

# **“Leather waste management and cost efficiency: Optimizing chemical usage, quantifying scraps and expanding efficiency”**

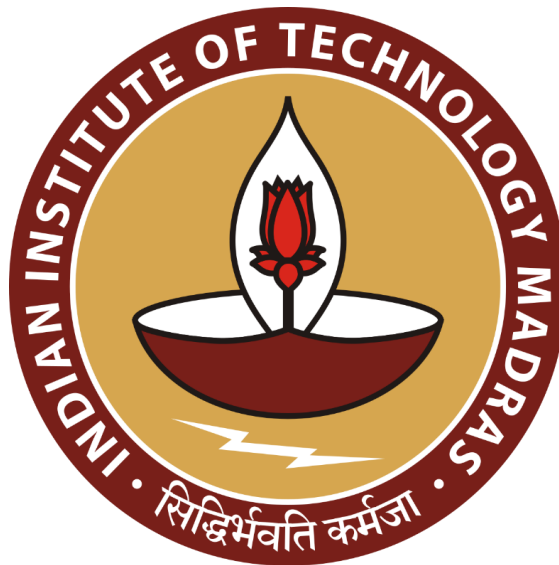
**Mid term report for the BDM capstone Project**

Submitted by

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**May Term 2024**



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**[DRIVE LINK TO DECLARATION \(CLICK HERE\)](#)**



# EXECUTIVE SUMMARY

Dugros Leather India Pvt Ltd an ISO 9001:2015 compliant professional OEM/ODM leather goods manufacturer, exporter and wholesale supplier with its factory located at zone no.8/plot 622 Kolkata leather complex Kolkata-743502 West Bengal, India. It's a B2B organized business which deals with customers in the range of "leather goods and accessories".

With over 15 years of industry experience, this business has addressed many challenges. Current issues include high costs of wasted chemicals and leather, and inadequate tracking of leather scraps, leading to disposal expenses. Improved tracking systems and sustainable practices could minimize waste and reduce costs.

The main objectives are to implement a data-driven approach to waste management, accurately track and quantify wastage, and identify cost-saving and profit opportunities. Additionally, the aim is to monitor excess deadstock in unused chemicals and optimize stock levels to minimize wastage and stockouts. Utilizing tools such as Excel, Python, and Machine Learning, the goal is to streamline data processing and decision-making. The expected outcomes include improved waste management, discovering profitable uses for waste materials, and minimizing dead stocks and wasted chemicals and finished leather, ultimately enhancing efficiency and profitability through advanced technology integration.

## PROOF OF ORIGINALITY

To establish the authenticity of the data, the supporting evidence has been listed below:

1. **Approval from the company on the letterhead signed by the CAO:** [Click here \(drive link\)](#)
2. **Video of meeting with the Owner and small tour of the factory:** [Click here \(Drive link to video\)](#)
3. **Inventory and data collection images:** Images are in Appendix A, page . It can also be accessed by the link: [Click here \(drive folder\)](#)
4. **Images of the organization:** [Click here \(drive folder images\)](#)

# METADATA

I was provided with various data I required for my analysis of the business. Additionally the owner has given me access to the different sections of the factory to collect raw data from site.

**1. Sales data:** The accounts department shared a compiled sales report on number of articles sold under each leather product categories for the financial years 2021-22, 2022-23 and 2023-24.

KEY	DESCRIPTION
Leather article category	Different categories of articles being exported
Quantity	The number of articles per category being exported
Revenue generated	The revenue generated from each category

**2. Leather tannery production:** The various data written on boards and some of them arranged in Excel sheets in the leather tannery were meticulously congregated and divided into two major parts:

- **Leather production data:** An Excel sheet was shared on the quantity of production of the five major leather categories over the past three financial years.
- **Leather rejection data:** Certain minimal quantities of leather that do not match the demand quality are rejected before production. Raw data was collected on the five major categories from writings on boards and were converted to Excel sheets.

METADATA KEYS	DESCRIPTION
Categories	Different categories of leather produced / rejected
Year	Financial year of production / rejection
Quantity	Quantity of production /rejection in Kilograms
Rate	Cost per square feet
Value	Total revenue of produced /rejected leather

*The metadata keys for both tables are similar and hence have been shown in one here.*

**3. Losses and wastage data:** Optimization of loss and wastage is divided into two parts:

- **Chemical Wastage:** An excel sheet was shared on the various yearly financial losses due to chemical wastage for the past 3 years.

