

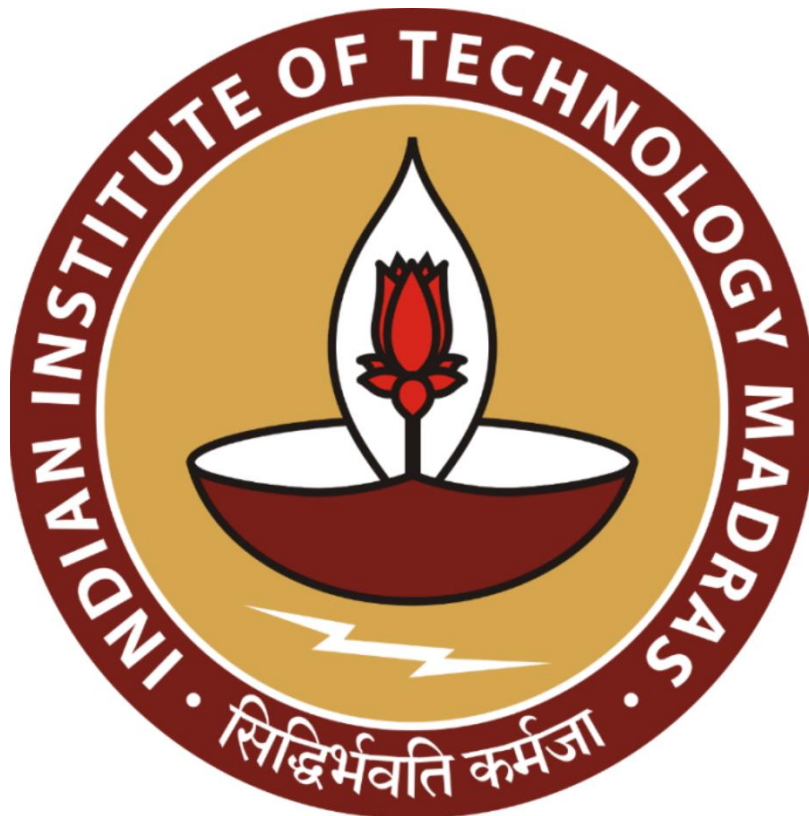
Optimizing Inventory and Service Offerings for a Multi-Service Retail Shop

Final Report for BDM Capstone Project

Submitted by

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Declaration Statement

I am working on a Project titled “**Optimizing Inventory and Service Offerings for a Multi-Service Retail Shop**”. I extend my appreciation to **Cafe.com**, for providing the necessary resources that enabled me to conduct my project.

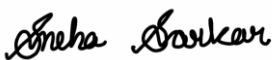
I hereby assert that the data presented and assessed in this project report is genuine and precise to the utmost extent of my knowledge and capabilities. The data has been gathered through primary sources and carefully analyzed to assure its reliability.

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 information 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 agree that all the recommendations are business-specific and limited to this project exclusively, and cannot be utilized for any other purpose with an IIT Madras tag. I understand that IIT Madras does not endorse this.

Signature of Candidate: 

Name: Sneha Sarkar

Date: November 1, 2025

1. Executive Summary and Title

Cafe.com runs as this multi-service spot right at the Suri Bus Stand in Birbhum, West Bengal. It started up back in 2018, going with a straight B2C setup. The place pulls in students and pros along with folks from around there. They handle stuff like printing documents, Xerox copies, and making photo ID cards, think Aadhaar or voter IDs in PVC. Plus, they sell stationery, school gear, and those little utility things people need.

Even with how popular it is and that prime spot, things get tough on tracking sales, managing stock, and making the most of the space they have.

Data for this study was pulled together in Excel first analyzed using Python and the analysis was handled using Matplotlib and Seaborn all in VSCode. The set covered **1740** sales entries, spread over **7** product types, and tracked **194** days' worth of deals. Stats and other methods dug into the ops to spot where it's inefficient and what could actually get fixed.

When breaking down the basics, sales records came off uneven, no real standard there. That messed with following how products or services did on their own. Looking at inventory, much of the stock value sat in items that barely moved, especially in categories like **Photo Services & Office Supplies**. High-demand stuff ran short way too often. Trends by season hit spikes and drops around **April** during school session end. Seems like it ties hard to school schedules or events outside.

To get deeper on those patterns, they ran things like **Pareto Analysis, Behavioral Segmentation, Demand Forecasting & Cross-Selling Insights etc.** That pulled out what drives revenue, how sales shift by time, and if stock works well enough. All of it built a solid base from data for choices ahead.

Recommendations point to fixing inventory smarter, getting sales data on a standard track, and shifting space around for better service flow. It all boosts profits too. The whole thing shows how leaning on data like this lifts efficiency in ops, keeps customers happier, and sets up small shops like **Cafe.com** for the long haul.



Figure 1.1: Proof of Originality

2. Detailed Explanation of Analysis Procedure

This analysis digs into the store's operational data. It tries to pull out real insights that can help with smarter business choices. Mainly, it looks at sales performance. It spots those high-demand times and the slow ones too. Plus, it figures out which products or services bring in the most revenue. Then there's inventory movement. That part highlights items sitting around too long or ones that are always short. All this helps with better stock planning. It even checks out customer behavior and how efficient operations are. Patterns show up there, along with some inefficiencies and chances to get better. In the end, it gives a solid data-based view of how **Cafe.com** is doing. That sets up the base for strategic recommendations. Key steps in the process come next.

