

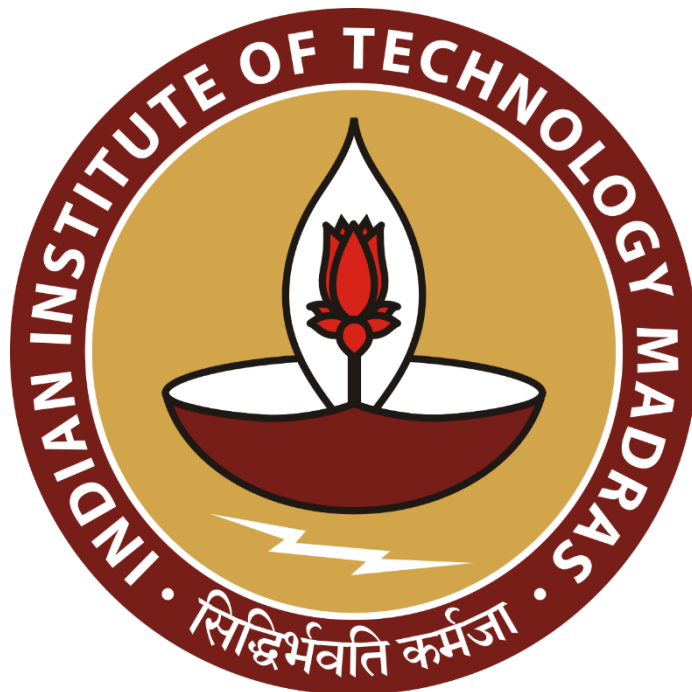
Optimizing Inventory Management and Supply Chain Efficiency

An End-Term report for the BDM capstone Project

Submitted by

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Declaration Statement

I am working on a Project titled “Optimizing Inventory Management and Supply Chain Efficiency”. I extend my appreciation to Katha Coffee and Bakehouse, 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: Anirudh Thimmaraju Penumatcha

Date: 26/03/24

1 Executive Summary and Title

The project focuses on Katha Coffee and Bakery house located at Banjara hills, Hyderabad. The business is B2B and deals in the segment of F&B. Katha produces specialty coffee, artisanal bakery options and has an extensive collection of music and vinyl records. Their most selling items are the cold brews, the iced teas, and their croissant options. Additionally, this business has a very high foot traffic of music enthusiasts.

The primary issue that the organization is facing is Increased expenditure on inventory and other resources without a substantial increase in sales or turnover rates. Katha's operational efficiency is hindered by a fragmented data collection system, where inventory data is dispersed across various platforms including Excel files, manual entry logs, and online billing platforms like Paidpooja. This disarray obscures the resource flow, impeding effective problem-solving efforts. Moreover, the company's heightened spending is exacerbated by limited negotiation leverage and an over-reliance on select suppliers.

Renowned for its specialty coffee, Katha's hallmark cold brew is crafted through a meticulous roasting process with a unique blend of Barako beans. However, the exclusivity of this method limits supplier options, weakening Katha's bargaining power and forcing excessive spending despite suboptimal supplier performance and reliability. Addressing these challenges is imperative to fortify Katha's competitive edge and optimize resource utilization.

In this report we will go into detail regarding the analysis processes performed on the collected data (September - November 2023, January - March 2024) from Katha Coffee house. This report will broadly follow this guideline:

- Analysis Processes : MetaData and Exploratory analysis, Inventory Management and Purchases analysis, Supplier Performance and Comparison analysis.
- Findings and Takeaways: address the findings from the analysis, Explore and identify causes for the findings and key takeaways
- Results and Solutions: Summarize the key findings and provide recommendations for solutions.

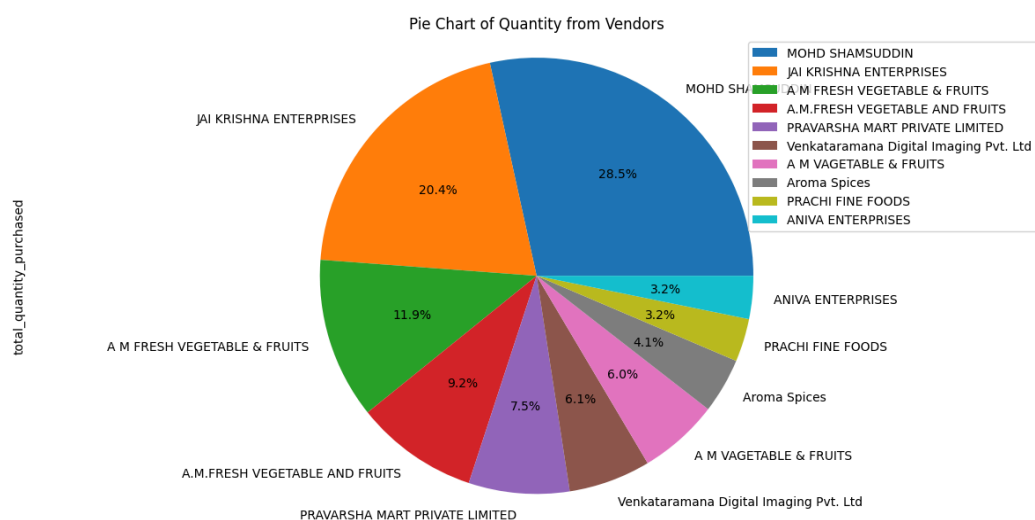
2 Detailed Explanation of Analysis Process

I've collected the data of inventory purchases (and other resources) of Katha Coffee House over the months of September through November 2023, and January through March 2024. Available data sources with information regarding Inventory Levels and Procurement processes were maintained by Katha across different data collection methods disjointly. Data was recorded in manual bookkeeping processes, excel sheets, and PaidPooja, an online POS software for F&B Businesses.