METADATA KEYS	DESCRIPTION
Type of chemical	The category of chemical wasted
Quantity	Amount of each chemical category wasted
Value	Loss amount

- **Leather scraps and wastage:** This data was measured by myself since there is no tracking system for this and I also used various mathematical calculations to derive the wastage.

METADATA KEYS	DESCRIPTION
Categories	Different categories of leather scraps generated
Year	Financial year of scraps generation
Quantity	Quantity of wastage in Kilograms
Rate	Cost per square feet
Value	Total revenue of wasted leather

**4. Chemical composition data:** The composition of various crusting and finishing chemicals used for leather production was shared as notes written down in a copy and were converted to Excel format for analysis.

METADATA KEYS	DESCRIPTION
Leather type	Different categories of leather being produced
Chemical type	Different categories of chemicals used in production
Quantity	Quantity of each chemical used

# DESCRIPTIVE ANALYSIS

After data processing and cleansing, I have attempted to condense the information by highlighting the descriptive stats below relevant for leather production, leather rejection, chemical wastage and leather wastage (**All costs are in rupees, quantities in kg**)

**1. Leather rejection (various types of leather)**

Year	Parameter	Mean	Median	Standard Deviation	Sum	Min	Max
2021-22	Quantity (Qty)	366.47	109.56	719.67	2567.19	0	1958.6
	Rate	77.65	75.6	23.96	543.55	46.8	119.6
	Value	19561.17	91662.48	32765.34	136928.2	0	91662.48
2022-23	Quantity (Qty)	384.69	369	285.49	2696.8	82.2	1012
	Rate	84.44	81.4	24.59	591.13	45.29	130.15
	Value	26729.42	26260.28	13497.77	187009	9648.64	45833.48
2023-24	Quantity (Qty)	558.89	230.5	840.88	3898.25	60	2649.5
	Rate	84.77	81.86	23.21	593.4	57.64	117.38
	Value	37796.78	14982.5	51037.72	263797.4	7042.8	152717.2

The business produces a lot of different types of leather, but the 7 main leather types have been identified for easier analysis because others are negligible to these. The types and their trends in recent years is given below:



- Buff Nappa (*Increasing trend*)
- VT Venezia (*Rapidly increasing trend*)
- Hunter (*Slight increasing trend*)
- Oil Pullup (*Rapidly increasing trend*)
- Beetle (*Decreasing trend*)
- Crunch (*Slight increasing trend*)
- Heritage (*Increasing trend*)

Naturally as demand increases, production increases and so does rejection most of the times

## 2. Leather production:

Year	Parameter	Mean	Median	Standard Deviation	Sum	Min	Max
2021-22	Quantity (Qty)	150502.6	65623	203136.94	1053518	0	519560
	Rate	60.39	59.89	25.93	543.55	46.8	119.6
	Value	10185312	26146554	12370887.42	71297186	0	30446216
2022-23	Quantity (Qty)	166984.4	66890	206573.51	1166891	12000	567805
	Rate	73.89	81.4	26.61	591.13	45.29	130.15
	Value	13151237	39599152	13642287.11	92058664	1561800	39599152
2023-24	Quantity (Qty)	174949	60230	229431.77	1218353	8000	600892
	Rate	74.18	81.86	25.63	593.4	57.64	117.38
	Value	12779584	32785421	13872343.28	89456590	939040	39057980

## 3. Financial statistics of chemical wastage and usage for Crusting chemicals

Statistic	Mean	Median	Standard Deviation	Minimum	Maximum	Range
Closing Stock (Cost)	3,950,501	3,988,700	248,720.71	3,689,458	4,173,345	483,887
Actual Stock (Cost)	3,221,370	3,267,891	202,070.45	2,999,784	3,396,434	396,650
Loss (Cost)	729,798	720,809	45,128.53	689,674	776,911	87,237
Closing Stock (kg)	886,238.56	936,587.23	134,218.79	730,557.87	991,570.57	261,012.70
Actual Stock (kg)	721,150.82	766,932.57	113,722.06	592,634.78	805,883.10	213,248.32
Loss (kg)	164,749.07	169,654.66	24,172.59	137,923.09	185,687.47	47,764.38

