across industries

- Pie Chart analysis in Figs 6.1, clearly shows that Education industry is the biggest market of Silicon Systems, followed by Retail while the other industries are in minority.
- Similar trend is observed across all distributions – Number of clients, Purchase data (historic as well as latest) and Revenue, hence has not been included.

6.2 Category Analysis Results

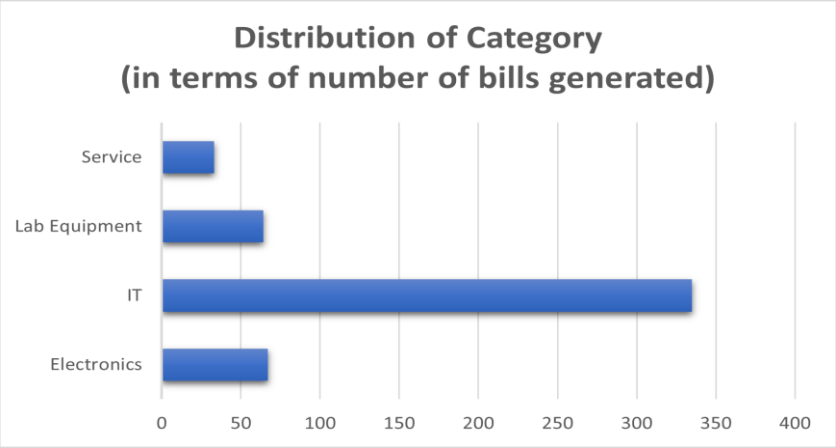


Fig 6.5: Bar chart to show the distribution of bills generated across categories

- Bar chart analysis (Fig 6.5, 6.6 and 6.7) of category reveals that clearly the majority percentage of sales belong to IT products.
- Services contribute least to Silicon Systems revenue.
- Electronics and Lab Equipment business has an equal split.

6.3 Product Analysis Results

Row Labels	Sum of Quantity	Sum of Amount
CABLES AND WIRINGS	1546	₹ 8,15,727.64
PRINTER COMPONENTS	739	₹ 16,98,050.00
BEAKER	565	₹ 38,367.55
STORAGE DEVICE	431	₹ 24,21,250.00
FURNITURE	336	₹ 6,59,770.00

Fig 6.8: Top 5 products in terms of units sold

MOTHER BOARD	21	₹ 53,550.00
SPEAKERS	21	₹ 30,450.00
SOLAR PANELS	18	₹ 3,49,200.00
PHOTOCOPY MACHINE	16	₹ 12,32,000.00
SOLDERING IRON	9	₹ 3,599.64

Fig 6.9: Bottom 5 products in terms of units sold

MONITOR	212	₹ 53,03,359.23
DEKSTOP	144	₹ 38,32,516.00
STORAGE DEVICE	431	₹ 24,21,250.00
PRINTER COMPONENTS	739	₹ 16,98,050.00
PHOTOCOPY MACHINE	16	₹ 12,32,000.00

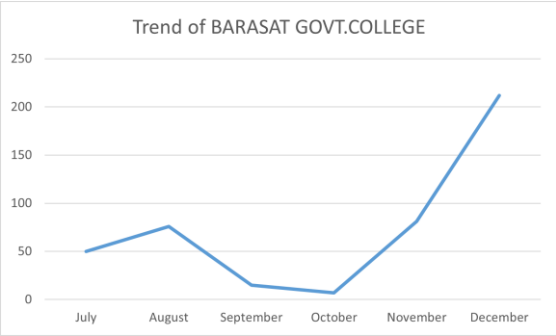
Fig 6.10: Top 5 products in terms of revenue generated

HELIUM DISCHARGE TUBE	23	₹ 6,899.31
LAMPS	27	₹ 5,129.46
SOLDERING IRON	9	₹ 3,599.64
CABLES AND WIRINGS	95	₹ 3,325.00
ACRYLICS	199	₹ 2,536.00

Fig 6.11: Bottom 5 products in terms of revenue generated

- The top 5 products in terms of units sold and revenue generated do not converge.
- This an expected outcome since cheaper items are assumed to be sold in more quantities compared to expensive items.
- The bottom 5 products, in terms of units sold, are the slow-moving items.
- A striking feature of the data is that while Photocopy Machine belongs to the bottom 5 in terms of units sold, it belongs to top 5 in terms of revenue generated. This likely indicates that Silicon Systems is unable to find enough customers for products as expensive as Photocopy Machines.

6.4 Monthly Analysis Results



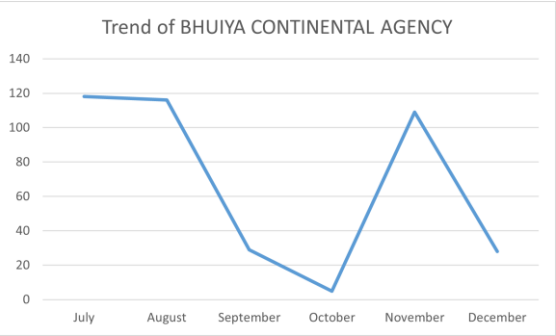


Fig 6.12: Monthly Trend of BARASAT GOVT. COLLEGE Fig 6.13: Monthly Trend of BHUYIA CONTINENTAL AGENCY (Six Months Data)

- Preliminary trend analysis over 6 months has been carried out for a few of the customers of Silicon Systems. Further analysis to be done for final submission.
- Preliminary analysis has revealed the presence of customers whom the business might lose as well as the ones that it is expected to retain.
- For example, Fig 6.12 shows how the business has seen a rise in orders from BARASAT GOVT. COLLEGE. The business is likely to retain this customer.
- Fig 6.13, reveals a constant downfall of orders from BHUIYA CONTINENTAL AGENCY indicating a possible loss of the customer.