First open source OCR was used to convert part of the manually written files to an excel spreadsheet, the ones that could not be processed this way were manually entered. After this, using purchase order numbers and Invoice numbers as keys, available data structures from Excel sheets and PaidPooja documents were compiled to make a complete data sheet. Then this was cleaned of duplicate entries and as many missing errors as possible were filled through manually. The inventory levels data consisted of 2 different categories each covering a different 3 month period. Suitable analysis methods were charted and performed in google sheets and google colab.

However, the business chose not to share any major financial data, leading to some data inconsistencies which were appended with purchase order quantity data. All this data has been compiled to a [google sheets document](#) which was then used for calculating metadata and the subsequent analysis processes.

MetaData And Exploratory Data Analysis



Plot0: A comparison of all inventory vendors for Katha Coffee house.

Katha 2023 Purchase Tracker: September - November

- Data entries: Date, Invoice number, Category, Item Description, Units (L/Kg/pc), quantity.

Date	Invoice	Vendors	Category	Item	Units (L/kg/pc)	Quantity
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	LC CHICKEN SPICY MORTADELLA LOG	KG	4
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	PRESIDENT UNSALTED BUTTER 500GM	PCS	60
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	GOLOKA BURRATA CHEESE 600GM	KG	6
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	DEL MONTE EGGLESS MAYO 1KG	KG	12
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Oil	OIL SESAME TOASTED 500ML	PCS	4
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	GOLDEN CROW N CORN FLAKES 500G	PCS	2
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	RICHS WILBER FARMS DAIRY CREAM 1LTR	PCS	12
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	MONIN PEACH NAT TEA IN 1LTR	PCS	5
01/09/23	11386	SPREADERS FOODS SOLUTIONS	Groceries	DABUR REAL HONEY 1KG	KG	5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	ONION	KG	3
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	TOMATO B	KG	5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	SPRING ONION	KG	0.5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	CORRIONDER	KG	0.5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	PUDINA	KG	1
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	CHERRY TOMATO	KG	1
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	Y-ZUCCHINI	KG	0.5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	G-ZUCCHINI	KG	0.5
01/09/23	867	A M FRESH VEGETABLE & FRUITS	Vegetables	GREEN SALAD	KG	0.5
01/09/23	2269	SRI RAMDEV MARKETING	Cleaning Sup	TOILET ROLL	PCS	100
01/09/23	2269	SRI RAMDEV MARKETING	Cleaning Sup	CLING FILM 600(1.6KG)BIO	PCS	12
01/09/23	2269	SRI RAMDEV MARKETING	Cleaning Sup	NITRILE POWDER FREE BLUE GLOVES	NOS	6
01/09/23	2269	SRI RAMDEV MARKETING	Cleaning Sup	GARBAGE BAG 35'45	KG	20
02/09/23	3942	CORRIDO SEVEN COFFEE ROASTERS	Coffee	CASCARA	KG	5
02/09/23	3942	CORRIDO SEVEN COFFEE ROASTERS		SHIPPING CHARGES		1
02/09/23	336	AROMA SPICES	Groceries	RICE BAGS (26KG)	BAGS	1
02/09/23	336	AROMA SPICES	Groceries	SUGAR	KG	15
02/09/23	336	AROMA SPICES	Groceries	GHEE		4

