



Indian Institute of Technology Madras

Optimizing Working Capital Management through Credit Control at M/S Sarada Builders & Suppliers

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Course: Business Data Management – Capstone Project

M/S Sarada Builders & Suppliers

• About the firm:

- Construction materials trading firm
- Owner & Founder: Suman Ghosh
- Location: Swarupnagar Bazar, North 24 Parganas, West Bengal
- Products: Stone, Sand, Bricks, Cement, Metal
- Customer base: Builders, Contractors, Retail Customers

• Business characteristics:

- High-volume sales with credit-based transactions
- Frequent repeat customers
- Records maintained through handwritten invoices

• Core challenge:

- Cash blocked in customer dues → strain on working capital



Problem Statements



Problem 1: Delayed Customer Payments

- Customers frequently delay clearing dues after billing
- Sales are recorded, but cash is realized late
- This creates a mismatch between revenue and cash inflow



Problem 2: Blocked Working Capital

- A significant portion of funds remains tied up in receivables
- Receivables are not evenly distributed. A few customers and a few products drive most dues.
- Day-to-day operations depend on waiting for collections
- Liquidity pressure affects procurement and supplier payments



Objective:

- To analyze customer credit behavior using primary data and design a data-driven credit control framework to improve cash flow and working capital management.



Problem 3: Absence of Structured Credit

- Credit decisions are based on relationships, not data
- No segmentation of customers or products by risk
- Same credit terms applied to all, increasing default exposure

Data Collection and Methodology

Invoice No.	Date of Sale	Customer Name	Customer_Type	Product Name	Product Type	Quantity	Rate	Total Amount	Payment Method	Payment	Due Payment	Cost Price	Profit	Remark	Month	Quantity_Value	Quantity_Unit
1	2025-05-04	Anirban Das	Retail Customer	5/8" Stone	Stone	505 CFT	8000 PER 100 CFT	40400	Cash	40400	0	38400	2000	Paid	2025-05	505	CFT
2	2025-05-04	Khan Builder's	Builder's	Coarse Sand	Sand	850 CFT	7000 PER 100 CFT	59500	Cash	49500	10000	55000	4500	Partially Paid	2025-05	850	CFT
3	2025-05-04	Hasan Mondal	Retail Customer	5/8" Stone	Stone	400 CFT	8000 PER 100 CFT	32000	Cash	32000	0	30000	2000	Paid	2025-05	400	CFT
4	2025-05-04	Hasan Mondal	Retail Customer	Lafarge Cement	Cement	50 BAG	370 PER BAG	18500	Cash	18500	0	18000	500	Paid	2025-05	50	BAG
5	2025-05-04	Roni Builder's	Builder's	Coarse Sand	Sand	850 CFT	7000 PER 100CFT	59500	Cash	54500	5000	55000	4500	Partially Paid	2025-05	850	CFT
6	2025-05-05	Tamal Biswas	Builder's	Coarse Sand	Sand	850 CFT	6470 PER 100 CFT	55000	Cash	40000	15000	53000	2000	Partially Paid	2025-05	850	CFT

Fig-1: Digitalised Invoices

Dataset:

- Primary transactional data comprising 222 sales invoices
- Period covered: May 2025 – November 2025
- Data manually digitized from handwritten invoice registers
- Key variables include:
 - Invoice value, payment received, outstanding dues
 - Customer type and identity
 - Product category, quantity, and pricing
- Tools used: Microsoft Excel and Python

Data Preparation & Cleaning:

- Standardized date formats, units of measurement (CFT, BAG, PIECE)
- Converted textual rate fields into numeric values for analysis
- Validated invoice totals against original records
- Addressed missing, inconsistent, and duplicate entries
- Engineered derived variables:
 - Due Ratio = Due Payment / Total Invoice Amount
 - Monthly aggregation to enable trend and seasonality analysis

Methodology Mapped to Problems

Payment delays → DSO proxy & ageing buckets → measure delay duration and outstanding value

Dues concentration → customer-level aggregation → identify top customers contributing to receivables

Product risk → ABC, FSN & delay ratio → flag materials with high value and delayed payments

Customer behaviour → RFM analysis → segment customers by recency, frequency, and spending

Invoice risk prediction → decision tree model → classify invoices as Low / Medium / High risk

