Detailed Analytical Report – Bank Management BI System

1. Project Overview

This project is a full-scale **Bank Management Analytics System** developed using **PostgreSQL** as the transactional database and **Power BI** as the analytical layer. It provides a 360° view of banking operations—customers, accounts, cards, loans, transactions, and branches—through six interactive dashboards.
The solution is designed for management, analysts, and branch operations teams to support daily decision-making, performance tracking, and risk monitoring.

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2. Objective of the Analytics System

- Provide real-time visibility into **customer activity, transactions, and financial exposure**.
- Track **loan portfolio health**, including principal, interest, tenure, and status.
- Monitor **card usage**, network trends, merchant spend patterns, and timing trends.
- Evaluate **branch performance** across accounts, loans, and customer base.
- Offer a **Customer 360 profile** for relationship managers.
- Enable data-driven decisions through interactive filters and detailed summaries.

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3. Data Architecture & Model

Data Source:

- PostgreSQL tables:
  `customers`, `accounts`, `cards`, `transactions`, `loans`, `branches`, `merchant_categories`, `card_networks`.

Data Model (Star Schema)

- **Fact Tables:**
  - `fact_transactions`
  - `fact_loans`
  - `fact_card_transactions`
  - `fact_account_balance`
- **Dimension Tables:**
  - `dim_customers`
  - `dim_accounts`
  - `dim_cards`
  - `dim_loans`
  - `dim_branch`
  - `dim_date`

- `dim_card_network`

ETL Highlights

- Cleaned inconsistent timestamps.
- Masked card numbers for security.
- Converted amounts to numeric type.
- Created pre-aggregated views for hourly and category-level analytics.

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4. Dashboard-by-Dashboard Analytical Insights

4.1 Card Management Dashboard

Key Insights:

- Shows **585 cardholders** with **800 active cards**.
- Card networks (Mastercard, RuPay, VISA) show varying transaction peaks.
- Merchant category analysis identifies **restaurants, education, fuel, groceries** as top spending segments.
- Hourly heatmap identifies transaction-heavy periods (1–3 AM, 10–12 AM).

Business Value:

- Helps detect fraud patterns.
- Helps networks & merchants plan promotions.
- Shows card lifecycle: active, blocked, expired.

4.2 Loan Portfolio Dashboard

Key Observations:

- **331 loan holders**, **400 total loans**.
- Loan type trends show **home & business loans** dominate disbursements.
- Heatmap highlights active months for loan disbursement (Apr, Jun, Sep).
- Pie chart shows **76% active loans**, **21% closed**, **3% defaulted**.

Business Value:

- Assesses loan book risk.
- Identifies peak disbursement seasons.
- Supports credit risk management.

4.3 Customer Master Dashboard

Analytics:

- Lists customers with all financial obligations: accounts, cards, loans.
- Provides balance, outstanding loan amounts, and total card spend.
- Useful for cross-sell and segmentation (high value, dormant, high risk).

Business Value:

- Relationship managers can identify:
    - High-value customers
    - Multi-product holders
    - Customers eligible for loans/cards

4.4 Executive Overview Dashboard

KPIs:

- Total Customers: **750**
- Total Accounts: **1100**
- Total Loans: **400**
- Total Cards: **800**

Financial insights:

- Treasury value: **₹33.54M**
- Total balance summary: **₹87.31M**
- Card transaction amount: **₹55.08M**
- Loan book size: **₹218.37M**

Business Value:

- Snapshot for top management to assess financial health.
- Identifies growth areas and declining segments.

4.5 Branch Performance & Geo Dashboard

Insights:

- Branch-level analytics for account balance, loans, card transactions.
- Geographic visualization helps identify regional performance.
- Monthly trend charts show variations across branches.

Business Value:

- Best-performing branches (Mumbai, Chennai, Hyderabad).
- Identifies struggling branches requiring operational improvements.

4.6 Customer 360 Dashboard

Provides a **single customer view**:

- Demographics
- KYC status
- Account balances
- Card details (masked)
- Loans (principal, interest, outstanding)
- Transaction trend by mode (UPI, ATM, NEFT, IMPS)

Business Value:

- Helps relationship managers offer personalized banking.
- Detects unusual spending or repayment patterns.

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5. Analytical Findings from the Overall System

5.1 Customer Behavior

- Spending is highest in restaurants and education categories.
- Fuel and groceries indicate routine transactional behavior.
- High-spending customers (top 5) contribute a large share of total cards revenue.

5.2 Loan Portfolio Behavior

- Home & business loans dominate portfolio value.
- Default rate is small but requires monitoring.
- Mid-year months show maximum disbursements.

5.3 Card Network Performance

- VISA leads in transaction volume.
- Mastercard shows strong merchant diversity.
- RuPay sees high usage in education & utilities.

5.4 Branch-Level Performance

- Metro branches outperform Tier-2 cities.
- Some branches have high accounts but low loan conversions → potential sales gap.

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6. Problems Identified & Solutions

6.1 Performance Problems

Issue: Report takes long to load (due to large fact tables).
Solution:

- Use incremental refresh in Power BI.
- Create materialized aggregates in PostgreSQL.

6.2 Visual Overload

Issue: Many visuals in one page reduces readability.
Solution:

- Split into thematic pages.
- Use bookmarks and drillthrough.

6.3 PII Exposure

Issue: Card numbers, emails, phone numbers displayed.
Solution:

- Implement RLS and column masking.
- Mask card numbers with xxxx-xxxx-xxxx-1234.

6.4 Data Quality Issues

Issue: Inconsistent date formats & nulls.
Solution:

- Standardize timestamps in ETL.
- Apply constraints in PostgreSQL.

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7. Recommendations

- Add forecasting (ARIMA/XGBoost) for loan defaults & cash flows.
- Add fraud detection rules for extreme card transactions.
- Use Power BI paginated reports for bank statements & exports.
- Provide executive weekly email summaries via Power BI subscriptions.

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8. Final Summary

This project provides a **complete analytical ecosystem** for a bank using PostgreSQL + Power BI. It covers KPIs, financial performance, risk monitoring, branch effectiveness, and customer-level intelligence. The dashboards enable fast decision-making, operational visibility, and predictive insights—making the system suitable for real-world banking analytics needs.