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

**Final report for the BDM capstone Project**

Submitted by


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# INDEX



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# EXECUTIVE SUMMARY

Dugros Leather India Pvt Ltd, an ISO 9001:2015 certified OEM/ODM manufacturer, exporter, and wholesale supplier of leather goods, operates from its factory in Kolkata Leather Complex, West Bengal, India. With over 15 years of industry experience, Dugros Leather serves a B2B market, focusing on leather goods and accessories. However, the company faces challenges due to high costs from wasted chemicals and leather, as well as inadequate tracking of leather scraps, leading to additional disposal expenses.

The goal of this project was to identify cost-saving opportunities by reducing chemical and leather wastage through a systematic, data-driven approach. Extensive data collection and analysis were conducted using principles from the Business Data Management (BDM) course. The data was organized into Excel tables, and machine learning models were developed using Python on Google Colab to analyze current data and forecast potential future losses over the next five years.

The analysis revealed that without intervention, the company could face significant losses of approximately 30 lakh rupees due to chemical wastage by the year 2027-28. Similar losses were identified in leather waste. The division of loss due to wastage was grouped by leather type to provide a more detailed overview.

The report recommends key interventions such as implementing real-time tracking systems for waste, optimizing chemical usage, and repurposing leather scraps into bonded leather goods, which could mitigate predicted losses and enhance sustainability. By adopting these measures, Dugros Leather India Pvt Ltd can not only mitigate future financial losses but also improve its operational efficiency and sustainability, positioning itself as a forward-thinking leader in the leather goods industry.

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)

# ANALYSIS PROCESS & METHODS USED

The data analysis journey for inventory optimization involves several key steps that build towards a comprehensive understanding of the process. This includes clearly defining the problem, gathering and structuring the necessary data, followed by cleaning and transforming the data into a usable format. Next, appropriate analysis techniques are applied to the prepared data, ultimately leading to insightful conclusions and informed decision-making.

## DATA ACQUISITION

Data acquisition is a time-consuming process requiring trust and rapport with businesses. Early efforts faced resistance as I directly requested data without building relationships. It was challenging to show how my analysis could benefit their operations, leading to unclear data requirements and skepticism from stakeholders.

To overcome this, I focused on understanding business needs, demonstrating genuine interest, and explaining how data insights improve decision-making. By building trust through regular engagement, I eventually secured data from a cooperative business owner, marking a key milestone in the process.

## PROBLEM IDENTIFICATION

With over 15 years of experience in this field the business has encountered many challenges and has subsequently implemented various practices to solve them. So it was quite challenging to identify problem statements in the business. But by visiting the factory and interacting with the employees I understood various parts of the business and soon some areas of further improvement were identified which were converted to problem statements.

## DATA CLEANING AND TABULATION

The data obtained was first obtained as a combination of notepad writings, white board tables and excel sheets. They were all converted to one excel notebook and subsequent cleaning was done to ensure no data point was missed. If a data point was missing, machine learning models were used to fill it up along with the trend as seen in the production. The overall data collected were converted to 7 data tables and has been discussed in details below:

## LEATHER PRODUCTION

The records are written on lots of whiteboards (picture given). This data was manually converted into an excel table. The data received included the following information:

*Records*

| Order No | Order Date | Article | Color | Quantity(Kg) | Delivery No. | Status |
|---|---|---|---|---|---|---|

Out of all the categories, three categories were chosen for analysis: Article, Quantity and Status. They were further divided based on the year of production. The top 7 produced leather types were identified, and analysis was done based on them. These categories accounted for a substantial 94.85% of the production. They are:

1. Buff Nappa
2. Oil Pullup
3. Hunter
4. VT Venezia
5. Heritage
6. Beetle
7. Crunch

The production data table thus consisted of :

| Leather type | Quantity Produced (Kg) | Rate(₹/Kg) | Value(₹) |
|---|---|---|---|

The data collected was for 3 financial years (2021-22,2022-23,2023-24).

A row containing the total quantity of leather produced from the 7 major categories and the revenue generated from them was added to the table to give a fair idea about the percentage of each category in production.

A pareto pattern was observed. Despite production in low quantity VT Venezia accounted for a substantial portion of the cost of production. The data of production gave a lot of insight regarding the financial loss due to wastage of chemicals as well as leather scraps. The RCA or Root Cause Analysis was applied. More the production, more is the wastage.

## LEATHER REJECTION

RCA and VSM diagrams indicated that the raw leather produced when shifted to goods production unit is classified into 4 types:

1. **Type A**: The best category, used for outer parts (main components, most visible).
2. **Type B**: The second category, used for bottom parts, zipper components, gussets, comparatively smaller and lesser visible parts than type A leather.
3. **Type C**: The third category, used for smallest and thinner parts like pullers and inside parts.
4. **Type D**: Generally rejected and not used for production directly.

The data of Type D leather for each of the 7 leather categories was collected and arranged as:

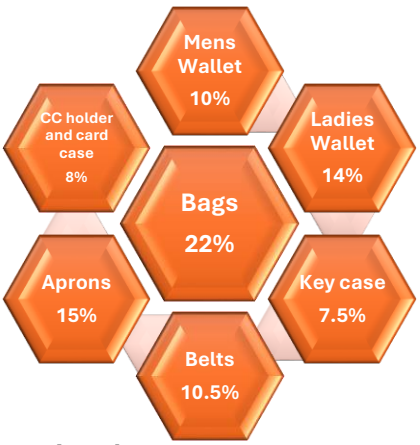
| Leather type | Quantity rejected(Kg) | Rate(₹/Kg) | Value(₹) |
|---|---|---|---|

This leather accounted for a low yet significant cost. This data was available on excel sheets provided to me by the employees.