Pie Chart of Categories of inventory

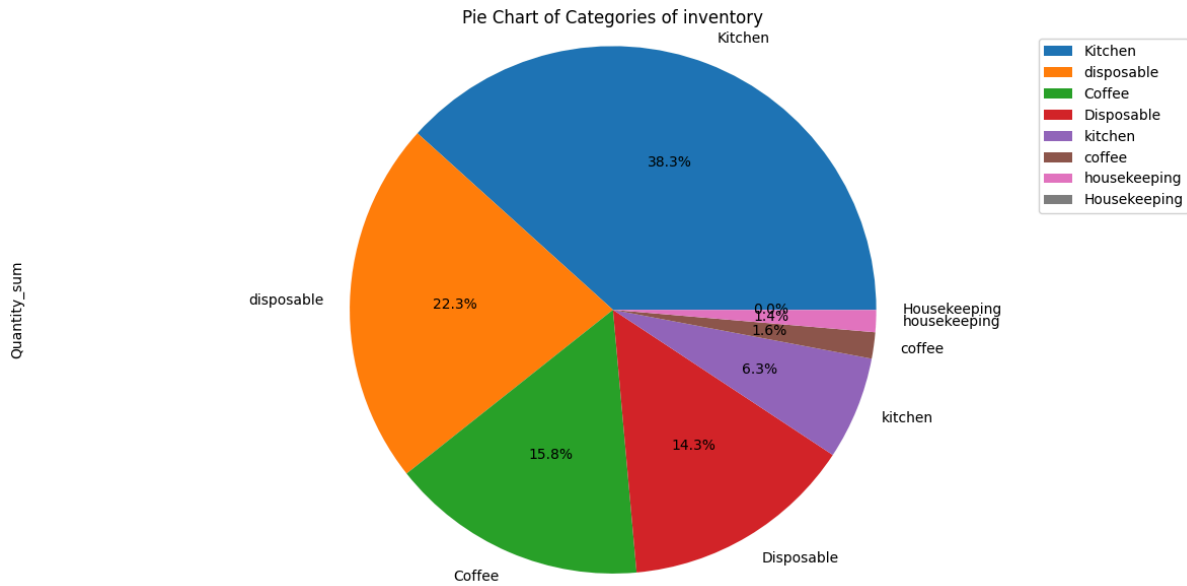
Category	Percentage
Cleaning Supplies	28.2%
Vegetables	28.0%
Cling Wrap and Foil	12.8%
Groceries	10.6%
Fruits	5.7%
Meat	4.1%
Cheese	1.9%
Flour	1.8%
Milk	1.6%
Cream	1.6%
Other	1.6%
Dry cleaning	0.9%
Ice Cream	0.8%
Water	0.8%
Dry Fruits	0.8%
Butters	0.8%
Coffee	0.8%
Gas	0.8%
Chocolate	0.8%
Paneer	0.8%
Oil	0.8%
Eggs	0.8%
Milk	0.8%
Flour	0.8%
Cream	0.8%
Other	0.8%
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Paneer	0.8%
Oil	0.8%
Eggs	0.8%
Milk	0.8%
Flour	0.8%
Cream	0.8%
Other	0.8%

Katha 2024 Purchase Tracker: Jan - March

- Data Entries: Company, GST No, State, State Code, City, Address, Zip Code, PAN, CIN, Vendors, Customer Address, GST No, Phone, Email, Type, Invoice No., MRN/PO No., Invoice Date, Raw Material, Category, Sub Category, Unit, Quantity, Raw Material, ID, Description

Category	SKU No	State	State Code	City	Address	Zip Code	State	CR	Vendors	Item Description	SKU No	Phone	Email	Type	Invoice No.	MPO/PO No.	Invoice Date	Invoice Month	Location	Sub Category	Item Code	Net Price	Unit	Quantity	Raw Material Cost	Raw Material Cost Description
Kaffa Coffee and Beans	500004	Tennessee	500004	Memphis	500004	500004	MOORE SHAMUON		MOORE SHAMUON	PRANAM'S REGUMET SA MAALCP27C	772009600			Purchase	36018	398	1 Jan 2024	Jan 2024	Kishen	Coife Vegetables	0	BULK	2	1607275		
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Kaffa Coffee and Beans	500004	Tennessee	500004	Memphis	500004	500004	MOORE SHAMUON		MOORE SHAMUON	PRANAM'S REGUMET SA MAALCP27C	772009600			Purchase	36018	398	1 Jan 2024	Jan 2024	Kishen	Coife Vegetables	0	BULK	2	1607275		
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6



Plot2: Distribution of quantities of inventory purchased by category over 3 months

Inventory Management and Purchases Analysis

For this inventory management and purchase analysis data, 2 main types of analysis were conducted separately for the 2 3 month periods (Sep - Nov 23 / Jan - Mar 24)

Grouped Bar Chart Analysis: This chart was plotted with the intention to find and compare any changes in the inventory purchases by category. It was made by aggregating the purchases across different categories for all 3 months separately and plotted in a comparative grouped bar chart.

Time Series Analysis: This chart was plotted with the intention to discover any trend for the reorder points across a month and compare them with the other months. It was made by aggregating inventory purchases by Date and plotted in a time series chart. The markers for the x-axis are noted every 7 days to avoid overcrowding.

Supplier Performance and Comparison Analysis

For the supplier Performance and comparison Analysis, Data was collected and compiled from the 6 months' provided. Additionally, data was requested from other organizations in the same sectors and prospective suppliers.

Bar Chart Comparison Analysis: This chart was made with the intention of comparing Katha's primary supplier of Barako(Liberica) coffee beans. Multiple other sources for liberica beans were requested from other coffee houses, and directly from some supplies. It shows prices for Barako bean suppliers in Hyderabad (Processed / Preprocessed)

Box Plot Analysis: This chart was made with the intention to find a trend to the supplier delay time. The supplier in consideration is Mohd Shamsuddin pvt ltd, the primary supplier of Barako coffee beans to Katha. This data was collected from the manual ledgers and compiled across each month for visibility and better understanding

Multi Line Chart Analysis: This chart shows the quantities purchases vs inventory expenditure for Katha Coffee house over the period of 6 months. This chart doesn't have its own analysis. It is frequently used as evidence in the other charts.

