

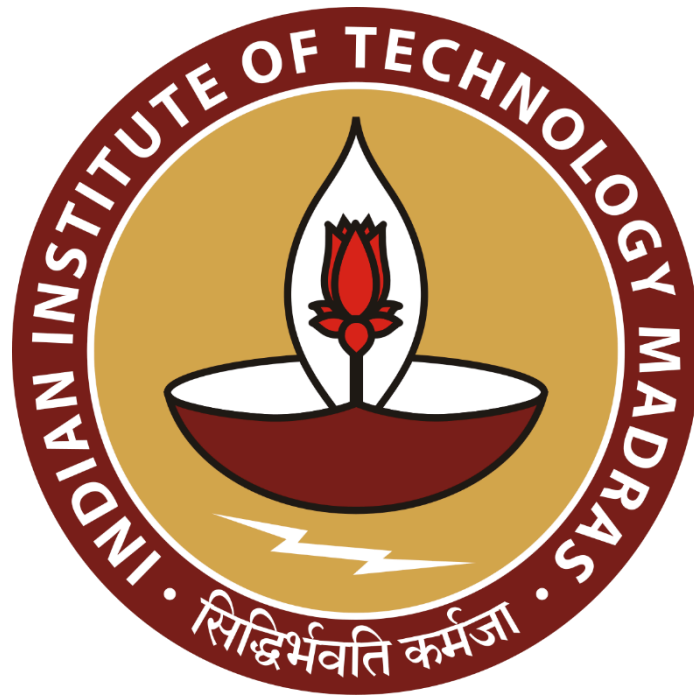
Data-Driven Retail Optimization: Optimizing Inventory & Margins at Pure'O Naturals

A Proposal report for the BDM capstone Project

Submitted by

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Declaration Statement

I am working on a Project titled “Data Driven Retail Optimization: Mitigating Volatility, Enhancing Margins, and Ensuring Pricing Consistency at Pure’O Naturals”. I extend my appreciation to Pure’O Naturals, 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: Vishal Bhandari

Date: 13-10-2025

1 Executive Summary and Title (200 Words)

Pure'O Naturals is a Hyderabad-based retail chain known for its fresh produce and cold-pressed juices, operating about 40+ outlets within the Hyderabad city. The Anjaneya Nagar branch (Store 0007), launched in 2018 generates approximately ₹1.8 crores in annual revenue. While the owners believe the business is running smoothly, a six-month (Apr–Sep 2025) quantitative analysis of their sales data tells a different story.

Key Challenges Identified: After immediately getting the data, I performed a detailed EDA, which revealed four critical inefficiencies that are currently constraining profitability, amounting to a combined annual inefficiency of nearly ₹48.6 lakhs. These are:

- **Inventory Shrinkage:** High demand-supply volatility exposes the business to a significant shrinkage risk, with up to **₹42 lakhs** in monthly inventory at stake.
- **Low-Margin Products:** A proliferation of low-margin SKUs has created a contribution gap of **₹3.73 lakhs** when measured against a healthy 20% margin benchmark.
- **Unclear Sales Data:** Over 40% of transactions are uncategorized, making it difficult to understand purchasing patterns and optimize the product mix effectively.

→ **Inconsistent Pricing:** A lack of standardized pricing between branches is generating a monthly revenue variance of ₹2.48 lakhs, eroding potential earnings.

To address these challenges, I have chosen a targeted, data-driven approach. Rather than relying on guesswork, will implement proven methodologies to bring stability and predictability to their operations. My recommendations include:

1. **Optimize Inventory & Reordering:** Will analyze historical sales data to establish clear demand patterns, allowing for smarter reorder points that protect working capital. An *ABC analysis* will be used to prioritize high-value inventory.
2. **Rationalize Product Offerings:** By focusing on high-margin SKUs and refining the product mix through association rule mining, will elevate overall profit margins.
3. **Standardize Categories & Pricing:** Will help implement a clear, standardized category system for all products and enforce stable price bands across all outlets to eliminate revenue variance.

2 Organization Background:

➤ Company Overview

- **Business:** Family-owned retail chain.
- **Specialization:** Fresh produce and cold-pressed juices.
- **Target Audience:** Health-conscious consumers.
- **Scale:** Approximately 40 outlets across Hyderabad.
- **Mission:** To deliver premium-quality fruits, vegetables, and preservative-free beverages.
- **Location Strategy:** Branches are strategically located in both residential and commercial neighborhoods.