## LEATHER WASTAGE (Done manually)

Understanding the workflow provided insights into the areas where leather waste is generated. The main process identified was cutting. Human error is unavoidable; hence, in the cutting process, the cutting is not done to 100% optimal precision, leading to the generation of scraps.

A problem arose as the business did not have its own waste tracking system, and there was no record of how much leather was wasted. I visited the cutting section and manually collected data for each leather type and article. Again, being human, it is not possible to provide an absolutely accurate figure, but my ground-based analysis showed the following percentage loss:




***Leather waste percentage***

Going deeper into the analysis showed that almost equal amounts of each of the seven categories of leather were used to make various articles (bags, purses, etc.). The amount of leather required for each type of article was considered, and the number of each article per leather type (Oil pullup, VT Venezia, etc.) and the wastage from each were evaluated to estimate the average wastage. I personally collected this data by regularly visiting the factory and monitoring each piece of leather cut for a week. A rough estimate indicated that around 12% of each leather category produced is wasted in the form of scraps.

Thus a table containing the following metda data keys was designed:

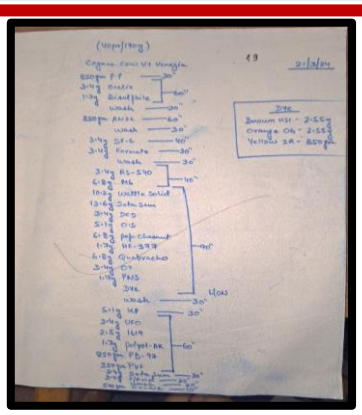
| Leather type | Quantity wasted(Kg) | Rate(₹/Kg) | Value(₹) |
|---|---|---|---|

The 12% wastage of the produced quantity was considered for 3 years and arranged in the table.

## CHEMICAL RATIO

The crusting as well as finishing chemicals' composition for each leather type is fixed. It is generally kept as a record in a notebook in the factory. The chemicals of crusting process was added up. This

gave us the total crusting chemical used and the weight of wet blue (primary leather) was already calculated beforehand. Thus the ratio of weight of the sum of crusting chemicals to the weight of the leather used was calculated. Same was done for finishing chemicals. A graph was plotted considering all the chemicals individually for all leather types but subsequent analysis was done on a graph considering all chemicals together for all leather types since the total revenue lost in chemicals was available in the factory.



***Records***

$$\textbf{Type\_1 Chemical ratio for leather type A} = \frac{\sum \textbf{Weight of Type\_1 Chemicals for Leather type A}}{\sum \textbf{Total weight of Leather type A that uses Type\_1 chemical weight}}$$

## CRUSTING CHEMICAL LOSS

The total revenue lost due to crusting chemicals was provided by the tannery department of the business. Further analysis on the production quantity and crusting chemical ratio obtained in the previous table mentioned above paved the way for an overall insight on the loss in terms of weight. A table was designed to solve our purpose of plotting of loss on a graph and extrapolating it.

| Year | Closing Stock (₹) | Actual Stock(₹) | Loss(₹) | Closing Stock(Kg) | Actual Stock(Kg) | Loss(Kg) |
|---|---|---|---|---|---|---|

The financial data was given. Extrapolation to material data was done by the following assumptions and equations *(Type 1 leather means any of the 7 types of leather we considered)* :

- Total production of Type 1 leather = $X$ kg *(let)*
- Crusting Chemical Ratio for Type 1 leather = $A$ *(let)*
- Crusting chemical used for Type 1 leather = $X \times A = \text{Y}$ *(let)*
- Total crusting chemical used for all leather types = $\sum_{All\ leather\ types} Crusting\ chemicals$ = U kg *(let)*
- Actual stock for crusting chemicals = ₹ V *(given, let)*
- Approx cost of crusting chemical per kg of leather(wet blue) = $\frac{\textbf{₹V}}{\textbf{U kg}} = \text{₹W/kg}$ *(let)*
- Closing stock for crusting chemicals = ₹P *(given, let)*
- Closing stock for crusting chemicals = $\frac{\text{₹P}}{\text{₹W/kg}}$
- Loss for crusting chemicals = ₹Q *(given, let)*
- Loss for crusting chemicals = $\frac{\text{₹}Q}{\text{₹W/kg}}$

Also,

*LOSS = CLOSING STOCK – ACTUAL STOCK*

## FINISHING CHEMICAL LOSS

Similar to the Crusting Chemical loss, the financial data was provided by the tannery and the quantitative data was extrapolated by the same equations and assumptions as shown in the crusting chemical part. The table for this part of analysis was also similar to the crusting chemical one.

| Year | Closing Stock (₹) | Actual Stock(₹) | Loss(₹) | Closing Stock(Kg) | Actual Stock(Kg) | Loss(Kg) |
|---|---|---|---|---|---|---|

**Assumption made for this analysis:** Excel tables of the financial data were stored collectively rather than separately for each leather type. As a result, all chemicals were grouped together, and their cost per kilogram was assumed to be the same. In reality, every chemical has a slightly different price (though not significantly, as they are purchased from wholesalers). While this method doesn't provide a perfectly accurate figure, it offers a close approximation of the losses the business incurs due to chemical wastage.

## LEATHER ARTICLES PRODUCED

The accounts department provided a sheet detailing the number of articles sold in each category. While this data isn't directly related to the project's primary analysis, it serves an important purpose: calculating the overall waste percentage for each leather category, which is 12%.
The table includes 16 categories of articles and uses the following keys:

| Articles | Export Quantity in pieces |
|---|---|

The data collected is for the 2023-24 financial year and provides insight into the percentage share of the number of product pieces exported for each article category.