- **Sum:** The total value across 3 years
- **Mean:** The average value over 3 years
- **Median:** The middle value in the dataset
- **Standard deviation:** Amount of variation
- **Minimum:** The minimum across 3 years
- **Maximum:** The maximum across 3 years

## 4. Financial statistics of chemical wastage and usage for Finishing chemicals

Statistic	Mean	Median	Standard Deviation	Minimum	Maximum	Range
Closing Stock (Cost)	3,418,521	3,430,090	319,619.65	3,098,665	3,726,808	628,143
Actual Stock (Cost)	2,314,971	2,308,560	250,496.05	2,067,977	2,568,375	500,398
Loss (Cost)	1,103,550	1,121,530	64,354.17	1,030,688	1,158,433	127,745
Closing Stock (kg)	125,117.41	129,697.42	7,590.98	116,644.86	131,009.95	14,365.09
Actual Stock (kg)	85,163.43	87,334.50	6,485.05	77,837.51	90,318.29	12,480.78
Loss (kg)	40,620.64	40,691.66	1,850.42	38,807.35	42,362.92	3,555.57

4. Leather scraps generated

Year	Parameter	Mean	Median	Standard Deviation	Sum	Min	Max
2021-22	Quantity (kg)	18,163.17	7,874.76	21,634.83	720	62,347.20	61,627.20
	Rate (₹/kg)	77.65	75.6	23.96	46.8	119.6	72.8
	Value (₹)	1,234,539	407,497	1,389,617	86,112	3,653,546	3,567,434
2022-23	Quantity (kg)	20,003.85	8,026.80	23,610.30	1,440.00	68,136.60	66,696.60
	Rate (₹/kg)	84.45	81.4	28.42	45.29	130.15	84.86
	Value (₹)	1,578,149	408,849	1,821,676	187,416	4,751,898	4,564,482
2023-24	Quantity (kg)	20,886.05	7,227.60	25,711.44	960	72,107.04	71,147.04
	Rate (₹/kg)	84.77	81.86	21.61	57.64	117.38	59.74
	Value (₹)	1,533,542	486,286	1,777,670	112,684	4,686,958	4,574,273

After collecting and analyzing data for various articles over the course of a month and categorizing them into seven major leather categories, it was observed that the average wastage during the manufacturing process is approximately 12%. This data has been compiled and presented accordingly.

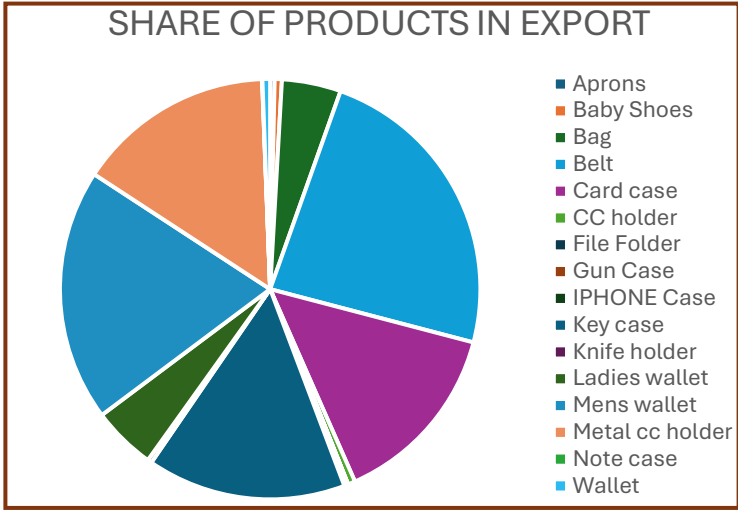
ANALYSIS PROCESS & METHODS USED

- Data analysis includes understanding the business, defining the problem, collecting and cleaning data, transforming it, applying analytical techniques, and drawing conclusions.
- The initial phase, involving understanding various businesses and persuading owners to share data, took about two months. The data was carefully reviewed for inconsistencies, missing values, and outliers. Descriptive statistics, including metrics like mean, profit, and inventory stocks, were calculated and summarized in detailed Excel tables.
- Subsequently, the focus shifted to inventory management, following the owner’s satisfaction with customer retention and profits. Original files were backed up to prevent data loss.
- The provided data, a mix of clean and messy datasets, required thorough cleaning, categorization, merging with sales data, and adding features for improved inventory optimization. This process required the owner's confirmation for accuracy.
- Microsoft Excel tools, such as the Data Analysis ToolPak, PivotTables, and custom formulas, were used extensively. The analysis provided comprehensive insights, with descriptive statistics systematically organized for deep data exploration.
- Value Stream Mapping (VSM) diagrams were utilized to thoroughly analyze workflows across all business departments, identifying bottlenecks and opportunities for efficiency gains. This analysis laid the groundwork for a preliminary assessment of critical issues and areas ripe for improvement.