2.1. 80/20 Revenue Impact Assessment (Pareto Analysis)

This analysis identifies which services contribute most to total revenue, following the Pareto Principle (80/20 rule) — that roughly 80% of effects come from 20% of causes.

- Total revenue is computed using:

$$Total\ Revenue\ per\ Service = \sum (Quantity \times Price)$$

- Revenue share is then calculated as:

$$Revenue\ Share = \frac{Service\ Revenue}{Overall\ Revenue} \times 100$$

- Cumulative revenue percentage identifies the smallest group of services contributing to 80% of total revenue.

Purpose: To find top-performing services for focused marketing, inventory stocking, and promotional investment.

Example Output: Typically, top 4–5 services contribute around 80% of total revenue — these are prioritized for business focus.

2.2. Market Basket Analysis (Cross-Selling Insights)

This analysis explores relationships between services purchased together to uncover cross-selling or bundling opportunities.

- Transactional data is first grouped by invoice and converted to a one-hot encoded matrix (*mlxtend.frequent_patterns.apriori*).
- The Apriori algorithm is used with:
 - *min_support* = **0.01**
 - *metric* = **'lift'**
 - *min_threshold* = **1.0**
- Rules are generated using:

$$\text{Support}(A \Rightarrow B) = \frac{\text{Transactions containing both } A \text{ and } B}{\text{Total Transactions}}$$

$$\text{Confidence}(A \Rightarrow B) = \frac{\text{Support}(A \Rightarrow B)}{\text{Support}(A)}$$

$$\text{Lift}(A \Rightarrow B) = \frac{\text{Confidence}(A \Rightarrow B)}{\text{Support}(B)}$$

Total Number of Baskets Found: 34

Purpose: To detect service pairs often bought together, suggesting bundle promotions or strategic placement.

Example Insight: If ID Card Print and Stationery Purchase show a *high Lift (>1.5)*, they can be marketed as a combined offering.

2.3. Cyclic Demand Decomposition (Seasonality Analysis)

This analysis looks at how demand changes over time. It picks out those repeating seasonal patterns and the bigger trends that stick around longer.

- We break down the time-series revenue data with *seasonal_decompose()* from statsmodels. This function helps split things into trend, seasonal, and residual parts.
- The model separates the series Y_t into:

$$Y_t = T_t + S_t + R_t$$

where $T_t = \text{trend}$, $S_t = \text{seasonal pattern}$ and $R_t = \text{residual (noise)}$.

- Plots visualize each component to detect seasonal spikes (e.g., during exam periods or festivals).

Purpose: To recognize recurring demand patterns for better forecasting and inventory scheduling.

Example Insight: Revenue hits peaks in February, March, and then again in November. That lines up with exam times and admission seasons pretty much.

2.4. K-Means Customer Segmentation (Behavioral Segmentation)

This analysis focuses on behavioral stuff. It groups customers by how they buy things, spotting those different bunches.

- We take the invoice-level data and aggregate it using groupby in pandas. That gives us total quantity, which is *Total_Quantity*, and total spending as *Total_Spend* for each invoice. For categorical bits like **Customer Type** and **Payment Method**, we grab the mode to summarize. And the product categories they bought get stored in lists.
- Category proportions are calculated for each invoice as:

$$Pct_{C_k} = \frac{\text{Number of items in category } C_k}{\text{Total items in invoice}}$$

- This converts categorical information into numeric features for clustering.
- All features are standardized using Z-score normalization:

$$z = \frac{x - \mu}{\sigma}$$

- Then we run K-Means clustering on it. Set *n_clusters* to **4**, *random_state* at **42**, and *n_init* to **10**. This segments the invoices based on those purchasing patterns.
- To visualize, we use PCA with *n_components*=**2**. That drops the features down to two dimensions. Scatter plots come next. They show the clusters and their centroids all projected into that PCA space.

Explained Variance Ratio: [0.26167298 0.1441562]

Purpose: To find those distinct customer segments. We can use them for targeted marketing, maybe some promotions, and planning inventory too.

Example Insight: They show up with high-spending customers who buy a diverse range of stuff. Then there are the small-volume ones focused on specific categories. And yeah, other patterns in between that are kind of intermediate.

2.5. Service Utilization Dynamics (Trend Mining)

This analysis examines service utilization trends over time and across shifts to identify demand patterns.

- Daily revenue and quantity for each service category are aggregated using *groupby()* in pandas.
- The top 3 service categories by total revenue are identified using *sum()* and *sort_values()*. Only these top categories are considered for trend visualization to maintain clarity.
- Revenue trends for the top services are plotted over time using *sns.lineplot()*, showing how demand fluctuates day by day.
- Shift-wise popularity is analyzed by grouping revenue by Purchase Shift and Category, then visualized as a heatmap with *sns.heatmap()*. This reveals which shifts generate the most revenue for each service.
- There's another analysis that looks at service demand by day of the week. Revenue gets grouped by **DayOfWeek** and **Category**. They reorder it from *Monday* to *Sunday*. Then plot the whole thing as a heatmap.