## MARKET ANALYSIS

Analyzing the market trends, I found that Vegetable Tanned (VT) leathers, such as VT Venezia, are becoming increasingly popular. This trend is driven by the growing demand for eco-friendly products, as these leathers offer a sustainable yet stylish option. Similarly, Oil Pullup leather is gaining traction due to its natural appearance and biodegradability.

***VT Venezia***

***Oil Pullup***

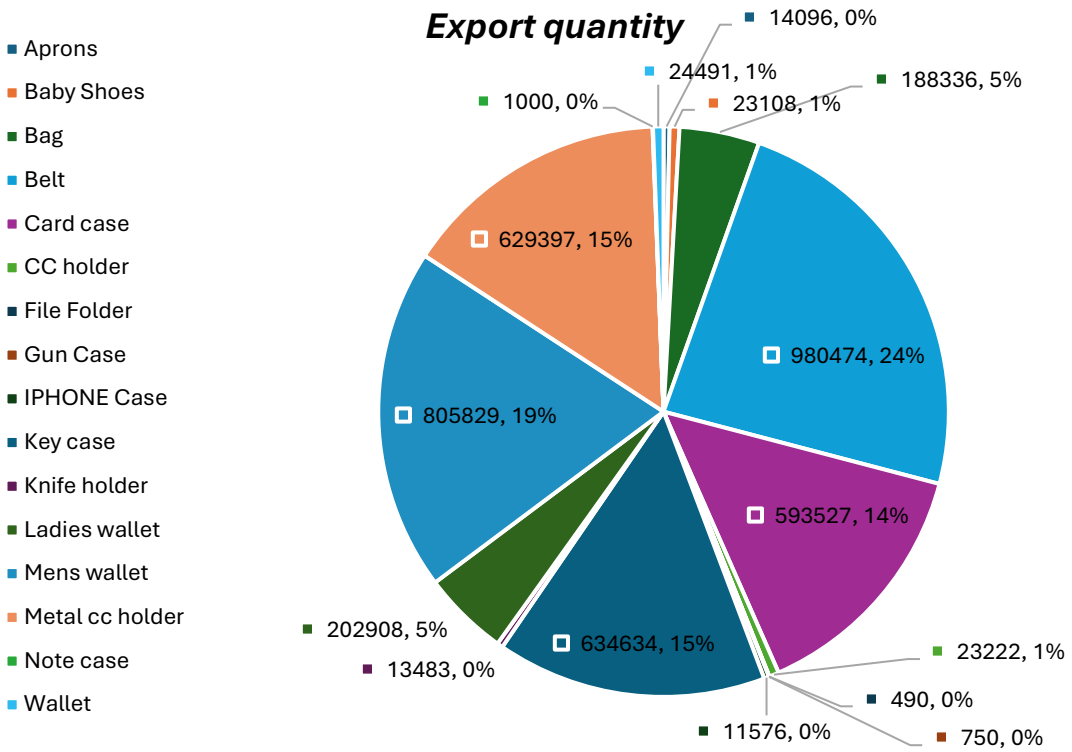
Buff nappa has and will always be a popular choice among people specially because of its softness and smooth finish. Hunter has a high demand because of its durability and temperature resistance. On the other hand Heritage and Beetle is currently suffering a loss in interest among the European markets because the other leather types seem to have more advantages in terms of looks and properties.

***Hunter***

# RESULTS AND FINDINGS

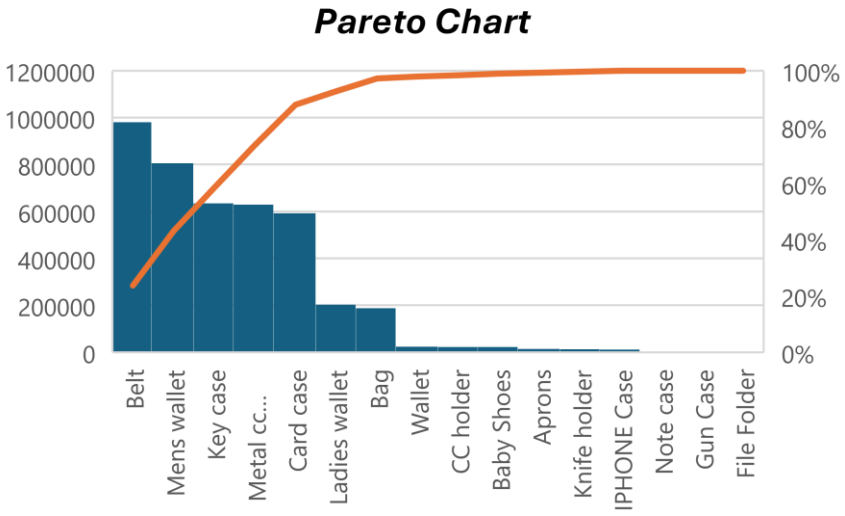
## EXPORT DATA RESULTS

The sales data from financial year 2023-24 gave insights to the percentage share of different leather articles exported from this business.




- Data revealed that the highest article exported is Belts (980474 pieces) followed by Men's wallets (805829 pieces). The chart contains the number of products per article category exported and also their percentage share in the total number of articles exported.
- File folders (490 pieces) , Gun case (750 pieces) and note cases (1000 pieces) are produced in small quantities only on demands. They have been shown as 0% but are not exactly 0%.