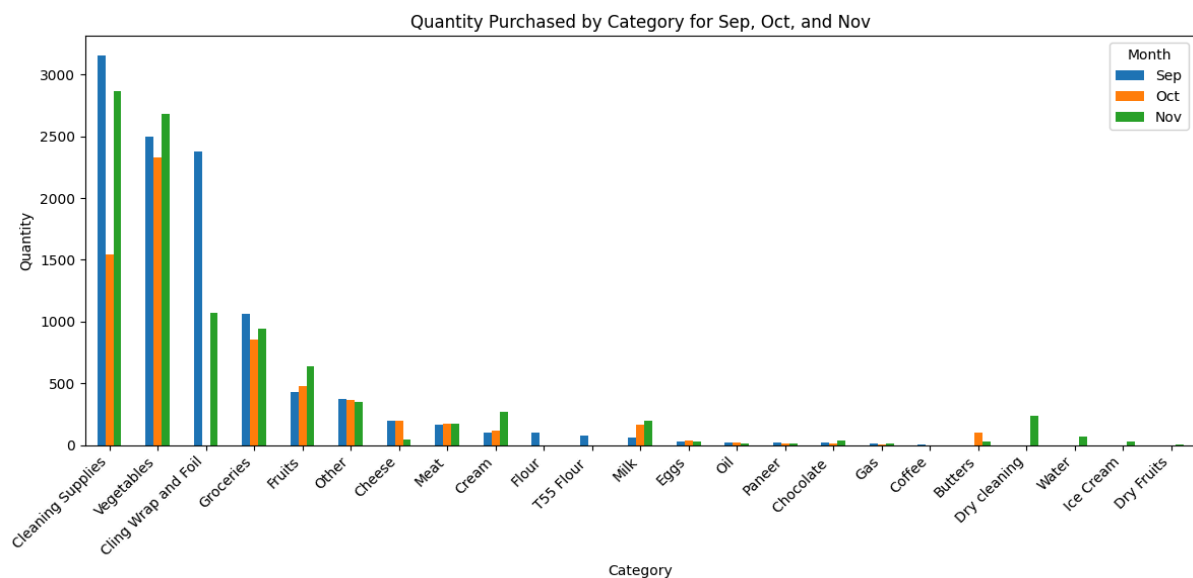
3 Results and Findings

Here are a few noteworthy numbers from the data that can give you a better understanding as we explore the results and findings of the performed analysis.

- Total purchase orders over 6 months: 4194
 - Main Order Categories: Kitchen items , Cleaning Supplies, Vegetables.
 - Costs increase over 6 months: 1116.9%
 - Revenue increase over 6 months: 450%
-
- Largest Inventory Vendor: MohD Shamshuddin pvt ltd. (28.5%)
 - Average MohD Shamsuddin order lead / delay time (3.3 days)
 - Average cost of preprocessed Liberica beans (310 rupees)
-

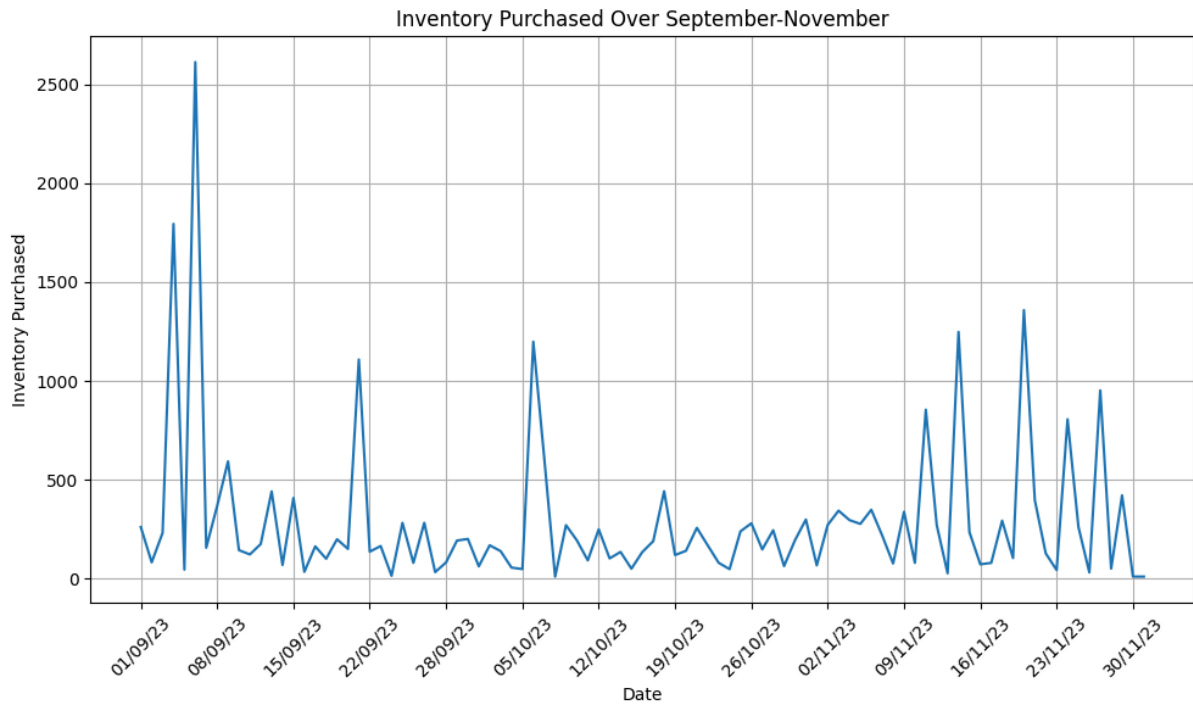
Inventory Management and Purchases Analysis