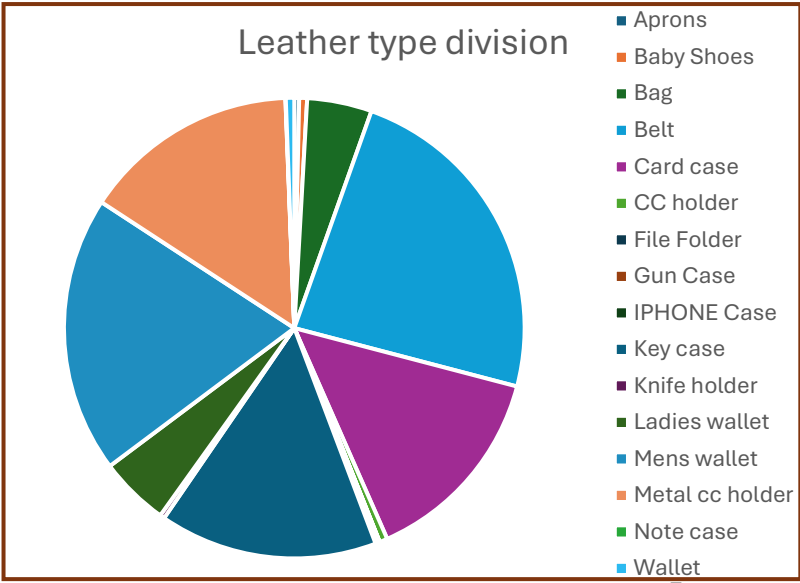
- A detailed Cost-Benefit Analysis (CBA) was then conducted, projecting potential financial losses if current practices were not addressed, and highlighting key areas for cost reduction.
- Extensive research into various types of leather, including Buff Nappa and VT Venezia, provided valuable insights into industry trends. To further refine the analysis, data from Excel sheets was imported into Google Colab, where I developed machine learning models such as linear and polynomial regression. These models forecasted the business's performance over the next five years, revealing significant financial risks due to ongoing wastage of chemicals and leather.
- The predictive analysis underscored the urgent need for corrective actions to avoid these projected losses. By implementing the recommended changes, the business can protect its profitability and enhance resource management.

# RESULTS AND FINDINGS

A comprehensive dashboard including all the data tables I made will be available to the business owner for future uses. The results and findings have been summarized as following:



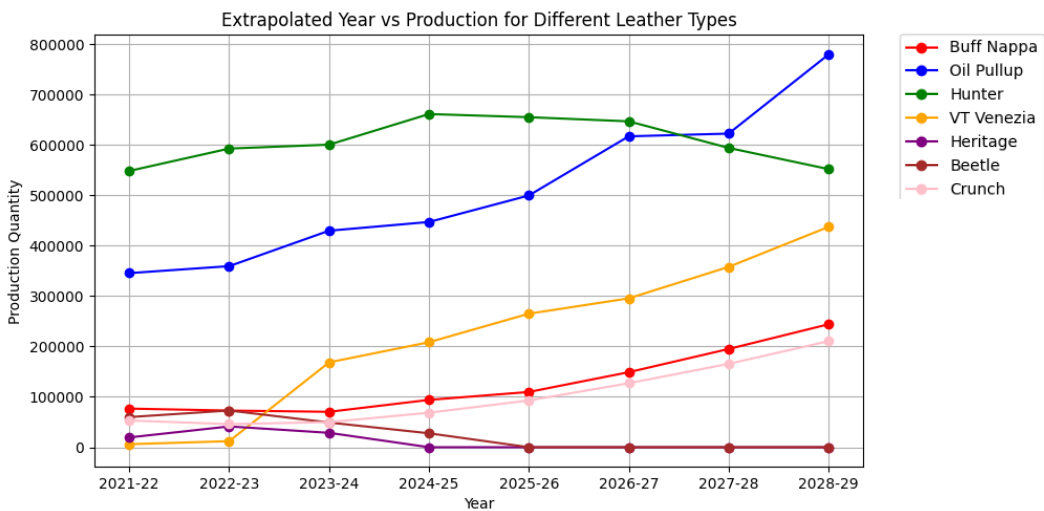
1. The sales data reveals that the business's top export product is belts, followed by men's wallets, metal credit card holders, and bags. This data also allows us to determine the amount of leather used for each category and the total revenue generated from each.