Payment Delay, Ageing & Dues per product

Delay Buckets with Average Delay and Average Due Ratio

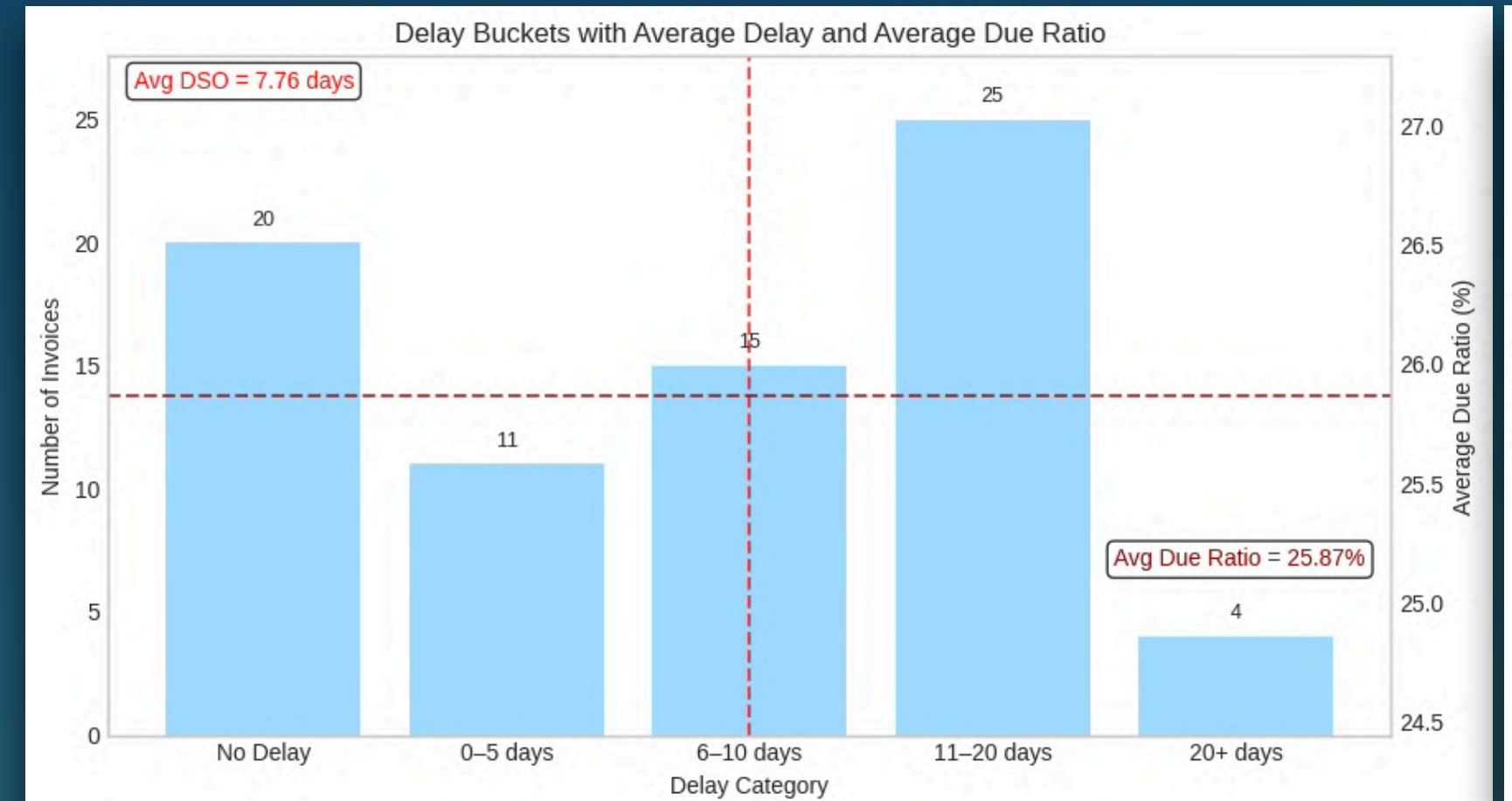


Fig-2: Delay Buckets with Average Delay and Average Due Ratio

Receivables Ageing Distribution

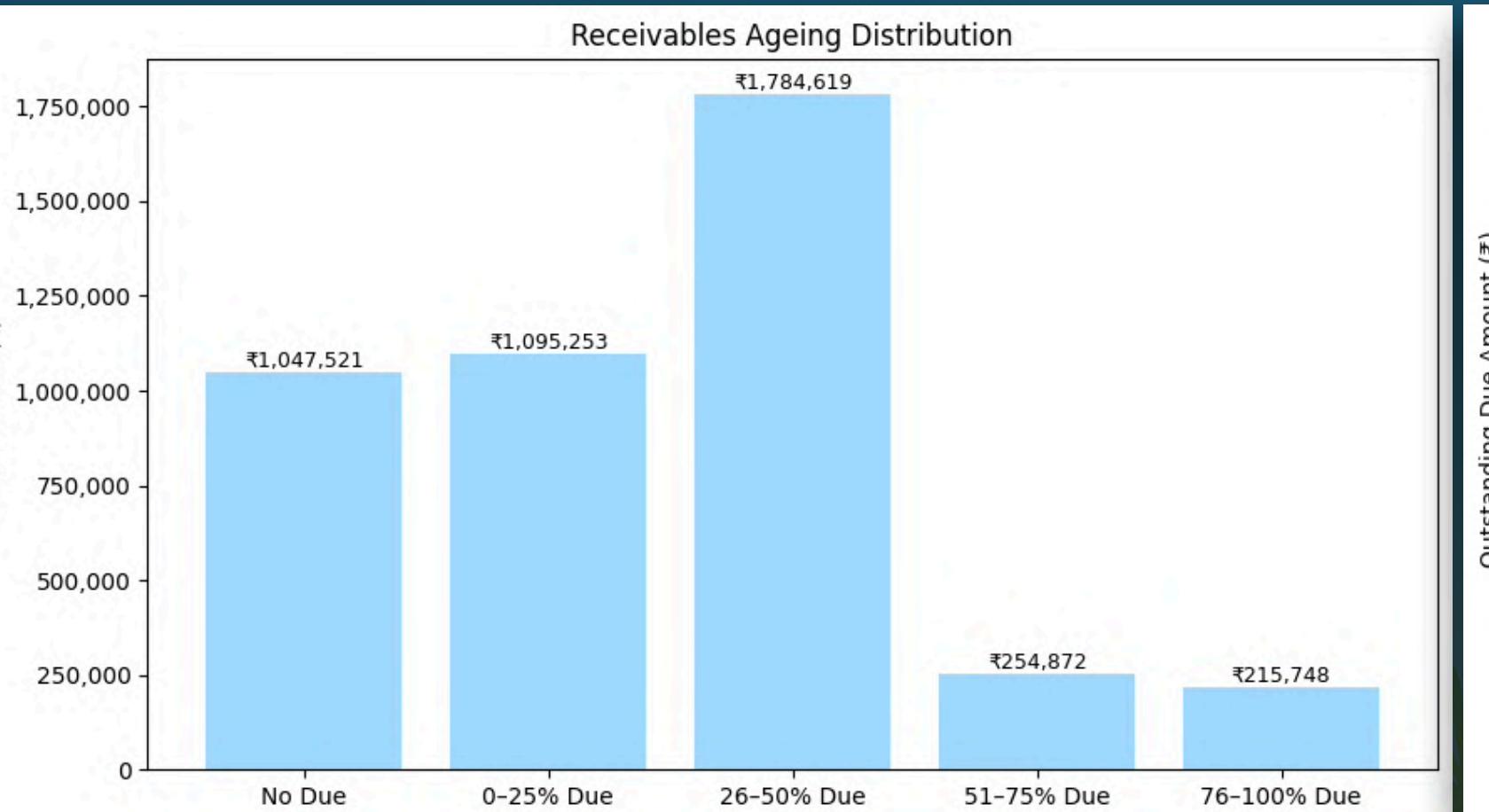


Fig-3: Receivables Ageing Distribution

Product-Name Wise Outstanding Dues

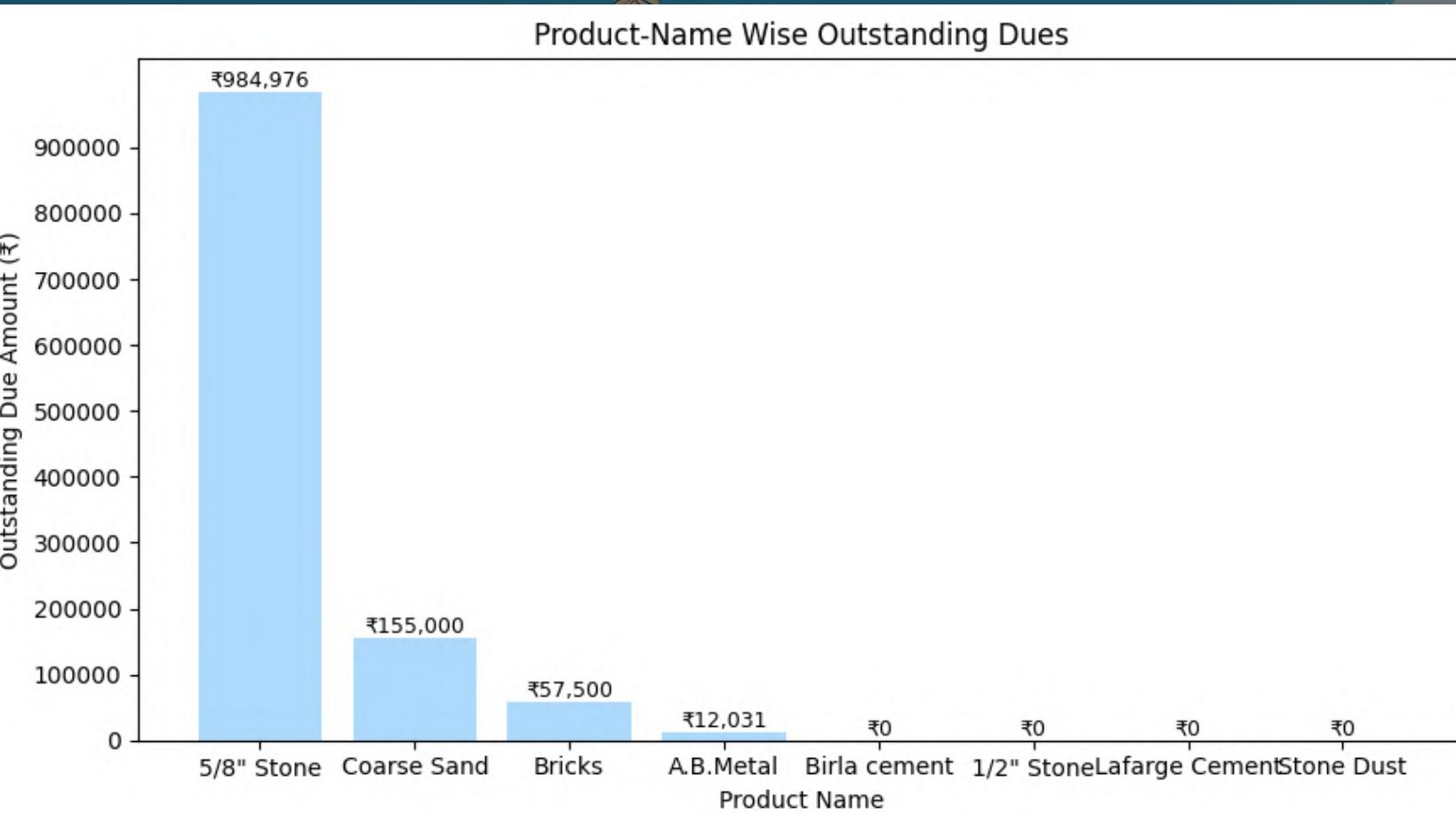


Fig-4: Product-Name wise Outstanding Dues

Delay & Cash Conversion (DSO)

- Avg DSO \approx 7.76 days
- Avg Due Ratio \approx 25.87%
- ~25-26% of sales value unpaid at any time
- Delay in value is high, even if delay in days is moderate
- Cash flow depends heavily on timely customer payments

Receivables Ageing Pattern

- Highest dues in 26-50% unpaid bucket
- Followed by 0-25% due and no-due invoices
- Delays are mostly partial payments
- Many invoices remain open for extended periods
- Indicates weak follow-up and settlement discipline

Product-wise Outstanding Dues

- Dues are heavily concentrated in 5/8" Stone
- Other products contribute comparatively minor outstanding amounts
- Credit risk is driven by high-value, high-volume materials
- Product-specific credit control can unlock significant blocked cash

ABC Analysis - Product Contribution & Credit Risk

ABC Logic

- Products ranked by sales value
- Classified by cumulative contribution
- Cut-offs:
 - A: Top 70%
 - B: Next 20%
 - C: Remaining 10%

	Product Name	Sales Value	Cumulative %	Class
0	5/8" Stone	3258478	75.074101	B
1	Coarse Sand	655000	90.165054	C
2	Bricks	140000	93.390601	C
3	Birla cement	130000	96.385751	C
4	A.B.Metal	62031	97.814922	C
5	1/2" Stone	44044	98.829679	C
6	Stone Dust	32296	99.573767	C
7	Lafarge Cement	18500	100.000000	C