September - November 2023



Plot3: Grouped Bar Chart for Inventory Distribution across categories made over 3 months

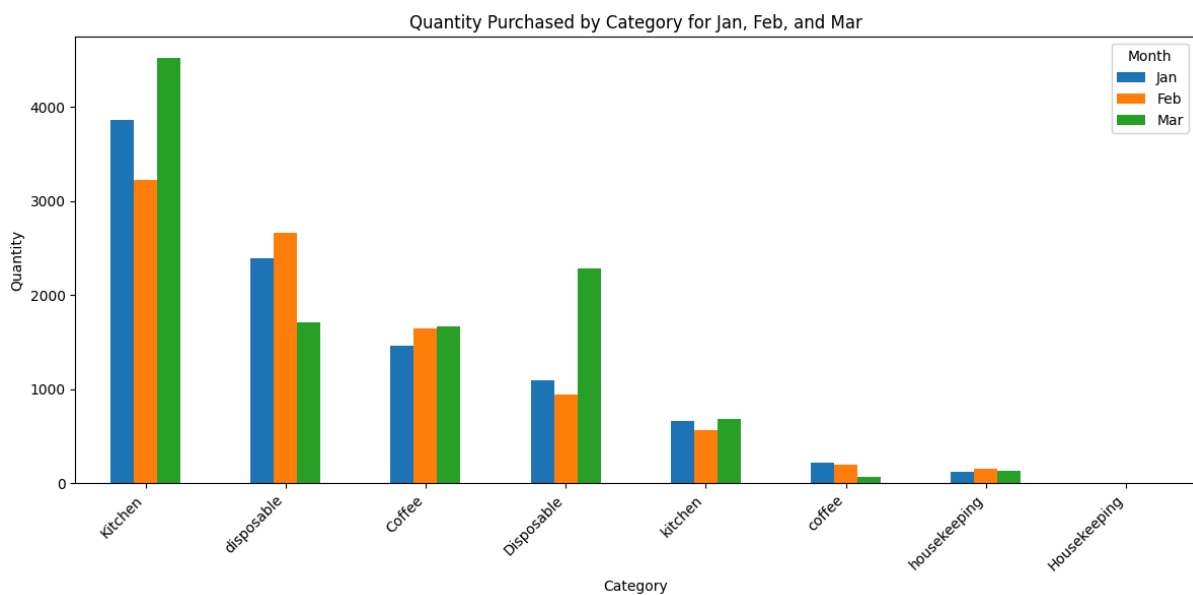
Grouped Bar Chart Analysis: We can see in this chart that Katha has irregular inventory reorders. We can see that cleaning supplies and cling wrap with a larger use period were overstocked. This is proof that the reorder points need to be revised.



Plot4: Time series line chart for Inventory Purchases made over 3 months

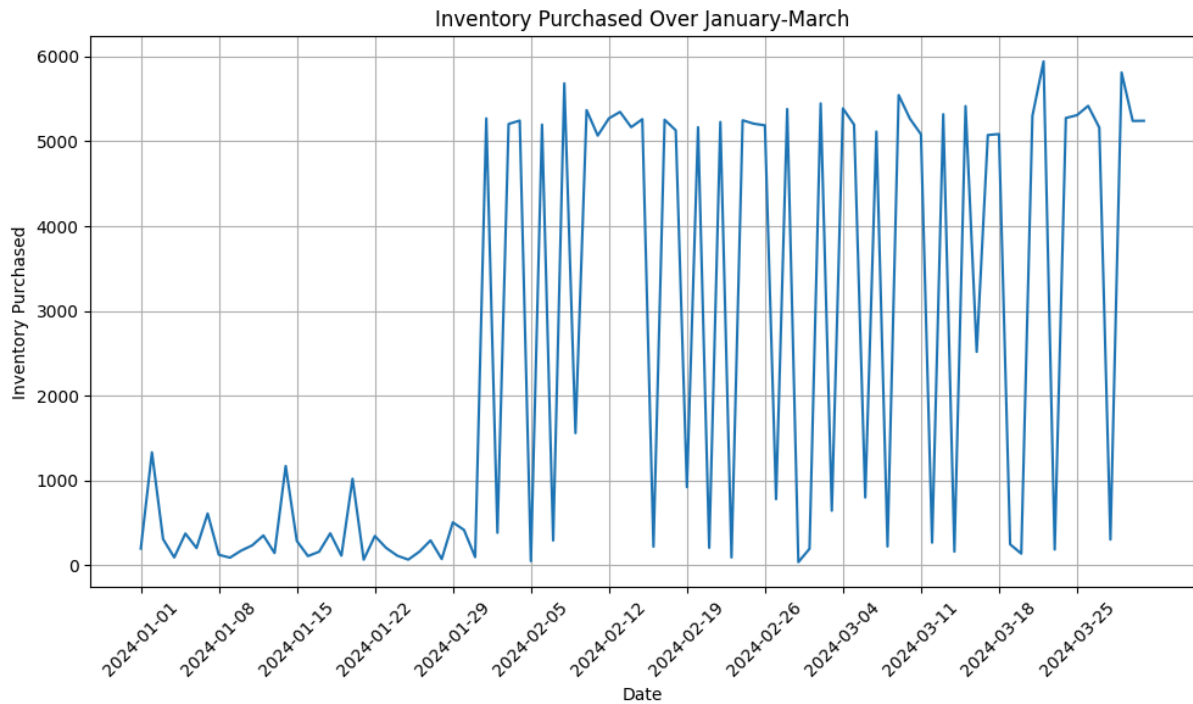
Time Series Analysis: Over the 3 months, we can clearly see the reorder points (the peaks) distributed irregularly for September and October, 2 concise large order points in the first week of January which lasted them for almost the rest of the month. Due to these large purchases and the nature of the business, many of the inventory items(consumables) are at risk of expiry. These purchase points were more evenly and regularly distributed in the month of November. After September and October's wasted inventory, they decided to go for orders in smaller quantities at more regular intervals to prevent overstocking. We can see that the major order frequency increased to 5 from 2, and the decreased order size. However, this partially increased their costs as they had to buy the lesser quantities at a higher price point.