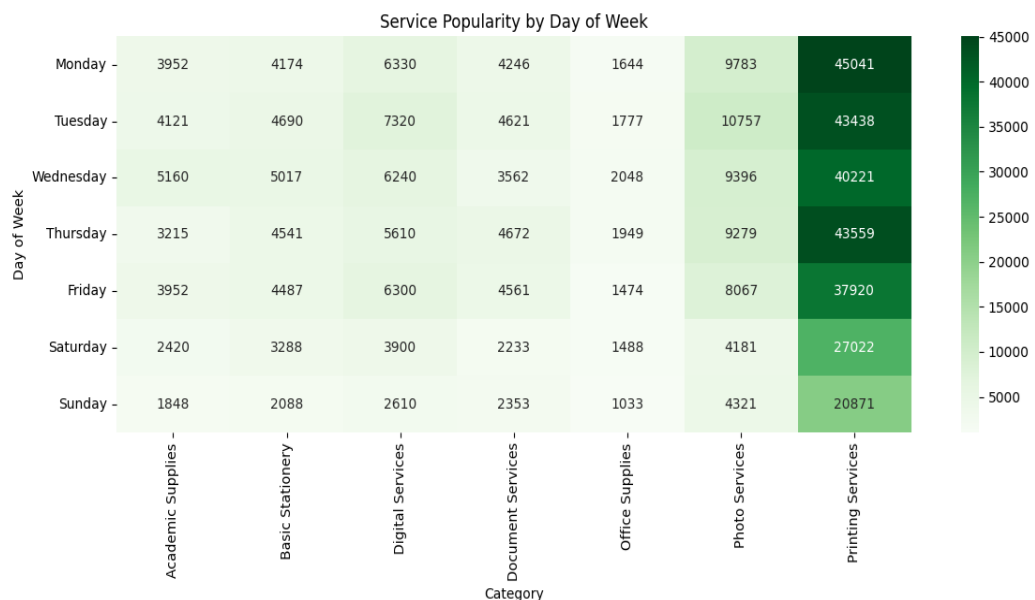


Figure 2.1: Service Popularity by the Day Heatmap

Purpose: to figure out daily patterns and shift-level ones for service demand. You know, that helps with staffing better. And allocating resources in a smarter way.

Example insight: Certain services peak during specific shifts or on certain days. Basically, it optimizes workforce scheduling. And promotional strategies too.

2.6. ARIMA Time Series Forecasting (Demand Forecasting)

This analysis uses time series stuff to predict daily revenue. It helps spot trends and figure out what demand might look like down the line. They pull together the daily totals from transactions, just adding up the total prices for each date. Any gaps in dates get filled with zeros, so the series stays smooth and ongoing.

- They check if the series is stationary with that Augmented Dickey Fuller test, the ADF one. If the *p-value* is over **0.05**, it means it's not stationary, so they differentiate it to keep the average steady.
- You look at the ACF and PACF plots next. Those help pick the right *(p, d, q)* values for ARIMA. They usually start with *(1, 1, 1)*, based on common setups.
- The model gets fit to the past daily revenue data. It picks up the overall trend and those quick dependencies. Then they run a forecast out thirty days, with ninety five percent confidence bands to show the uncertainty.
- They graph the predictions next to the old data. That way you see the trends coming and any ups and downs expected. The intervals give a spread for what revenue could actually hit, so you can gauge how solid the predictions are.

```
ADF Statistic: -8.947274291695255
p-value: 8.91818187850259e-15
✅ Data is stationary.
```

Purpose: This whole thing aims to guess revenue soon ahead. It backs up planning for operations and money matters.

Example Insight: The forecast lays out revenue patterns for the month coming up. That lets you adjust inventory and staff ahead of time.

3. Results and Findings

We ran those analyses on **Cafe.com**'s preprocessed business data. It turned up some actionable insights about sales performance. Customer behavior came into focus too. Demand dynamics got clearer as well. Each method we used showed unique sides of the store's operations. Things like spotting the top revenue-generating services. Uncovering patterns in how customers buy. Even forecasting what demand might look like down the line. The findings point out strengths in the business. They also flag areas that need improvement. This sets up data-driven strategies. For better inventory management, say. Sharper marketing focus. More efficient operations overall. In the end, these results build a solid base. For decisions that make sense. And growth that can last.