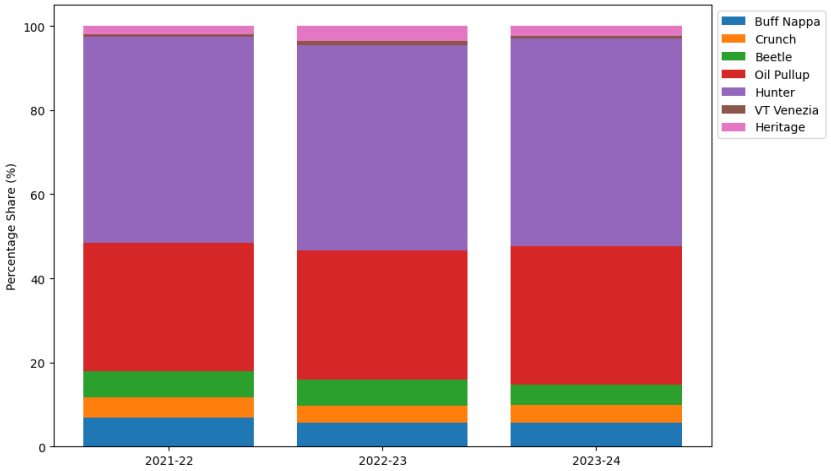
- The number of products of each article category was valuable in determining the waste percentage for each leather type.




## LEATHER PRODUCTION DATA

- The company manufactures a wide variety of leathers, with the top seven types in 2023-24 being Buff Nappa, Crunch, Beetle, Oil Pullup, Hunter, VT Venezia, and Heritage.
- Hunter represents almost 50% of the total production, making it the largest category. In contrast, VT Venezia is the smallest category.

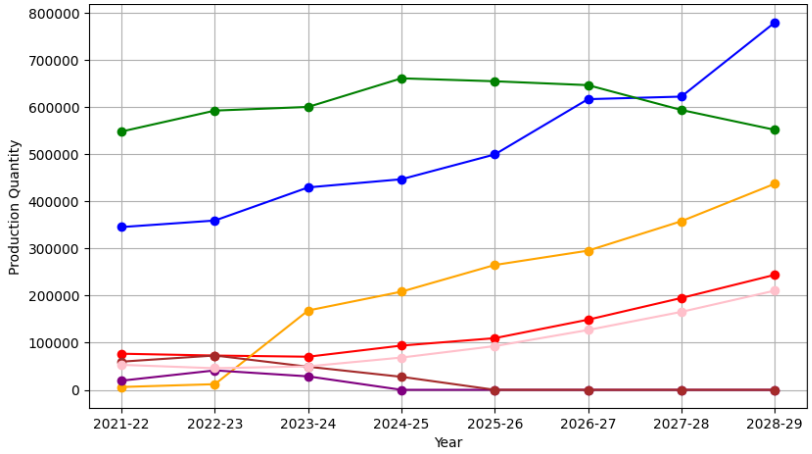
***Leather Production Percentage Share by Category***




- VT Venezia is low in production quantity because this type of leather is new in the market, but it is going to outburst in the next few years. This is because of the growing demand for sustainable leather and Vegetable Tanned Venezia serves the purpose.
- Oil pullup has a good percentage due to its polished look and market craze.
- Leather production is heavily influenced by market trends and evolving fashion preferences, making it challenging to pinpoint the exact reasons why certain leather styles experience heightened demand in specific years.
- A prediction in trends was made by speaking to some fashion designers and some industry experts. As discussed in the Market Analysis section in Page 7, we built a machine learning model to predict the production of various leather types in upcoming years. To ensure that the

prediction wasn't entirely biased towards some people, we added a 70% randomizer which made sure the predictions came into effects only 70% of the times.

***Extrapolated Year vs Production for Various leather Types***

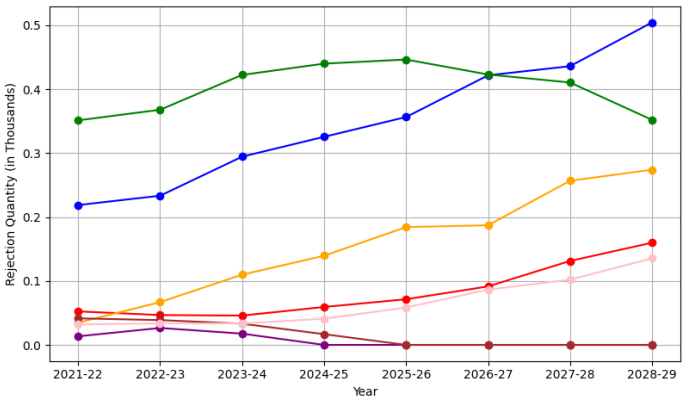



- The expected trend is that Oilpullup and VT Venezia has high chances of high increase in production. *(Market analysis Page 7)*
- While it may appear that Beetle and Heritage have reached zero production after 2024-25, this merely reflects their significantly low output. Their production is not expected to cease entirely.
- This graph shows the prediction of production (in Kgs) of the 7 major leather categories from 2021 to 2029 (extrapolated by machine learning)

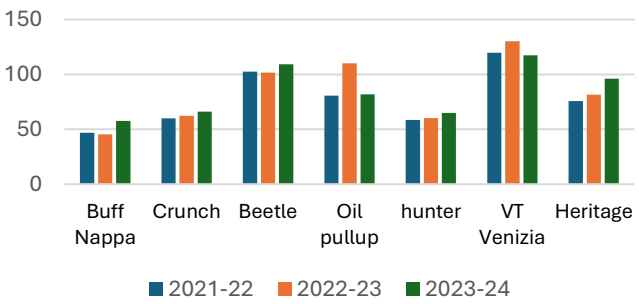
## LEATHER REJECTION DATA

- Rejection of leather is more or less directly proportional to leather production. So it follows kind of a similar trend to the extrapolated graph of production.
- This graph shows the amount of leather in thousands of Kg of each category that will be rejected for the last 3 years and the next 5 years.

***Extrapolated Year vs Rejection for Various Leather Types***




***Rate of Production of different leather types***




- This poses a problem. Since VT Venezia is costlier than rest of the leather types, higher production of VT means higher rejection quantity and thus more loss.
- Beetle and Heritage have higher cost of production while buff nappa is cheapest.