➤ **Governance & Management :** Decisions on assortment, pricing bands, vendor terms, and capex sit with the owners' committee, which includes:

- Founder and Chairman : Kosaraju Mallikarjuna Prasad
- Managing Director : Siva Rao Cherukur
- Director: Ravuri Venkata Narayana

- **Key Responsibilities:** Assortment planning, vendor negotiations, pricing strategy, and capital allocation.
- **Branch-Level Management:** Each outlet is managed by a store manager responsible for:
 - Daily operations and execution
 - Inventory oversight
 - Customer service
- **Operational Model**
 - **Sector:** Operates within the unorganized retail sector.
 - **Technology:** Lacks enterprise resource planning (ERP) infrastructure.
 - **Processes:** Relies on decentralized manual record-keeping and owner-driven decision-making.
 - **Product Portfolio:** Features over 150 stock-keeping units (SKUs), including:
 - Seasonal fruits
 - Exotic vegetables
 - Daily essentials
 - Signature beverage blends (prepared on-site)
- **Basis for Study :**
 - **Branch Address (Data Procured) :** Anjaneya Nagar, Kukatpally, Hyderabad, Telangana 500018
 - **Branch Owner Name :** Hari Krishna
 - **Reason for Selection:** Chosen due Furthermore, the researcher's direct access to a key staff member ensures a high degree of cooperation and facilitates in-depth data collection, providing a robust empirical foundation for the analysis.

3 Problem Statement:

3.1 Category Mix Drift and Data Hygiene Gaps

Forty percent (40.28%) of monthly revenue remains uncategorized, obscuring performance trends and preventing targeted merchandising, procurement planning, and promotional strategies.

3.2 Demand Volatility and Inventory Risk Exposure

Seven hundred seventy (770) product-branch pairs exhibit excessive sales volatility exceeding the 25% threshold, exposing approximately ₹42 lakhs in monthly revenue to shrinkage risk from overstocking and spoilage.

3.3 Systemic Margin Erosion on Core Products

High-volume staples operate below the 20% margin floor, creating an estimated monthly profit gap of ₹3.7 lakhs and diluting overall contribution margins despite transaction volume.

3.4 Pricing Inconsistency Across Key Stock-Keeping Units

The top twenty misaligned products demonstrate significant unit-price variance, affecting ₹2,48,358 in monthly revenue and destabilizing margin predictability.

Collectively, these inefficiencies represent ₹48.6 lakhs in quantifiable annual operational risk, constraining profitability and sustainable growth.

4 Background of the Problem

Pure'O Naturals operates within the unorganized retail sector, characterized by decentralized decision-making, manual record-keeping systems, and limited enterprise resource planning infrastructure.

- **Internal Root Causes:** The absence of standardized product taxonomy protocols has resulted in 40.28% of revenue remaining uncategorized, creating strategic blind spots in assortment planning and promotional targeting. Manual procurement processes driven by historical averages rather than statistical demand patterns have amplified volatility, exposing ₹42 lakhs in monthly revenue to spoilage risk across 770 high-variance stock-keeping units. Vendor negotiations conducted without systematic cost benchmarking have perpetuated margin erosion, generating a ₹3.74 lakh monthly profit gap on core staples. Decentralized pricing authority across branches, coupled with inadequate point-of-sale controls, has introduced ₹2.48 lakhs in monthly revenue variance from inconsistent unit pricing.
- **External Contributing Factors:** Perishable inventory constraints mandate rapid turnover cycles, amplifying the financial impact of demand volatility. Input cost inflation from agricultural commodity markets pressures margins on high-volume products. Competitive pricing dynamics within Hyderabad's fresh produce segment limit pricing flexibility without robust margin guardrails.

5 Problem Solving Approach (400 Words)

5.1 Methods Used : A multi-method analytical strategy will be deployed to target each specific business challenge with the most appropriate and statistically robust techniques.

- **For Demand Volatility & Shrinkage:** To diagnose sales instability, a **rolling-window coefficient of variation analysis** will be applied to 770 high-variance SKUs. This method is ideal for dynamically tracking volatility over time. This will be supplemented by **Shewhart X-MR control charts**, a proven statistical process control (SPC) tool used to distinguish between common fluctuations and significant, actionable anomalies. This prevents overreactions to random noise and pinpoints true operational issues.
- **For Margin Erosion: Margin simulation modeling** will be used to test and predict the financial impact of various pricing architectures without real-world risk. This is a best-practice approach for pricing strategy. It will be combined with an **ABC analysis of vendor costs** and **sensitivity analysis** on procurement alternatives (stress-tested at $\pm 10\%$ price variance) to identify the most impactful opportunities for cost reduction and margin improvement.
- **For Category Mix & Pricing:** To resolve the 40.28% uncategorized revenue, the approach begins with **systematic data profiling and cleansing** using **interquartile range (IQR)** and **Z-score outlier detection**. These are standard statistical methods for ensuring data integrity. Following this, **elasticity modeling** will be conducted to quantitatively measure demand responsiveness, providing a solid, data-driven basis for optimizing the product category mix and enforcing consistent pricing bands.

5.2 Data Collection:

The analysis will exclusively use primary data to ensure direct relevance and authenticity. A six-month (April–September 2025) dataset of daily transactional records - totaling 25,394 lines - will be extracted from the Anjaneya Nagar branch's POS and procurement systems. This period is justified as it captures multiple seasonal cycles, ensuring the data is representative for trend analysis. This primary data approach is critical for generating credible, actionable recommendations tailored specifically to the business's unique context.

