Supplier Performance & SLA Dashboard

1. Problem Statement

Organizations often face challenges in evaluating supplier performance due to scattered data, delayed insights, and lack of predictive analysis. Manual tracking of supplier KPIs such as delivery timeliness, invoice accuracy, and payment delays is time-consuming and error-prone.

Objective:

- Analyzes supplier transaction data
- Calculates key performance indicators (KPIs)
- Visualizes supplier performance through an interactive dashboard
- Predicts supplier risk using machine learning
- Ensures correctness using unit testing

2. System Architecture / Flow

Data Flow:

Supplier Data (CSV)

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Data Loading (Pandas)

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KPI Calculation Engine

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Machine Learning Risk Model

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Dashboard Visualization (Dash)

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End User (Browser)

Explanation:

- Supplier transaction data is loaded from a CSV file.
- KPIs are calculated using business rules.
- A machine learning model predicts supplier risk.
- Results are displayed in an interactive web dashboard.
- Unit tests validate KPI logic.

3. Tools & Libraries Used

Tool / Library	Purpose
Python	Core programming language
Pandas	Data manipulation and analysis
Plotly Dash	Interactive dashboard and UI
Scikit-learn	Machine learning (risk prediction)
Pytest	Unit testing framework
Conda	Environment management
CSV	Data storage format

4. Key Logic Explanation

KPI Calculation Logic

- On-Time Delivery (%)
  Calculated by checking if actual_delivery ≤ expected_delivery
- Invoice Accuracy (%)
  Percentage of invoices marked as Correct
- Average Payment Days
  Difference between payment date and actual delivery date

- Average Outstanding Days

  Difference between due date and payment date (non-negative)

Machine Learning Logic

- A **Random Forest Classifier** is used
- Suppliers with on-time delivery below a threshold are labeled as high risk
- Model predicts **High Risk / Low Risk** suppliers

Dashboard Logic

- Dropdown filter allows supplier-wise analysis
- Tables show raw data and KPI summaries
- Graphs visualize delivery, payment, and risk metrics
- Browser auto-opens when the app runs

Testing Logic

- Unit tests are written using **pytest**
- KPI calculations are validated using sample data
- Ensures accuracy and reliability of business logic

5. Conclusion

The system provides an end-to-end solution for supplier performance analysis by integrating data processing, visualization, machine learning, and testing. It improves decision-making by offering accurate KPIs, predictive insights, and an easy-to-use dashboard.