In future, when VT Venezia increases in production, it will provide almost 50% of the revenue although it will constitute much lesser percentage of production.

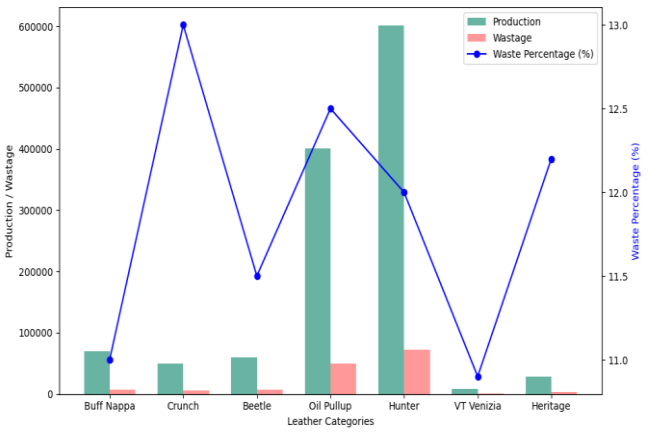
## LEATHER WASTAGE DATA

Waste generation has been an integral part of leather production for years. Though the business did not have a fully functional waste tracking system, data collected from the site gave a rough estimate on how much waste is generated from each leather category.

| Wastage | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Particulars | 2021-22 | | | 2022-23 | | | 2023-24 | | |
| | Qty | Rate | Value | Qty | Rate | Value | Qty | Rate | Value |
| Buff Nappa | 7981.6 | 46.8 | 373538.9 | 7357.9 | 45.29 | 333239.3 | 7733.55 | 57.64 | 445761.8 |
| Crunch | 6633.25 | 59.89 | 397265.3 | 5960.5 | 62.4 | 371935.2 | 6481.8 | 66.2 | 429095.2 |
| Beetle | 7546.645 | 102.5 | 773531.1 | 8382.35 | 101.54 | 851143.8 | 6926.45 | 109.16 | 756091.3 |
| Oil pullup | 40570 | 80.56 | 3268319 | 44950 | 110.12 | 4949894 | 50063.25 | 81.86 | 4098178 |
| Hunter | 62347.2 | 58.6 | 3653546 | 68136.6 | 60.23 | 4103867 | 72107.04 | 65 | 4686958 |
| VT Venizia | 654 | 119.6 | 78218.4 | 1308 | 130.15 | 170236.2 | 872 | 117.38 | 102355.4 |
| Heritage | 2463.18 | 75.6 | 186216.4 | 5106.432 | 81.4 | 415663.6 | 3484.32 | 96.16 | 335052.2 |
| TOTAL | 128195.9 | | 8730635 | 141201.8 | | 11195979 | 147668.4 | | 10853491 |

The ratio of waste to production was calculated for a month and thus the waste for the last three financial years was calculated by multiplying the ratio with the production quantity for each of the 7 leather categories.

***Production, Wastage and Waste Ratio by Leather Category***




The graph contains 3 information:

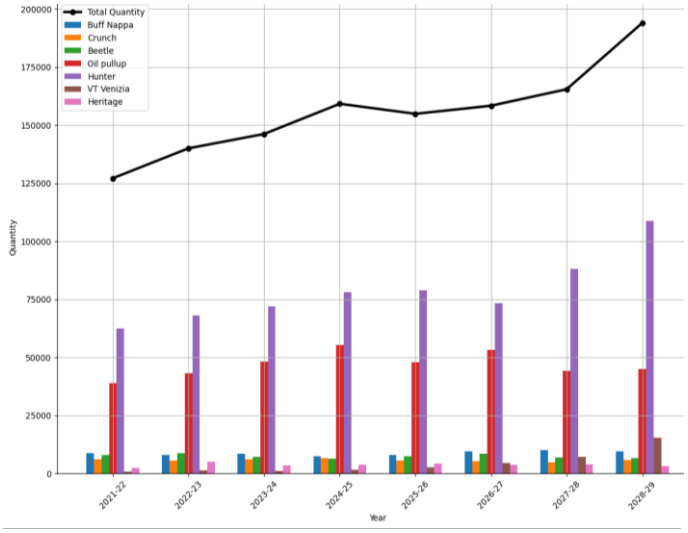
- The green bar is the production quantity for the year 2023-24
- The pink bar is the wastage quantity for the year 2023-24
- The blue line connects the wastage percentage, all of them close enough to 12%

A whooping nearly 1 crore rupees worth of leather is lost every year in the form of scraps and wastage. This is only going to increase in future as the production goes up.

The following graphs show the wastage of each leather category in the form of cumulative blocks for the last 3 years and the next 5 years. The black line on the graph is the total wastage of the year which is the sum of the wastage of all 7 categories of leathers.

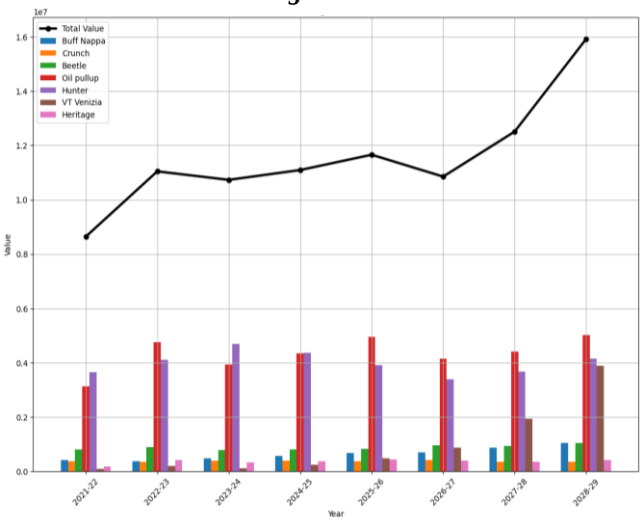
- The left one shows in terms of Quantity(Kg)
- The right one shows in terms of value (₹)

***Leather Wastage – Quantity Over The Years***




- It can be seen that the wastage is most for Hunter and second most for Oil-pullup.
- Though in the recent years the wastage of VT Venezia is less in quantities, as its production rises in the next few years, so does its wastage.