5.3 Analysis Tools (Justification)

The analytical toolkit is chosen to balance sophisticated data processing with clear, stakeholder-friendly communication. **Python**, with its powerful Pandas, NumPy, and Matplotlib libraries, will serve as the primary platform for all large-scale data manipulation and statistical computation. **Microsoft Excel** will be used as a supplementary tool for initial exploratory analysis and creating accessible visualizations and pivot tables for the management team. This integrated toolset ensures the analytical depth is matched by practical implementation feasibility.

6 Expected Timeline

6.1 Work Breakdown Structure:

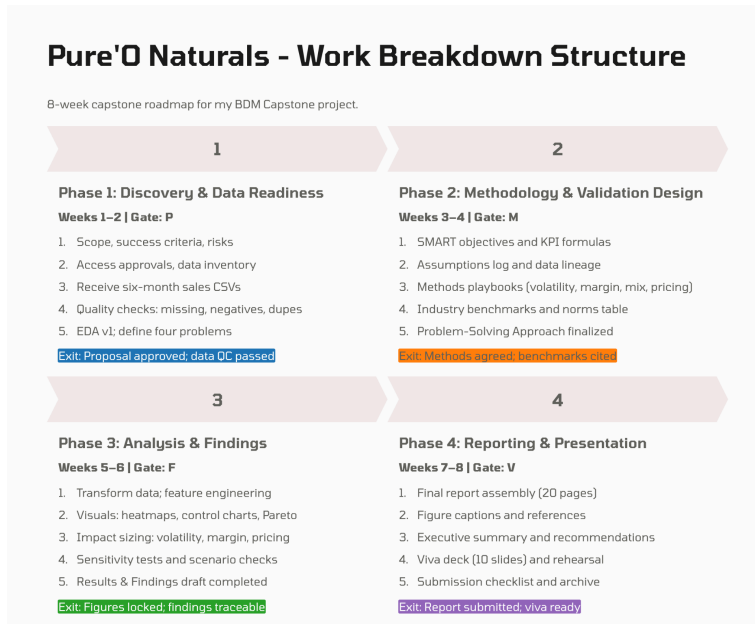


Figure 1 Work Breakdown Structure

6.2 Gantt chart

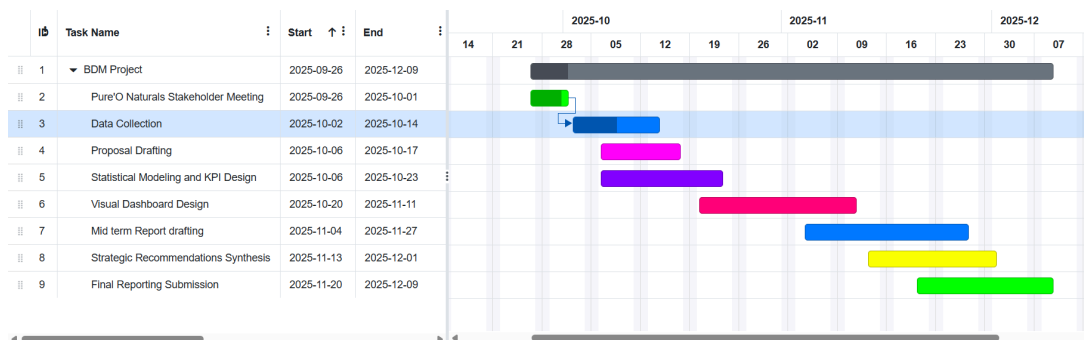


Figure 2 Gantt chart

7 Expected Outcome

7.1 **Outcome 1: Inventory Optimization and Volatility Control**

Dynamic, percentile-based reorder systems targeting the 770 high-variance stock-keeping units will reduce shrinkage rates to $\leq 2\%$ of sales value, releasing approximately ₹42 lakhs in monthly working capital previously exposed to spoilage risk. On-shelf availability is expected to stabilize at $\geq 97\%$, minimizing stockout-related revenue loss while eliminating overstocking inefficiencies.

7.2 **Outcome 2: Margin Recovery Through Strategic Sourcing**

Vendor renegotiations guided by ABC cost analysis and margin simulation modeling will elevate gross margins on core staples to the 20% floor, closing the existing ₹3.74 lakh monthly profit gap. SKU rationalization will phase out chronically low-performing products, concentrating resources on high-contribution items.

7.3 **Outcome 3: Data Governance and Category Clarity**

Standardized product taxonomy protocols will reduce uncategorized revenue from 40.28% to $<5\%$ within 45 days, enabling precise merchandising strategies, promotional targeting, and procurement planning. Clean data architecture will support advanced analytics including demand elasticity modeling and basket optimization.

7.4 **Outcome 4: Pricing Discipline and Consistency**

Enforcement of statistical price bands with point-of-sale controls will reduce unit-price variance to $<3\%$, stabilizing the ₹2.48 lakh monthly revenue fluctuation while improving customer trust and promotional return on investment to $\geq 1.5\times$.

Collectively, these interventions target 15–20% operational efficiency improvement within twelve months, mitigating ₹48.6 lakhs in annual risk while establishing sustainable, analytics-driven decision-making frameworks. Pilot validation at the Anjaneya Nagar branch within 30–45 days will enable controlled, evidence-based scale-up across all 40 outlets.