2. The company produces a diverse range of leathers, with the top seven types in 2023-24 being Buff Nappa, Crunch, Beetle, Oil Pullup, Hunter, VT Venezia, and Heritage. Hunter accounts for nearly 50% of total production, making it the largest category. Conversely, VT Venezia is the smallest category.

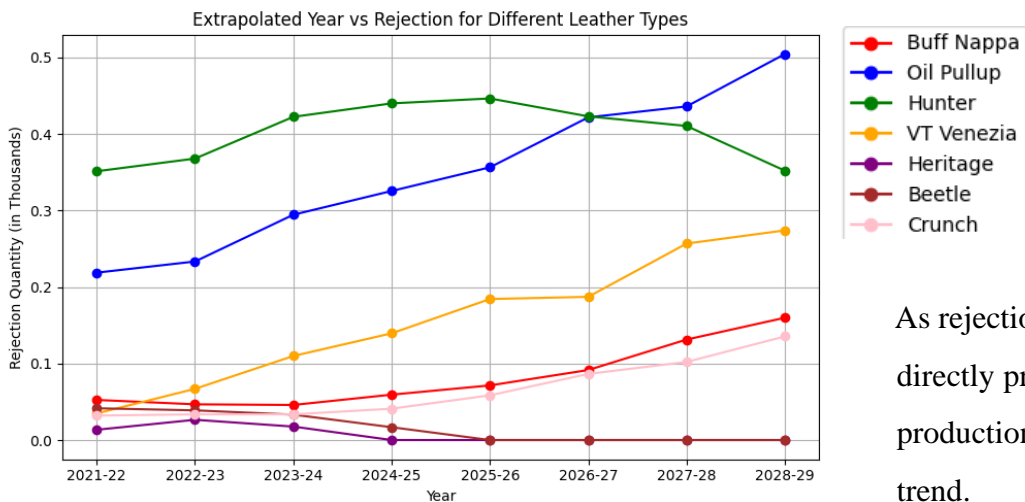


**3. Leather production** is greatly influenced by the market trend i.e. which type of leather is more in demand. Taking the data of the last 3 years and keeping a 70-80% reliability on the predicted market trend we come to the following graph:



We see that VT venizia and oil pullup have a great chance of growing in production quantities while beetle and heritage suffers a decline.

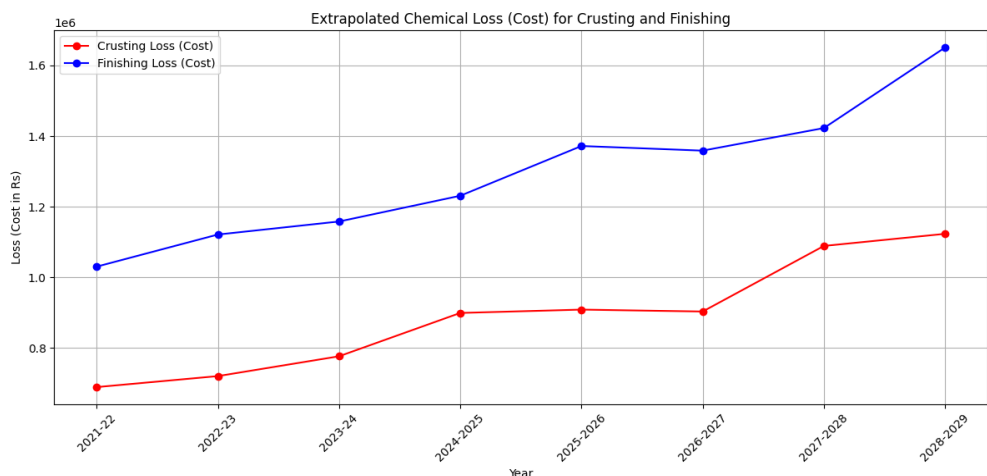
**4.** Similarly, we also drew the **Leather rejection** taking the 5 data points and extrapolating it.