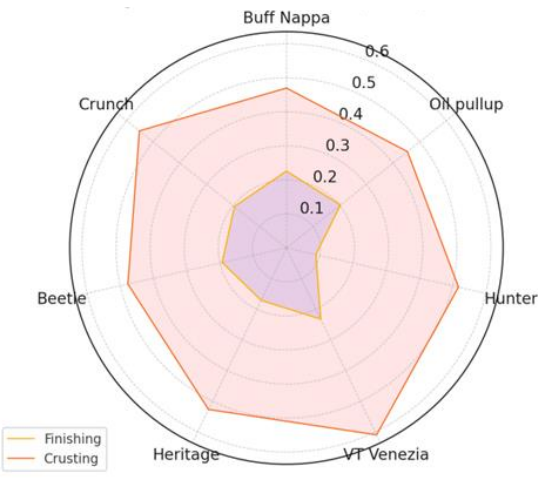
***Leather Wastage- Value over Years***




- From the Value- Wastage graph we see, since the cost of VT Venezia is highest, so slight increase in wastage of VT leather also causes quite a significant amount of loss in terms of value.
- On the otherhand , Oil-pullup is predicted to generate lesser wastage than Hunter leather always. But because of its higher price, it is mostly ahead of Hunter in terms of revenue wasted.
- All together, it turns out that production cost is going to go up with the rise in demand for sustainability and hence a shift towards VT leathers. But leather types such as Hunter continue to enjoy high production due to its durability. As production rises, waste and scrap leather also increase—representing a potentially valuable yet underutilized resource for the company.

## CHEMICAL DATA

***Chemical Use Ratio***




- The Spider graph shown on the side demonstrates the ratio of weight of chemical used to the weight of wet blue (raw leather).
- The orange line depicts the Crusting chemical while the yellow line depicts the Finishing chemical.
- For example: In the crusting process, if 100 kg of wet blue is put in the tanning drum to make Buff Nappa, a total of 22.5747 kg of

chemical is put in and for the finishing process 47.0037 kg of chemical is put in. This was calculated by adding up all the different crusting chemicals and dividing it up by the weight of wet blue used and same for finishing chemicals. The table containing info about all of them is given below:

| Percentage of chemical weight required per kg of leather | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Type Leather | | | | | | |
| Type chemical | Buff Nappa | Oil pullup | Hunter | VT Venezia | Heritage | Beetle | Crunch |
| Finishing(kg/ kg of leather) | 0.225747 | 0.202899 | 0.088525 | 0.232558 | 0.171053 | 0.19337 | 0.195402 |
| Crusting(kg/ kg of leather) | 0.470037 | 0.454054 | 0.517928 | 0.609706 | 0.526944 | 0.477273 | 0.551852 |

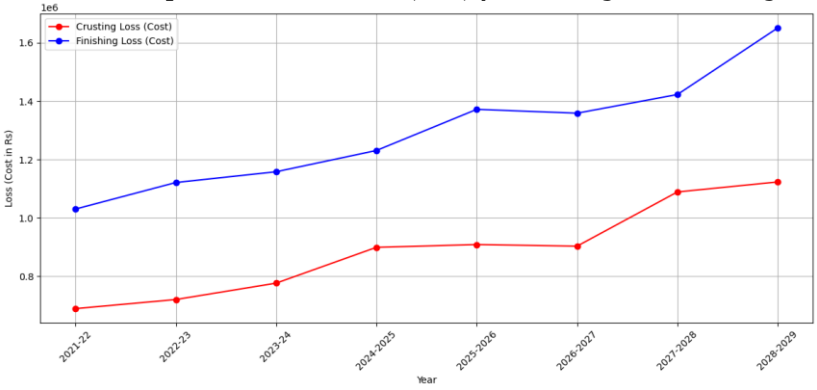
- It can be seen that the highest amount of crusting chemical is needed for making VT Venezia (60.97%) followed by Crunch (55.19%).
- The highest amount of finishing chemical is also need for VT Venezia (23.26%)
- After having conversations with the employees, I found that VT leathers generally need more amount of chemicals (both crusting and finishing).

**So how do we say VT is more sustainable?**

VT (Venezia in this case) is considered more sustainable because all the chemicals used to make it are eco-friendly and biodegradable, unlike synthetic chemicals. Biodegradable chemicals include vegetable-tanned extracts such as myrobalan, quebracho, wattle, etc. These are extracted from trees in South Africa and other regions. Since these chemicals are not typically produced in India and need to be imported—and because biodegradable chemicals are harder to produce than synthetic ones—their costs are higher. This increases the overall production cost of VT Venezia.

- The amount of crusting and finishing chemicals used in the entire production process of all leather categories as calculated from *Crusting Chemical Loss in Page 6* was further extrapolated to the next 5 years to showcase how much the company is going to lose if no immediate action is taken.