3.1. Revenue Concentration & Pareto Analysis

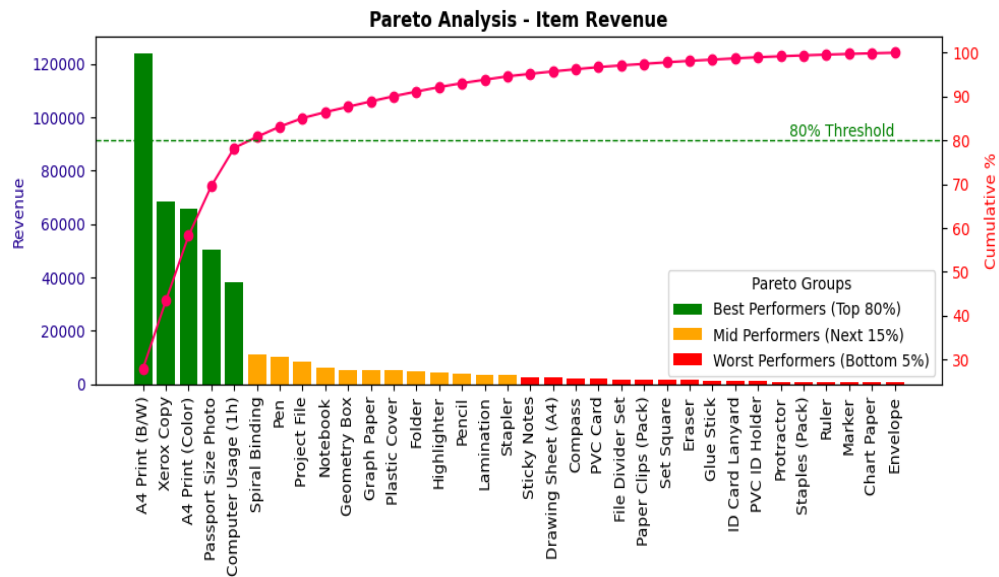


Figure 3.1: 80/20 Revenue Impact

Results:

- Pareto Analysis sorts all the items into three main groups. Best Performers Mid Performers and Low Performers. It does this based on how much they add to total sales revenue. You see it in a cumulative revenue curve. There's this sharp bend or elbow around the 80 percent spot. The pink line shows it. That bend points out the Pareto Principle. A small number of things, like 20 percent, bring in most of the money. The other 80 percent just add a little.
- **Best Performers** include five SKUs. Things like A4 Print in black and white or color. Xerox Copy. Passport Size Photo Clipping. And Computer Usage. Together they make up about 80 percent of revenue. The thing is, all these are services. Not retail products. It shows the store really shines in services. Not so much in selling stuff. These services get used every day. They move fast. And they have good margins. So they keep the shop running strong financially.
- **Mid Performers** have around 12 SKUs. Spiral Binding. Pens. Files. That kind of thing. They add up to the next 15 percent of sales. Most are products. Not services. So they help a bit with revenue. But they do not boost profits like the services do. Demand for them stays steady. Nothing huge though. They mostly come along with the main service sales. You know, complementary.
- **Low Performers** cover everything else. Mostly stationery and retail items. They do not sell much. After 95 percent, their share is tiny. Almost nothing. It proves they do not matter much to the business. This whole setup shows Cafe.com succeeds because of services. Retail sales play a small part.

- Overall, the Pareto stuff points to one big thing. The owner has to take care of certain things; focus on improving services, promote them across & make operations smoother for the top SKUs. And think again about stock and space for the weak ones. Doing that should help profits. And use resources better.

Findings:

The Pareto Analysis clearly shows that a small number of services drive most of the shop's revenue. Everyday offerings like A4 prints, Xerox copies, passport photos, and computer usage make up around 80% of sales, proving that the store's real strength lies in services rather than retail products. Mid-performing items, such as pens, files, and spiral bindings, add some extra revenue, mostly as add-ons to the main services, while low-performing products, mostly stationery, contribute very little and take up space without much return. Overall, the takeaway is simple: focus on improving and promoting the top services, keep operations smooth for these key earners, and rethink stock and space for slower-moving items. Doing this can help the shop run more efficiently and boost profits.

3.2. Market Basket Analysis



Figure 3.2: Cross-Selling Insights

Results:

- Market basket analysis lets you see how folks really shop. It shows what they pick up together. And it hints at what they need. They visualized the data like a network.

Services and products turned into nodes. Links between them meant how often stuff got bought on the same receipt. Stronger links showed more frequent pairings.

- A4 print in black and white jumps out right away. It sits smack in the middle. Kind of like a hub. It connects to things like folders. Staplers too. Protractors and graph paper. That service pulls people over. Once they are at the counter. They remember those little extras. You know. Everyday thing. Someone drops in for some black and white copies. Then they grab a folder for storage. Or a stapler to hold it all.
- A4 color print acts differently though. It is not so linked up. Way fewer connections. Seems like customers come for something specific. Printing a photo maybe. Or a school project. They do not wander much. No extra buys really.
- This points to how the shop gets used. Black and white printing keeps steady traffic coming. It triggers those quick impulse grabs. Color is more targeted. Just one off job usually. The shop can use this. Push some cross selling easy. Put folders and clips by the print area. Or bundle deals. Like twenty prints and a free folder.
- Small details like these make a difference. They not only help increase sales but also make the customer experience smoother; everything they might need is right there, in one place.

Findings:

The results show that black-and-white printing plays a big role in bringing people into the shop. Customers who come for A4 B/W prints often end up picking up small extras like folders, staplers, or graph paper; things that naturally go along with printing. It's a simple, everyday shopping habit that adds up to steady sales. In contrast, those who come for color prints usually have a specific purpose and don't browse much, which makes that service more of a one-time need. Overall, this suggests that regular printing services not only keep footfall consistent but also open the door for small impulse buys. By placing related items near the printing area or offering small bundle deals, the shop could make the shopping experience smoother and subtly boost sales at the same time.