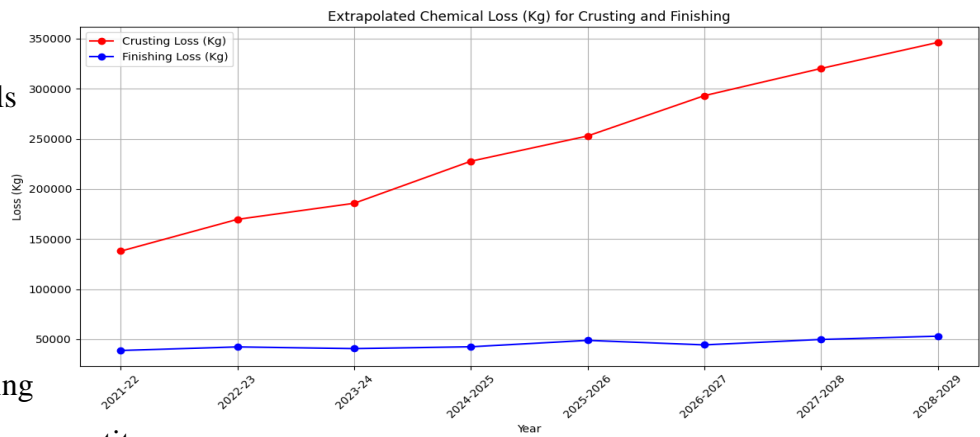
As rejection is somewhat directly proportional to production, we see a similar trend.

**5.** As production increases over the years, the losses incurred due to wastage of finishing and crusting chemicals

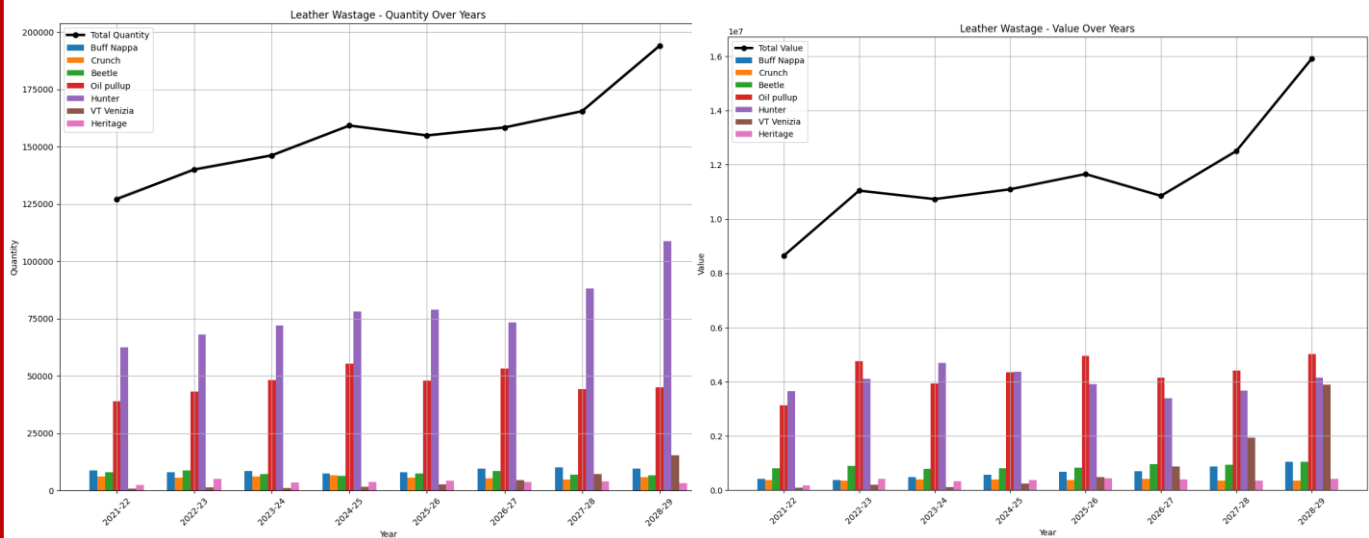
also rise. This trend is depicted in two graphs: one illustrating the revenue lost and the other showing the quantity of chemicals wasted.



Though we see the loss in finishing chemicals in quantity doesn't rise too fast, its total revenue lost rises. This is because unlike the crusting chemical, finishing chemicals are used in lesser quantity but are costlier than crusting chemicals.