January - March 2024



Plot5: Grouped Bar Chart for Inventory Distribution across categories made over 3 months

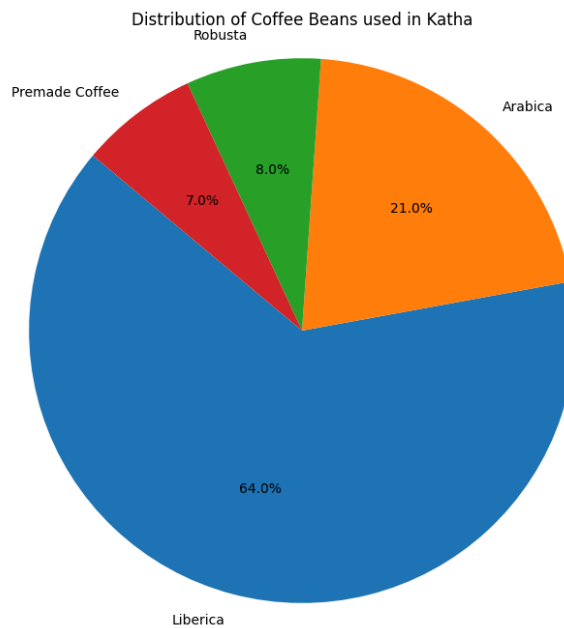
Trend Comparison Analysis: In the months of February and March Katha had a significantly higher operating cost related to inventory expenditure. However we fail to see the same reflected in amounts of quantities purchased. Even in these 2 months, February had especially lower purchase orders, hinting at a suboptimal use of funds given that there were no significant changes in industry prices during this period. We can also see that wastage charges have increased by a substantial amount.



Plot6: Time series line chart for Inventory Purchases made over 3 months

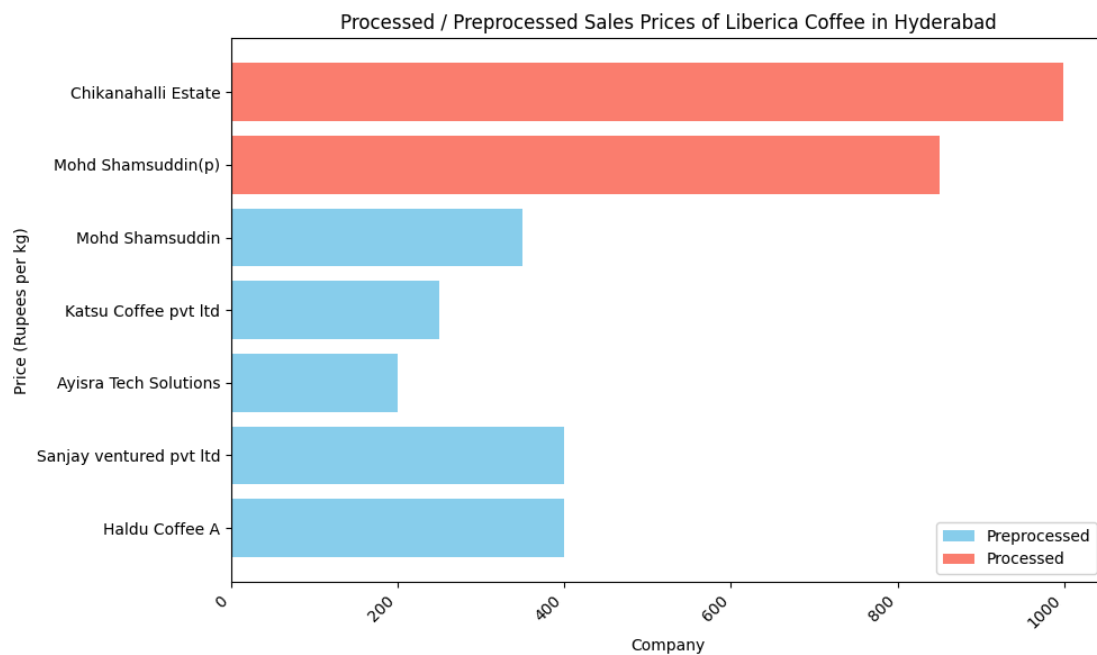
Time Series Analysis: Compared to the previous time series analysis, the reorder points are much more evenly distributed. The rise in purchases for the months of February and March can be attributed to a stark increase in popularity of the cafe, as the cafe was covered in multiple food blogger sites and received great exposure through social media. They also hosted a series of music oriented events: artist listening sessions, live music nights, and the works. However these increased orders did not bring forward the subsequent revenue as Katha had major renovation and marketing costs.