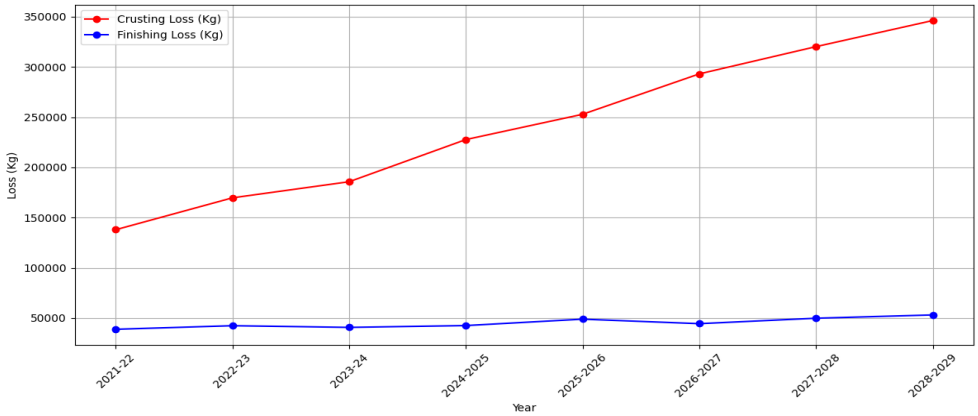
***Extrapolated chemical loss (Cost) for Crusting and Finishing***



In the graph we see that the blue line represents the loss in Finishing chemical and the orange line represents the loss in Crusting chemical.


The following graph shows the amount of loss of chemicals for the last 3 years and the upcoming 5 years:

***Extrapolated Chemical Loss(Kg) for Crusting and Finishing***

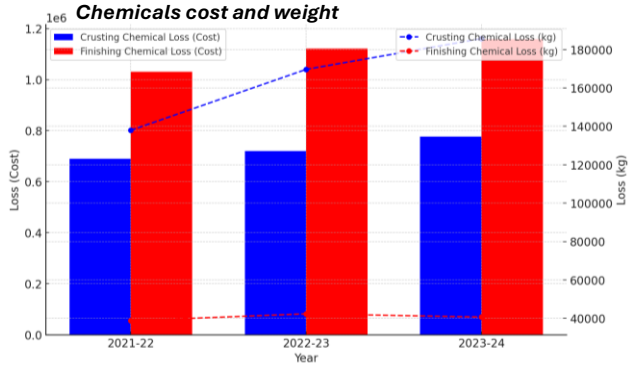



We observe that while the increase in the quantity of finishing chemical loss is not substantial, the rise in financial loss is significant. In fact, the amount of finishing chemicals is lower than that of crusting chemicals for all years, yet the financial loss associated with finishing chemicals is higher than that of crusting chemicals throughout. This suggests a Pareto like pattern.

This can be inferred from the higher cost of finishing chemicals than the crusting chemicals.

This graph shows both the loss in kgs as well as rupees for both finishing and crusting chemicals.

***Pareto like pattern between Crusting and Finishing Chemicals cost and weight***




## SOME IMPORTANT STATISTICS:

**Production:**

- The business produced 1059518 Kg, 1166891 Kg and 1218353 Kg of leather in total in the years 2021-22, 2022-23 and 2023-24 Years respectively.
- This clearly shows how production has been increasing for the last few years.
- Not only in amount, but the cost of production subsequently has increased.
- Last year it was ₹ 8,94,56,590.
- The highest cost of production was for Hunter (₹ 3,90,57,980).

**Rejection:**

- A total of ₹ 263797.4 worth of leather was rejected in the year 2023-24 Valuewise the highest rejected leather came from Beetle (₹ 43445.68) 3898.25 sqft of leather was rejected in the last financial year.
- The lowest quantity of leather rejected is VT Venezia, which can be attributed to its lower production volume.

**Wastage:**

- The business generated 147668.4 sqft of leather wastes in 2023-24.
- It is much more than what was generated in 2022-23 i.e. 141201.8 sqft.
- Although the waste generated in 2023-24 is higher compared to 2022-23, the total value in rupees has decreased. In 2022-23, it was ₹11,195,979, but it dropped to ₹10,853,491 in 2023-24. This decline is due to a larger portion of VT Venezia and Beetle being wasted in 2023-24, which have higher market rates.

**Chemical Ratio:**

- The highest finishing chemical ratio is for VT Venezia (23.25%) while the lowest finishing chemical ratio is for Hunter(8.85%).
- The highest crusting chemical ratio is for VT Venezia(60.97%) again while the lowest crusting chemical ratio is for Oil Pullup (45.4%).

**Crusting Chemical Wastage:**

- The loss in crusting chemical rose from 689674 in 2021-22 to 720809 in 2022-23 and further increased to 776911 in the financial year 2023-24.
- Though the amount of loss rose significantly, due to its low costs, the prices didn't increase much.

**Finishing Chemical Wastage:**

- The loss in finishing chemical rose from 1030688 in 2021-22 to 1121530 in 2022-23 and further increased to 1158433 in the financial year 2023-24.

**Leather Articles Produced:**

- The highest number of articles produced was belts (980474 pieces) followed by Men's wallet (805829 pieces)

***Leather scraps***

- Leather scraps at the present are taken by a truck and sold. But the cost incurred in hiring the truck is not very small while the profits obtained by selling those is low. Rather the recommendations, if implemented can increase the business domain and profits

# INTERPRETATION AND RECOMMENDATIONS

## RECOMMENDATION 1: OPTIMIZED CUTTING

- The cutting process in the factory has been observed to generate a significant amount of scraps, leading to considerable financial losses. Currently, most cutting in the Dugros factory is done by hand, where human error is inevitable, and achieving perfect optimization is difficult without advanced tools.In contrast, factories abroad employ machines that cut leather with optimal precision when designs are fed into the system through computers.

- Although the initial setup cost of these machines is high, they prove to be a valuable long-term investment, as they reduce the amount of leather wasted by minimizing scraps.