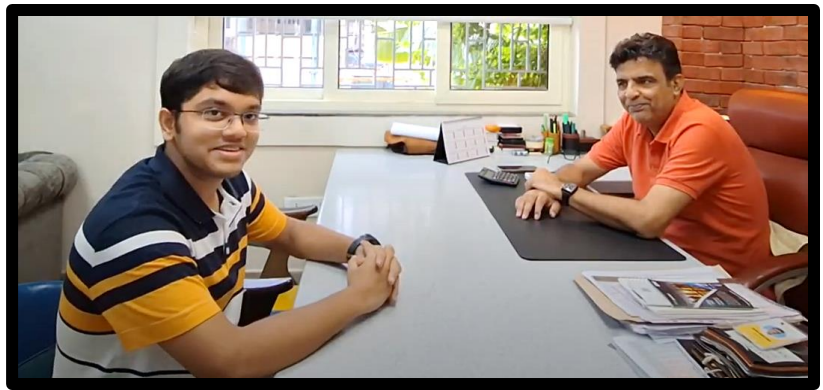
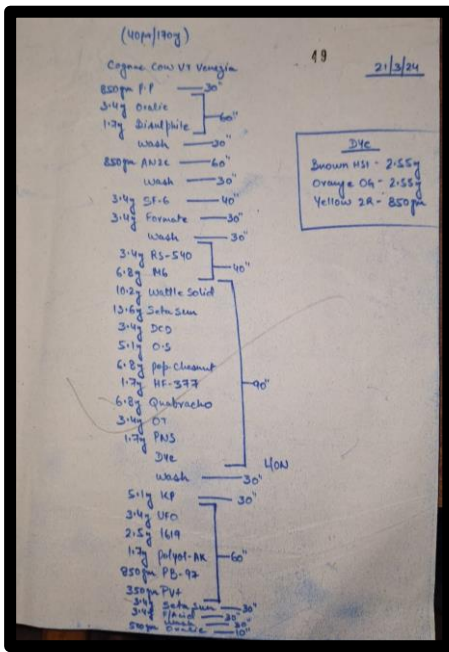
6. We also can see that the company incurs quite a hefty loss due to **scraps and leather wastage**.



The left graph illustrates the projected increase in leather scraps over the coming years, while the right graph highlights the corresponding revenue losses due to these scraps. As production rises, waste and scrap leather also increase—representing a potentially valuable yet underutilized resource for the company. The bars represent the scraps generated from each category of leather separately.

Although the company has maintained a strong turnover, minimizing losses from chemical wastage and leather scraps could enhance long-term profitability.

# APPENDIX A



Picture with the owner and different data available in the business.

PO NO	PO DATE	DET / N	ITEMS	QTY	DEVELOP	STATUS	PI-NO/COM	ARTICLE	QTY
70-01-001	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-002	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-003	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-004	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-005	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-006	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-007	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-008	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-009	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-010	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-011	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-012	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-013	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-014	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-015	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-016	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-017	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-018	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-019	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-020	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-021	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-022	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
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70-01-062	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-063	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-064	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-065	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
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70-01-095	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-096	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-097	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-098	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-099	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500
70-01-100	4/3/21	DET / N	BLACK	2500	2500	2500	2500	2500	2500

Export Dispatched Godown	
Godown Summary	
1-Apr-23 to 31-Mar-24	
Particulars	Inwards Quantity
Aprons	24096.000 Pcs
Baby Shoes	23108.000 Pcs
Bag ,	188336.000 Pcs
Belt	980474.000 Pcs
Card Case	593527.000 Pcs
CC HOLDER	23222.000 Pcs
File Folder	490.000 Pcs
Gun Case	750.000 Pcs
IPHONE CASE	11576.000 Pcs
KEY CASE / KEYRING/ KEYHOLDER (F.S)	634634.000 Pcs
Knife Holder	13483.000 Pcs
LADIES WALLET	202908.000 Pcs
MENS WALLET (MW)	805829.000 Pcs
Metal CC Holder	629397.000 Pcs
Note Case	1000.000 Pcs
POUCH	9497.000 Pcs
Sherpa Fabric	3024.000 Pcs
WALLET	24491.000 Pcs

These tables written on boards and copies were converted into excel tables who's link is given below:

[EXCEL TABLES \(CLICK HERE\)](#)



# APPENDIX B



Pictures of the business and process.

## Location of the factory (Google Maps):

Click on the location icon