Supplier Performance and Comparison Analysis



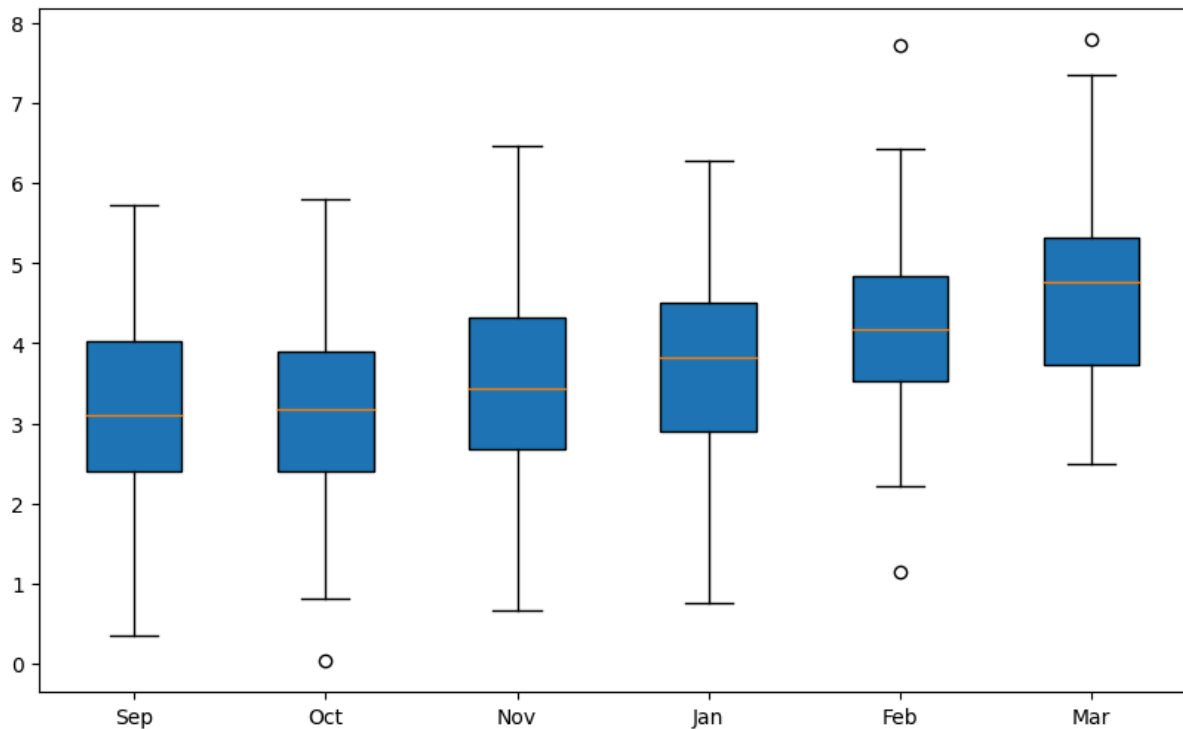
Plot7: Ratio of speciality Coffee Beans used at Katha

Katha Coffee House makes the majority of their specialty coffee from Barako (Liberica beans). Barako beans have limited suppliers in India, mainly in the region of Coorg, Karnataka. For their unique taste, Barako beans have a very specific roasting process, where the beans are placed in a preheated environment, roasted, and closely monitored for the first crack and color checks before processing and packaging them.



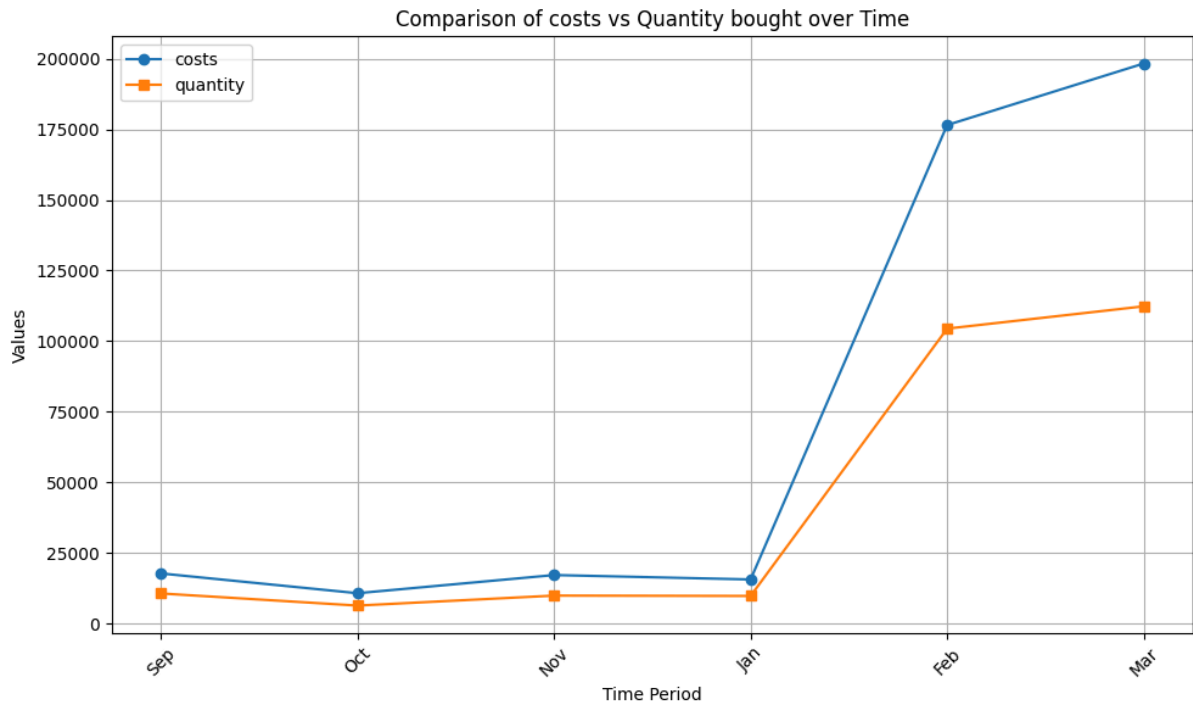
Plot8: Bar chart Comparison of Liberica suppliers across hyderabad speciality coffee shops