Fig-5: Table of ABC Analysis of Products

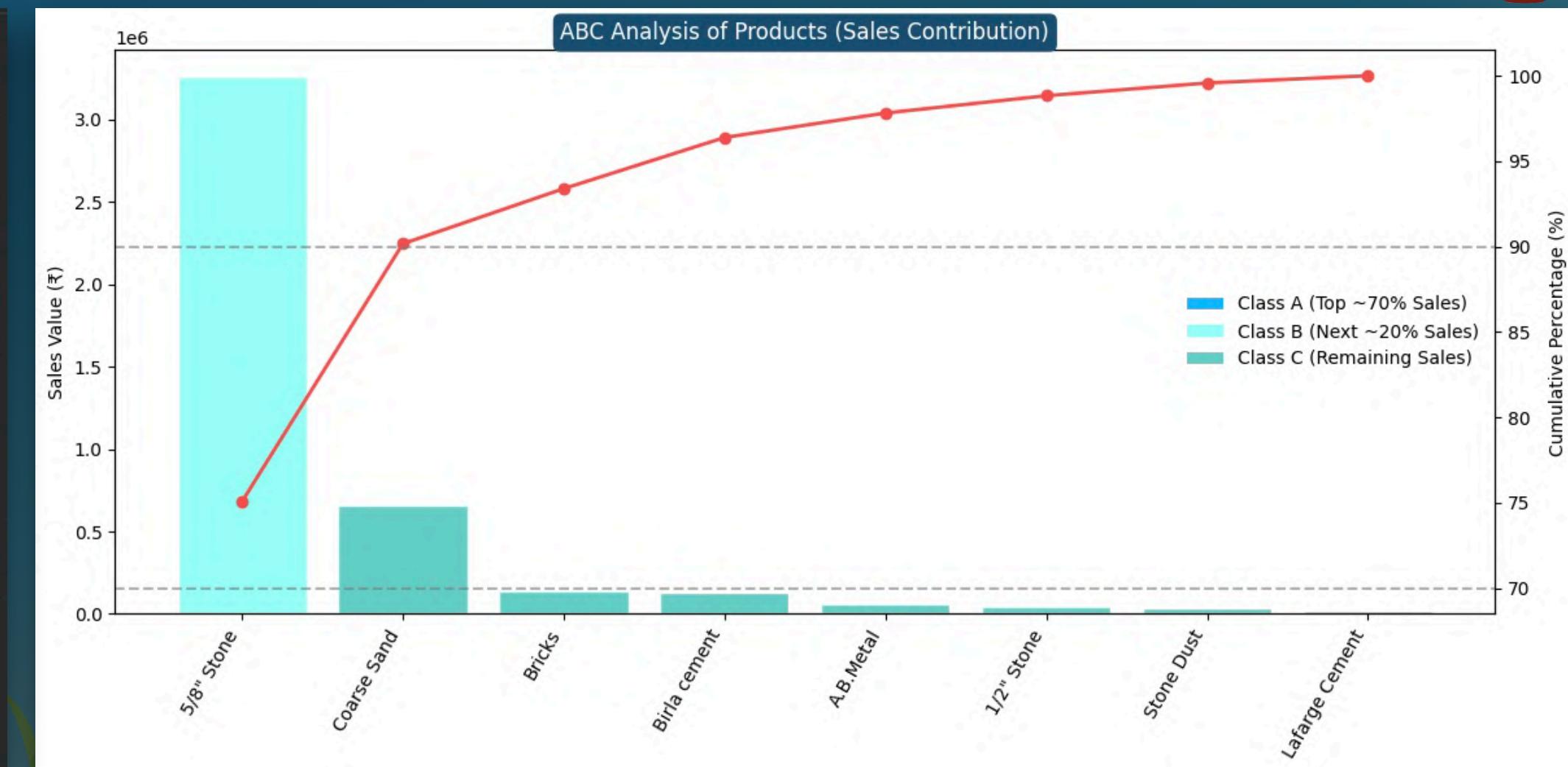


Fig-6: ABC Analysis of Products (Sales Contribution)

Revenue Concentration

- No Class A products
- Only one product contributes beyond 70% sales
- Most products fall under Class C
- Revenue is highly skewed
- Indicates dependence risk
- Sales are driven by one dominant item
- Low revenue diversification across products
- High sensitivity to performance of core product

Dominant Product

- 5/8" Stone ≈ 75% of sales
- Only product in Class B
- Others contribute marginal sales
- Clear long-tail structure

Risk Insight

- High sales + high dues = high risk
- Strong dependence on one core product
- Delays directly affect: cash flow, working capital, liquidity