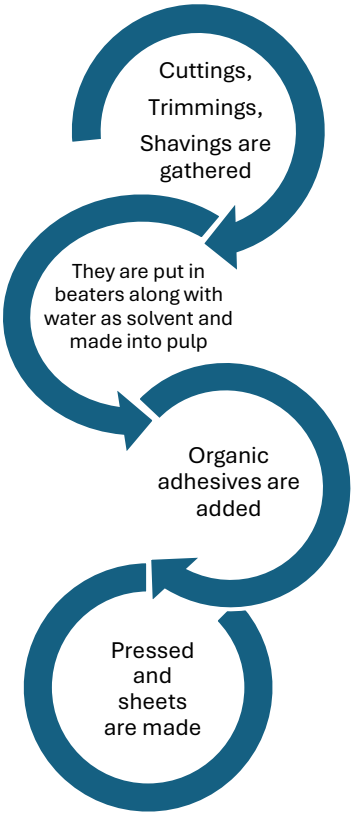

- Moreover, the manual cutting process requires a significant amount of manpower.
- These advanced machines can handle the workload of ten workers, operating more efficiently and completing tasks in a much shorter time. A single worker can be designated to oversee the machine, further streamlining the cutting process while conserving valuable resources.

## RECOMMENDATION 2: WASTE SEPARATION

- Currently, there is no system in place to track leather waste, making it difficult to maintain proper records of financial losses due to scraps. Implementing a tracking system would allow us to keep precise data on waste.
- By categorizing the scraps into separate dumping bags based on the different leather types—such as Buff Nappa, Heritage, Oil Pullup, VT Venezia, and others—we can then weigh each bag individually. Since the density (weight per square foot) of each leather type is known in advance, we can easily calculate the square footage of each category of leather wasted in the form of scraps.
- Once the square footage is calculated, multiplying this by the cost per square foot of the respective leather type will give us the exact monetary value lost for each category, allowing for better financial tracking and waste management.

# RECOMMENDATION 3: BONDED OR REGENERATIVE LEATHER

- Loss of leather in the form of scraps or other ways is very normal in the leather producing industries. But the business loses about 1 crore rupees worth of leather as wastes and 3 lakh rupees worth of leather is rejected.
- Apart from the monetary loss, dumping of leather also creates pollution because most of the chemicals such as chrome sulphate, sodium sulphide, inorganic acids, salts, are harmful for the environment and do not degrade easily.
- In this case, one innovative and sustainable way of tackling this problem is to generate make bonded leather from leather scraps.
- The steps to make bonded leather are shown in the flow diagram below:




- The bonded leather is made by a culmination of vacuum system and hydraulic pressing.
- Generally Bonded leather is made from a small amount of leather scraps and fibers. It is mashed into a pulp, then binded to a paper or fiber backing using polyurethane. Bonded leather is also sometimes referred to as composite leather, vinyl and reconstituted leather.
- There are some organizations working on circular economy and working to make bonded leather free from plastics.

***Bonded leather bag***

- Bonded leather articles are just as stylish as their genuine leather counterparts. They not only provide a sustainable way to utilize waste materials but also create an additional source of income for businesses. The main raw material is not purchased, making it essentially a free product.

***Bonded leather purse and belts***

## RECOMMENDATION 4: HANDTAGS AND COLLAGES

→ Instead of discarding the smaller leather scraps generated during production, these can be repurposed to create value-added products such as keychains and handtags. By using a variety of leather scraps—especially those with minor imperfections like miscoloration—it's possible to craft unique, stylish handtags that can serve as branding materials or accessories for various products.

→ These handtags can showcase the diversity of leather textures and colors, turning what would have been waste into a marketable item. Additionally, key rings can be crafted from an assortment of leather scraps in different colors and types, offering a creative way to highlight the company's sustainable practices. This approach not only helps reduce waste but also presents an opportunity to introduce a new line of small, cost-effective products that may appeal to customers.

→ Several foreign companies have already adopted this practice, demonstrating its feasibility and potential profitability.

→ Using scrap leather to create collages offers a sustainable way to reduce waste while boosting profits. These collages can be turned into products like wall art, notebook covers, or patches for clothing, adding unique value. By blending different leather textures and colors, businesses can create exclusive, eco-friendly items that appeal to customers. This approach not only cuts waste but also taps into the growing demand for upcycled products, increasing profitability and promoting the brand's sustainability efforts.

## RECOMMENDATION 5: CHEMICAL RECORDS

→ The company loses a lot of money on chemicals. In the finishing process, chemicals like solvents, wax, and silicon are crucial for tasks such as edge painting, color correction, and surface treatment to achieve the desired finish on leather products. These chemicals are mixed with specific colors before application. However, the mixture dries quickly and cannot be stored for extended periods. Frequently, after the application process, a portion of the mixture remains unused. Since each product demands a unique color gradient and design, the leftover mixture cannot be reused on other items. As a result, tanneries experience significant financial losses each month due to this waste.

→ A person can be appointed to keep a track of chemicals used. This will eventually lead to the formation of a database which can be continuously used and updated.

An individual could be designated to prepare the required chemical mixtures on demand, using basic ingredients purchased from the market. By mixing chemicals as needed rather than in advance, this approach would minimize wastage, as only the exact amount required for each batch would be prepared. This would not only reduce the leftover mixture but also lead to more efficient use of materials. In the long run, it could result in significant cost savings for the company, as fewer chemicals would be discarded, and resources would be utilized more effectively. Additionally, having a dedicated person for this task ensures better control over the chemical preparation process, enhancing precision and consistency in product quality.

# CONCLUSION

Initially this project seemed to be quite a challenging one specially because this was in an organized unit. But slowly as I delved deeper into the nitty gritties of the business, speaking to the employees as well as the owner and observing the different processes myself, I found that even such large and organized business may also have some loopholes. It was really a pleasure to work in Dugros and learning was beyond what I had imagined.

These tables written on boards and copies were converted into excel tables, the link is given below:

**EXCEL TABLES (CLICK HERE)**