Bar Comparison Analysis: Mohd Shamsuddin is a private supplier of Barako beans and they are one of the only suppliers in India that follow the traditional roasting method that gives the beans their unique earthy flavor. They also have a monopoly over the market in Hyderabad, as beans that are sold in the 288-300 rupees range in India are sold for 350+ rupees per kg to Katha. Adding the processing costs, the approximate cost comes out to 850 rupees per kg. The reason for the monopoly is that while there are many independent organizations that farm and sell liberica beans, there are very few that follow the appropriate grading and roasting processes. There are two main suppliers following these restrictions in Hyderabad, Mohd Shamsuddin pvt ltd, and Chikkanahalli estate (extension of Andheri - (W) roastery in Karnataka). Chikkanahalli estate sells AAA grade, which can only be appropriately tasted and enjoyed by coffee connoisseurs, leaving the majority of control of this niche market in one organization.



Plot9: Supplier Lead(Delivery delay) times across 6 months (y-axis = order delay in days)

Box Plot Analysis: In this chart, we can see that the lead times have slowly been increasing over the 6 months. Due to these lead times, Katha sometimes purchases specialty beans meant for private consumption from retail stores like Ratnadeep and Q mart at almost 3 times their current price. At the start of May, these products had an increased demand and subsequent change in price. As a consequence, We can see a higher increase in lead times for February and March. Similarly, Inventory expenditure has increased over the last 2 months disproportionate to the quantities ordered. This fact is also attributed to the increase in price put forward by their primary supplier of coffee beans. which is evident in the multi line chart provided below



Plot10: Multi line chart Comparison of inventory expenditure vs Quantity bought

4 Interpretations and Recommendations

From the original proposal, our problem statements were derived from Katha's problems regarding inventory management inefficiency and supplier underperformance / unreliability.

- Inventory management inefficiency: The main problems stem from Katha's siloed inventory data collection systems, and their inefficient reorder points.
- Supplier Underperformance / Unreliability: Katha depends solely on a primary supplier for their specialty coffee beans, this decreases their negotiating power for the item and allows the supplier to fluctuate prices and be lax in their performance.
-

Recommendations for Solutions

Data Collection: Katha has to adopt a streamlined data collection system. Manual entries are unreliable and difficult to perform any future analysis on. My recommendation is to shift to a software service like PaidPooja, which can automate and collect inventory and procurement data in POS (Point of Sale form). This also allows seamless tracking of sales and inventory in real time. Another alternative is to outsource the development of a simple data collection process, as doing it internally would require developing advanced data science skills and personnel. Regular Audits can be performed to address any fixes and reconcile actual stock levels with recorded data

Reorder Points: Set up an automated system that can detect lower stock levels and alert the respective personnel. Since the specialty coffee bean Baraka is native to Karnataka, multiple suppliers have guaranteed lead times of 2 days, which can provide the coffee shop with Reliability and a lesser need to depend on the more expensive retail options. A followed practice in the industry is to multiply the daily average usage with the lead time and add the safety stock (to be replaced with the newer stock each time).

Supplier: There are 2 solutions that I have identified after looking at the price and the lack of competing supplier restrictions. The simplest way is to reach out to other specialty coffee shops that use Liberica beans and set up a contract with them to provide beans from their

own suppliers in exchange for a commission. These organizations can acquire processed Liberica beans for prices in the range of 500 rupees, so even with a 20% commission, this deal would be favorable to Katha than the existing cost.

Alternatively a more long lasting solution would be to hire the required personnel and buy the equipment needed for roasting. Depending on the model, and functionality of the equipment, it would cost in the range of 13-16 lakh rupees. While this is an expensive alternative, it would fit in with Katha's plan to expand later this year to another branch in Hyderabad, and to other cities in the next 5 years. Allowing them to purchase the preprocessed beans for a price of 300 rupees from an alternative supplier. This would greatly decrease costs in the long run and could also produce an alternate income source by selling the extra beans.

This marks the end of the report.