Credit Exposure:

- 5/8" Stone also has:
 - highest outstanding dues
 - frequent repeat orders
- Class C products have negligible dues
- Receivables are concentrated

Managerial Action

- Tight credit control for 5/8" Stone
- Shorter credit / advance billing
- Strict pre-dispatch follow-ups
- Relaxed norms for Class C

RFM-Based Customer Segmentation & Credit Behaviour

RFM Construction

- Customers evaluated using Recency (days since last purchase), Frequency (number of transactions), and Monetary value (total spend)
- Each metric converted into quartile-based scores
 - Recency: lower days → higher score
 - Frequency & Monetary: higher value → higher score
- RFM Score = R + F + M (Range: 3-12)

RFM Segmentation Findings:

- High-Value Customers (RFM 10-12):** Recent, frequent, high-value buyers driving major revenue.
- Moderately Active Customers (RFM 6-9):** Regular but inconsistent buyers with growth potential.
- Dormant / Low-Value Customers (RFM 3-5):** Infrequent, low-spend customers with weakening engagement.

Core Problem: Best customers are also the biggest credit users—requiring tight credit control.



Fig-7: Distribution of Customers by RFM Scores

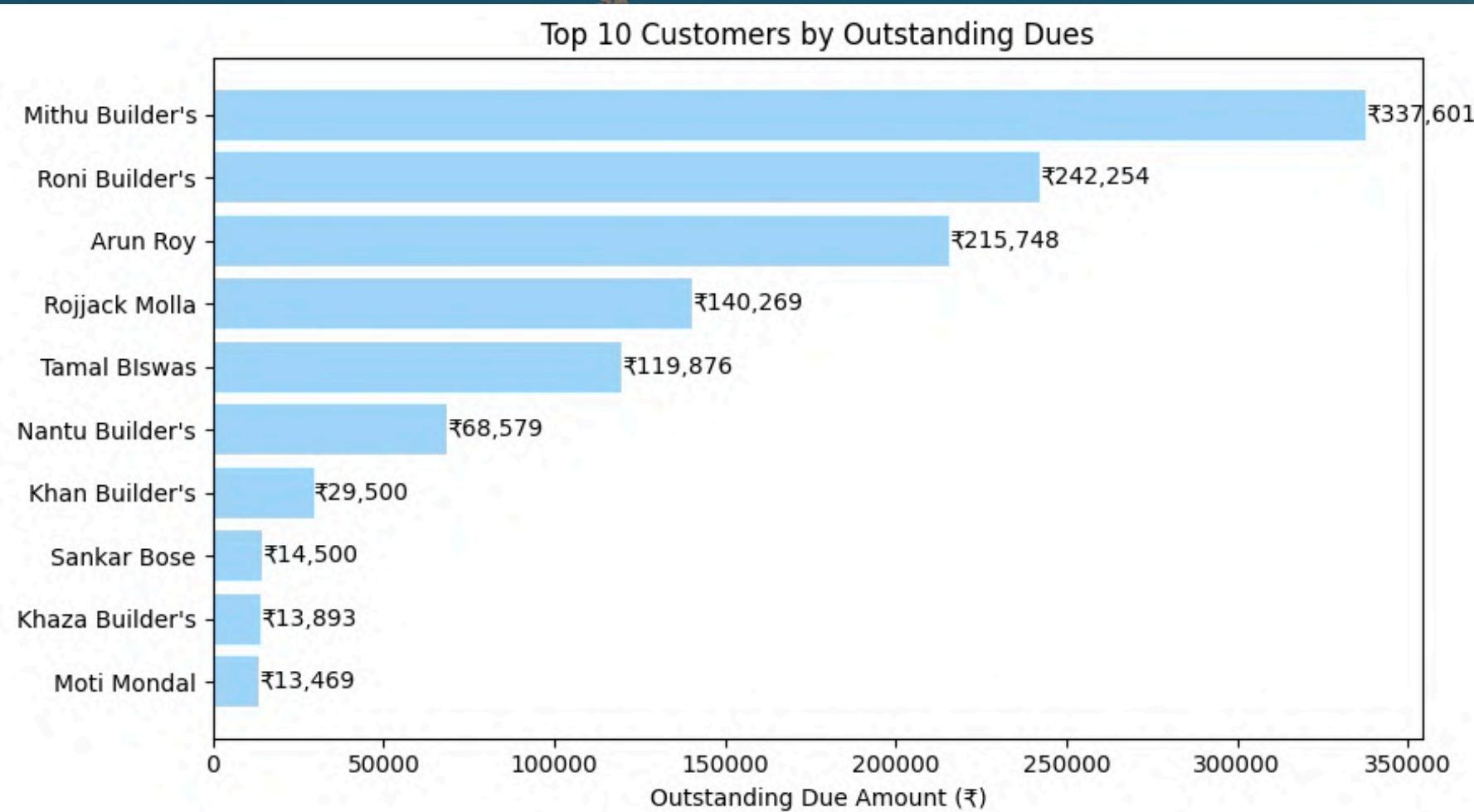


Fig-8: Top 10 Customers by Outstanding Dues

Customer Name	Recency	Frequency	Monetary	R_score	F_score	M_score	RFM_Score	Due Payment
Anirban Das	209	1	40400	1	1	1	3	0
Arun Roy	0	3	215748	4	3	3	10	215748
Bharat Builder's	11	2	108220	4	2	3	9	0
Hasan Mondal	209	2	50500	1	2	1	4	0
Khan Builder's	158	2	129000	2	3	3	8	29500
Khaza Builder's	18	6	403093	3	4	4	11	13893
MD. Mozam Mondal	17	1	68800	3	1	2	6	800

Fig-9: Table of RFM Analysis

High RFM with High Outstanding Dues

- Same high-RFM customers also appear among Top 10 customers by outstanding dues