3.3. Cyclic Demand Decomposition

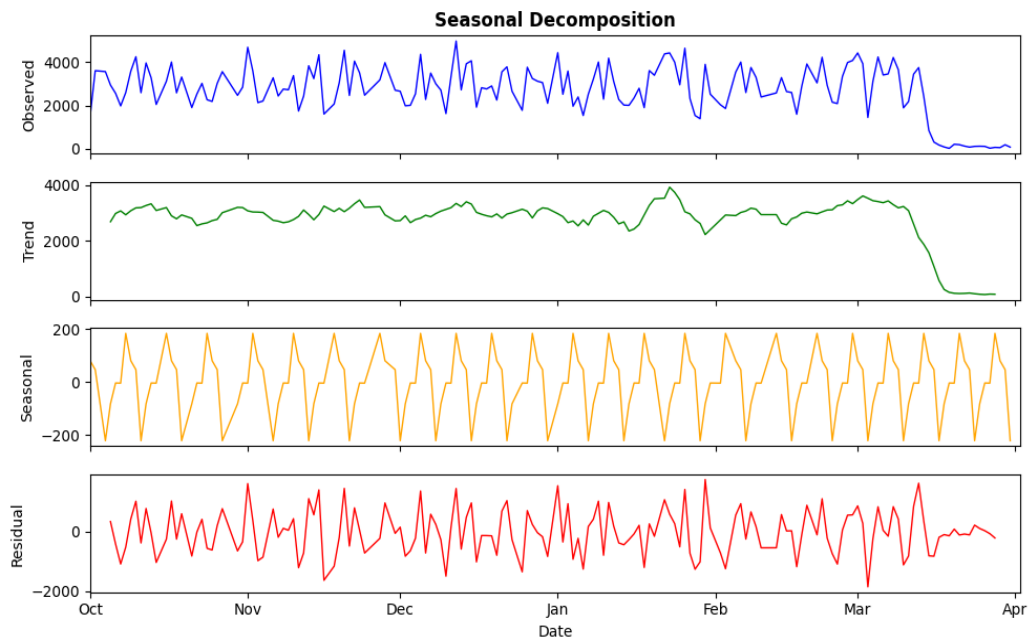


Figure 3.3: Seasonality Analysis

Results:

- People still look at the observed data. It shows the real demand numbers over time. You can see regular ups and downs there. That points to some kind of repeating cycle in how demand behaves. One thing stands out. There is a big drop around March to April. Maybe that's seasonal. Or it could be some outside issue. Perhaps a market thing hit sales hard then.
- The trend part tracks the bigger picture over the long haul. From October through February, it stays pretty even. Demand feels solid in those months. But come March, things take a nose dive. That lines up with what you see in the raw numbers. This kind of shift might mean deeper changes. Like the end of a busy season. Or folks buying habits shifting around.
- Seasonal stuff pulls out those patterns that keep coming back. They happen on a set schedule, like every week or month. In this data, they look steady. Demand cycles you can count on. That means some times of year always see more or less action. Businesses could use that for stocking up or running ads.
- Residuals are the leftovers. The random bits that do not fit the trend or seasons. Here, they stay small and even. Most of the demand story gets covered by the other parts. Near the end, those leftovers shrink a bit. Probably since overall demand fell off. Less room for weird swings.
- Putting it all together, demand has these clear repeating patterns. Cycles you can predict. It holds steady at first. Then drops big toward the end. So yeah, its mostly

stable and looped. But watch for outside stuff or season changes causing quick falls. Factor that into forecasts and plans.

Findings:

The data gives a clear picture of how demand changes over time. There are regular ups and downs, showing a repeating rhythm in how people buy. But one thing really stands out; a noticeable drop around March to April. That could be seasonal, or maybe something external slowed sales during that time. For most of the period, especially from October to February, demand looks steady and healthy. The seasonal patterns seem reliable too, with certain times consistently busier than others, which businesses can use to plan stock or promotions. The leftover random variations are small, meaning the overall demand story is pretty clear; steady, somewhat predictable, but with a sharp fall that's worth paying attention to. It's mostly stable, just with a few bumps that remind you how markets can shift suddenly.

3.4. Customer Segmentation with K-Means Clustering

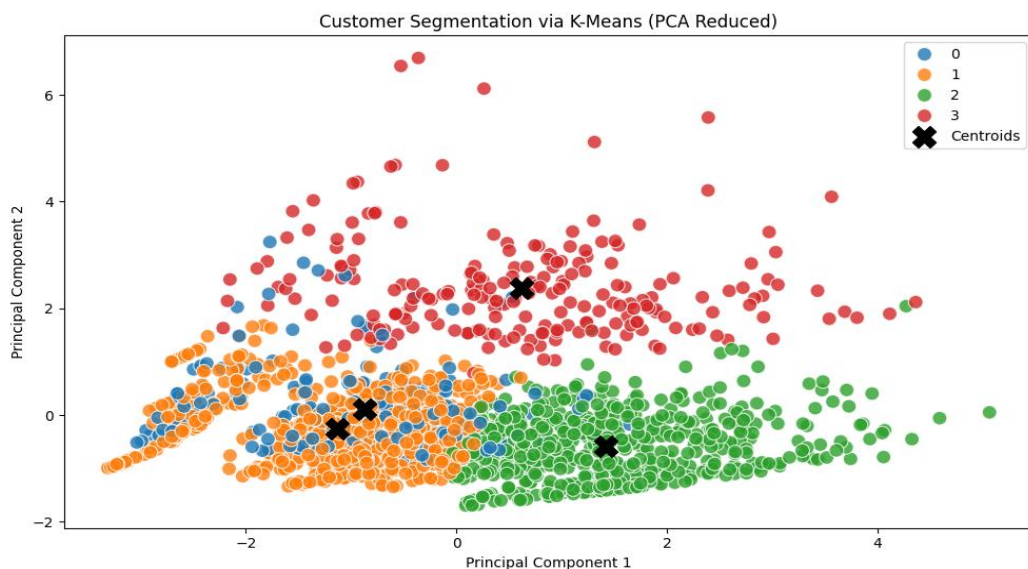


Figure 3.4: K-Means Customer Segmentation

Results:

- **Customer Segmentation by Purchase Behavior:** The analysis picked out four clear customer groups. They stand apart mostly based on total spending amounts. Some groups cover those high-value buyers who shop frequently. Others pick up the moderate spenders or the occasional ones. All this shows real differences in how engaged people are. Loyalty varies too.
- **Differences in Payment Methods and Product Preferences:** Every group has its own habits when it comes to paying. Think digital wallets for some. Cards for others. Cash still shows up. Product choices differ a lot across them. What they buy most often tells

a story. Preferences go beyond just how much they spend. They run deeper. Multi-dimensional really.

- **Actionable Business Insights:** Knowing these clusters gives a solid look at customer behavior. It helps shape marketing that targets specific folks. Personalized offers make sense now. Inventory planning gets sharper too. Businesses that fit offerings to each group's needs see better satisfaction. Revenue picks up from there.

Findings:

The results give a pretty clear look at how customers shop in all sorts of ways. You know, there are four main groups out there. Some folks spend big and hit the stores all the time. Others just pop in now and then. Their picking habits change too, like how they pay with digital wallets or cards or even straight cash sometimes. And they go for different products, basically. The thing is, these patterns make it obvious customers vary a lot. Not everyone acts the same, their routines and how loyal they are differ quite a bit. Getting a handle on that helps the business reach out right to each bunch. They can do personalized deals, plan stock smarter, and run marketing that actually matches what people care about.

3.5. Service Popularity & Trend Mining

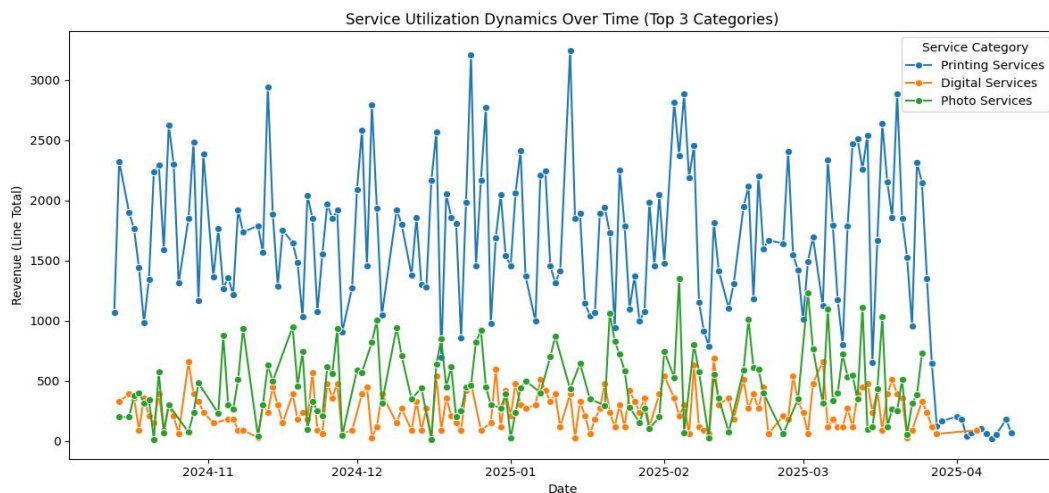


Figure 3.5: Service Utilization Dynamics

Results:

- **Printing Services:** They always come out on top for revenue, you know. It shows there's this solid customer demand that just keeps going steady. Printing is pretty much the main thing holding the business together. Customers count on it all the time. That kind of stability means you can predict how people will use it. So it's a reliable way to bring in money.
- **Photo Services:** Revenue here is okay, not too bad. But it goes up and down a lot over the months. Demand seems irregular, but it comes back around. Probably because of

seasons or personal events, or maybe some promotions pulling people in. It's not as steady as printing. Still, photo stuff adds a good chunk to the total revenue.

- **Digital Services:** These bring in less money than the others. The trend stays pretty level though. So, there's a smaller group of customers, but they stick with it. Demand is limited yet dependable. It doesn't make up much of the overall revenue. But it's a niche area. Could grow if we put some effort into it.

Findings:

- Printing services really form the core of this business. Customers depend on them all the time. Demand stays strong and even. That turns into revenue you can pretty much bank on without surprises.
- Photo services pull in a solid amount too. Demand shifts around though. Seems like seasonal stuff or personal reasons play into it. Promotions kick in once in a while as well. They are not as steady as printing. Still, they add up to something important for the total money coming in.
- Digital services do not rake in as much overall. Demand holds steady from a smaller bunch of loyal customers. It is a niche spot really. Could grow if more effort goes into it. Does not make up much of sales right now.