- Indicates revenue concentration and credit concentration
- Working capital remains locked despite strong sales performance

Credit Policy Implications

- High RFM (10-12):** Allow credit with tight limits, milestone billing, regular monitoring
- Medium RFM (6-9):** Standard credit with strong follow-ups
- Low RFM (3-5):** Advance payment / minimal exposure

Decision Tree-Based Credit Risk Classification

Model Overview

- Decision tree used to classify invoice-level credit risk
- Risk classes:
 - Low: fully cleared invoices
 - Medium: partial dues / short delay
 - High: persistent unpaid and aged invoices

Key Decision Logic

- Due Ratio is the primary split (root node)
- High Risk: very high unpaid proportion + older invoices
- Medium Risk: moderate unpaid share, limited delay
- Low Risk: zero / near-zero unpaid amount

Business Interpretation

- Credit risk is invoice-driven, not customer-driven.
- Even strong customers become risky when unpaid proportions rise.
- Enables early risk flags before severe overdue accumulation.

Classification Report Table:

	precision	recall	f1-score	support
0	1.000000	0.878788	0.935484	33.000000
1	0.809524	0.944444	0.871795	18.000000
2	0.833333	1.000000	0.909091	5.000000
accuracy	0.910714	0.910714	0.910714	0.910714
macro avg	0.880952	0.941077	0.905457	56.000000
weighted avg	0.923895	0.910714	0.912656	56.000000

Fig-1 1: Classification Report Table

```
Due_Ratio <= 1.578
gini = 0.648
samples = 166
value = [96, 110, 60]
class = Medium
```

True

False

```
Invoice_Age_Days <= -0.875
gini = 0.165
samples = 18
value = [0, 6, 60]
class = High
```

```
gini = 0.444
samples = 6
value = [0, 0, 48]
class = High
```

```
gini = 0.0
samples = 12
value = [0, 0, 48]
class = High
```