3.6. ARIMA Time Series Forecasting

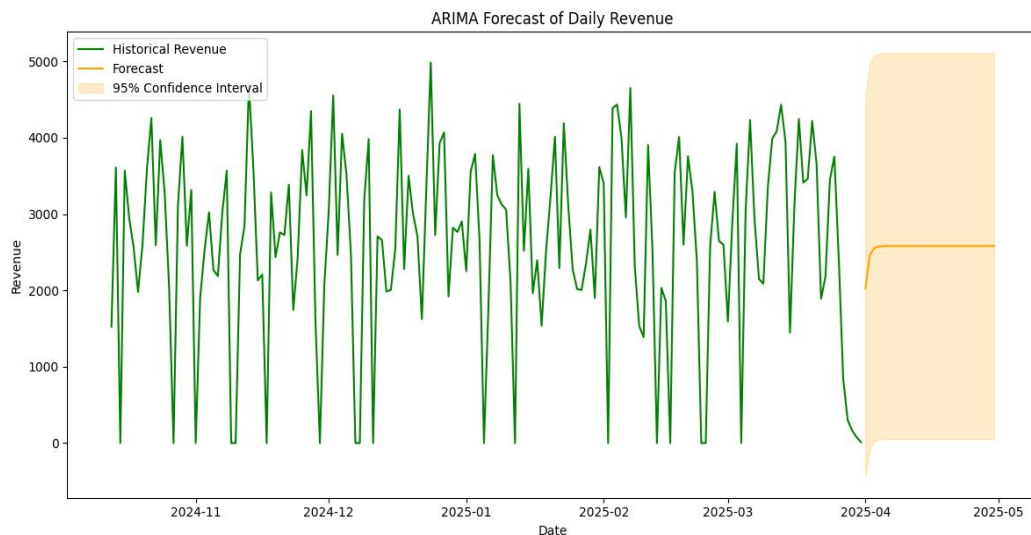


Figure 3.6: Demand Forecasting

Results:

- Looking at the history, revenue numbers jump around a lot. No real pattern going up or down. Just random ups and downs, probably from how customers come in, what they buy, or which services mix in each day.
- For the forecast, ARIMA model figures revenue will settle near the recent average. So, no big jumps or drops expected. The store can count on steady levels coming up soon.

- Uncertainty stands out with those wide intervals in the forecast. History is messy and bumpy, so the model cannot pin down exact numbers. Day to day stuff gets hit more by chance than any steady trend.
- In essence, the store's revenue pattern is stable on average but inherently unpredictable in the short term. Operational planning should therefore focus on managing variability and leveraging consistent revenue sources, rather than expecting clear growth trends.

SARIMAX Results						
=====						
Dep. Variable:	Line Total	No. Observations:	170			
Model:	ARIMA(1, 1, 1)	Log Likelihood	-1447.972			
Date:	Wed, 08 Oct 2025	AIC	2901.943			
Time:	00:38:41	BIC	2911.333			
Sample:	10-13-2024	HQIC	2905.754			
	- 03-31-2025					
Covariance Type:	opg					
=====						
	coef	std err	z	P> z	[0.025	0.975]

ar.L1	0.2160	0.072	2.982	0.003	0.074	0.358
ma.L1	-1.0000	0.119	-8.382	0.000	-1.234	-0.766
sigma2	1.574e+06	7.57e-08	2.08e+13	0.000	1.57e+06	1.57e+06
=====						
Ljung-Box (L1) (Q):		0.08	Jarque-Bera (JB):	9.35		
Prob(Q):		0.78	Prob(JB):	0.01		
Heteroskedasticity (H):		0.98	Skew:	-0.56		
Prob(H) (two-sided):		0.93	Kurtosis:	2.75		
=====						

Figure 3.7 – ARIMA Results

Findings:

Looking at the revenue history. It is clear daily numbers jump around quite a bit. There is no clear upward or downward trend. Just random ups and downs depending on who comes in. What they buy, or which services get used that day. The ARIMA forecast suggests revenue will likely hover around the recent average. So, the store can expect fairly steady levels in the near future. Without big spikes or drops. At the same time. The wide forecast range reminds us day-to-day revenue stays unpredictable. Driven more by chance than any consistent trend. Overall, this tells us the store has a stable revenue base. Short-term fluctuations are normal. Planning should focus on handling that variability. Leaning on the steady-performing services rather than counting on clear growth.

4. **Recommendations & Business Implications**

4.1. **Strategic Recommendations**

1. **Prioritize High-Value Service Lines**

Pareto analysis basically showed that just a few main services handle most of the money coming in. Things like A4 printing, Xerox copies, passport photo clipping, and using the computers. They make up around 80 percent of the total revenue. These are what keeps the business going financially.

Actionable Steps:

- We want to give more space at the counter to these top ones. Put more staff time on them too. And focus marketing right there. Make sure stuff like paper, ink, laminating sheets is always around. No running out and stopping service.
- Then introduce loyalty discounts. Or bulk printing deals for the regulars. Like students, small businesses, coaching centers. And set up a fast print lane in busy times. To cut down waiting in line for those common services.

Expected Outcome:

Should boost keeping customers around. Make operations run smoother. Maximize what you get from the busy services. By really zeroing in on the big revenue makers, Cafe.com can lock in steady cash. And get more repeat visits.

2. **Rethink Low-Performing Product Lines**

Those low revenue things in stationery and office supplies. They take up shelf space. But they do not bring in much profit at all.

Actionable Steps:

- Do a check on space versus performance. Measure how much money per shelf unit basically. Phase out the items that do not turn over enough. Minimum thresholds you know.
- Replace the slow stuff with quick sellers. Like paper reams, pens, clips. Ones that go with the main services. And add limited seasonal items. Say school stationery right before terms start.

Expected Outcome:

Better use of shelves. Cuts down on holding costs. Less waste in inventory. This way you shift resources to the better areas. Improves cash flow. And how you use the space overall.

3. Leverage Cross-Selling Opportunities

From the market basket analysis, black-and-white printing acts as a hub. People buy it with small stationery like folders, staplers, graph paper. Pretty often.

Actionable Steps:

- Redesign the layout. Put related stationery near the print counters. Create bundles. Like 20 prints plus a folder for 30 rupees. To get those impulse buys going.
- Train staff to suggest add-ons at checkout. Simple scripts. Would you like a folder for your prints. You know the kind.

Expected Outcome:

Impact from cross-selling raises the average per transaction. No need for new customers even. Makes the shopping smoother. More complete. Boosts how happy people are. And keeps them coming back.

4. Align Inventory and Staffing with Seasonal Demand

Cyclic demand stuff showed fluctuations. Clear ones. Especially drop in March to April. Tied to school cycles.

Actionable Steps:

- Use the data to stock up before high months. October to February say. Scale down in slow times.
- Schedule part-time staff around it. Balance the work and costs. Run promotions in quiet months. Discounted ID card prints in April. To keep folks engaged.

Expected Outcome:

Planning based on seasons cuts overstock risk. Stabilizes the money flow. Ensures services do not falter in peaks.

5. Adopt Targeted Customer Segmentation Strategies

K-Means clustering found four groups. From high-value frequent ones to low-frequency users.

Actionable Steps:

- Develop loyalty programs for the big spenders. Referral stuff too. Premium print pass with express service. Small discounts.
- For tech-savvy ones who use digital payments, wallet rewards. Cashback schemes.
- Flexible low-cost combos for price-sensitive like students. Gather quick feedback after service. Map satisfaction per group. Fine-tune from there.

Expected Outcome:

Personalized stuff improves how satisfied they are. Retention goes up. Marketing gets more efficient with differences. Builds loyal base over time. Predictable revenue.

6. Enhance Service Forecasting and Decision Support

ARIMA forecasting indicated stable revenue. But with irregular ups and downs.

Actionable Steps:

- Keep a rolling 30-day forecast dashboard. To see resource needs ahead.
- Use it for restocking consumables. Planning staff shifts.
- Adopt simple Excel or Python dashboard. Updates with new sales data automatically.

Expected Outcome:

Timely forecasts help decisions upfront. Less stockouts. Less idle time. Thus, Cafe.com run with some foresight. Not just reacting.

7. Digital and Data Transformation

Operations rely on Excel now. But moving to digital POS or inventory system adds structure. Traceability. Real-time views.

Actionable Steps:

- Steps, adopt low-cost POS like Loyverse or Square. Records transactions digitally.
- Set up Google Sheets or Python dashboards for daily tracking. Automated.
- Train staff to log every transaction right. For complete data.

Expected Outcome:

Digitization makes a feedback loop ongoing. Enables analytics all the time. Better control. Fewer manual mistakes. Helps growth based on evidence.

4.2. Business Implications

1. Revenue Optimization and Cost Efficiency

Putting these recommendations into place is going to change up **Cafe.com**'s cost structure quite a bit. They focus on the services that really perform well, and cut back on the inventory that's not pulling its weight. That way, the business ends up making more money per square foot, all while dropping those inventory carrying costs. Profit margins get a direct boost from this kind of realignment.

2. Customer Experience and Retention

Things like targeted promotions, bundled deals, plus a better store layout, they all add up to a smoother experience for people coming in. Customers start seeing convenience, quicker service, and some personalization too. That builds emotional loyalty, you know. And when customers are satisfied, they keep coming back. Repeat purchases turn into a steadier revenue stream.

3. Operational Agility

With season-based staffing and restocking based on data, operations become way more flexible. Instead of just reacting to shortages or too much stock, **Cafe.com** can shift quickly when demand changes. This keeps service quality steady, even if unexpected stuff pops up.

4. Data-Centric Business Culture

The project shows how even small retail spots can get a lot out of data analytics. By weaving in data-driven decisions every day, like through forecasting, dashboards, and analysis, **Cafe.com** gets more systematic. Less relying on gut feelings, and that makes them tougher against bigger chains.

5. Sustainable Long-Term Growth

Streamlined inventory, loyal customers, better planning, all that sets up for steady expansion. Once things stabilize, they could look into digital stuff, say online document uploads or prepaid print credits. Or even franchising in nearby towns. With a model that's scalable and based on analytics, long-term sustainability starts looking real.

6. Community and Market Positioning

Optimizing services for students and local professionals solidifies **Cafe.com** as a go-to community hub. Mixing affordability, reliability, and digital ease sets them apart from competitors. It positions them as more than just a retail spot, but a trusted local brand too.

4.3. Concluding Reflection

This analysis makes it clear that small businesses with limited resources can still thrive using structured data-driven management. **Cafe.com**'s issues, like untracked sales, spotty stock control, and tight space, they're all fixable with straightforward analytical strategies. Acting on the recommendations should lead to smoother operations, better profits, and more trust from the community.

In the end, this project shows data isn't merely a technical thing. It's a strategic asset really. Used right, it turns everyday transactions into insights that guide smarter decisions and support growth that lasts.

[Directory Link to all Project Resources](#)