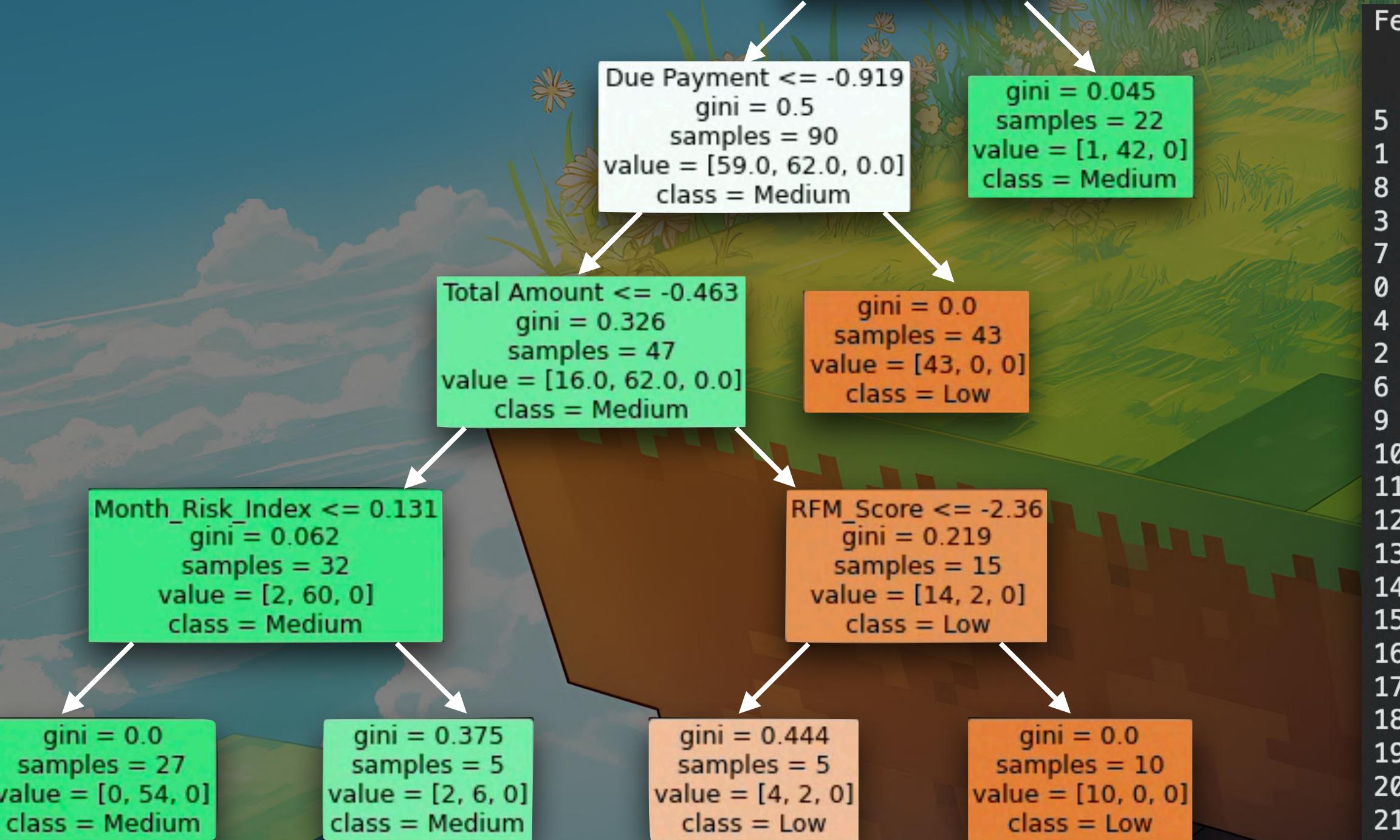


Fig-1 0: Decision Tree for Credit Risk Classification

Feature Importance Table:

	Feature	Importance
5	DSO_proxy	0.392965
1	Due_Payment	0.375018
8	Quantity_num	0.115276
3	Due_Ratio	0.087303
7	Month_Risk_Index	0.024121
0	Total_Amount	0.005318
4	Invoice_Age_Days	0.000000
2	Collected	0.000000
6	RFM_Score	0.000000
9	Cust_Builder's	0.000000
10	Cust_Contractor	0.000000
11	Cust_Retail_Customer	0.000000
12	Prod_Bricks	0.000000
13	Prod_Cement	0.000000
14	Prod_Dust	0.000000
15	Prod_Sand	0.000000
16	Prod_Stone	0.000000
17	Prod_nan	0.000000
18	ABC_B	0.000000
19	ABC_C	0.000000
20	FSN_Fast	0.000000
21	FSN_Non-moving	0.000000

Fig-1 2: Feature Importance Table

Recommendations

Implement Segmented Credit Policy

- Apply credit terms based on RFM score and payment history.
- Reason: High-value customers also hold the largest dues; uniform credit increases risk.

Set Credit Limits Using Risk Thresholds

- Define maximum due limits per customer and block supply beyond limits.
- Reason: Decision-tree shows risk spikes sharply after dues cross thresholds.

Strengthen Controls for Builder Customers

- Enforce part payments, commitment dates, and regular follow-ups.
- Reason: Builder accounts contribute the majority of outstanding receivables.

Tighten Credit on Stone & Brick Sales

- Shorter credit periods and partial advance on high-value materials.
- Reason: Stone and bricks drive revenue, delays, and credit risk simultaneously.

Digital Credit Monitoring

- Track customer-wise dues, ageing buckets, and billing vs collection digitally (Excel/Sheets).
- Reason: Delays are recurring and concentrated; real-time visibility prevents silent build-up of dues.