

END-TO-END BANKING CUSTOMER INTELLIGENCE & RISK ANALYSIS USING SQL & POWER BI

Business Problem

The bank aims to improve customer understanding, monitor product performance, and detect potential risk across various banking functions (personal loans, CRM, customer satisfaction, etc.).

Currently, customer, account, loan, and complaint data is siloed across different systems. The leadership team needs a unified, data-driven view to:

- Understand customer demographics and regional trends
- Evaluate loan portfolio performance and risk
- Monitor customer satisfaction and agent performance
- Identify high-risk accounts and high-value customers

The ultimate goal is to build a 360° view of customers and operations.

Data Source

- **Platform:** data.world ([LINK](#))
- **Dataset Name:** Retail Banking Demo Data
- **Provider Note:** Data stitched together from real-world sources; originally based on the **1999 Czech Banking Dataset**, further modified and translated for demo purposes.

Key Notes from Dataset Provider:

- Geospatial data: only accurate at zip code and area code level for MA & NY.
- Addresses: not real (zip codes 40000–60000 mostly random).
- CRM events: built from complaint datasets (contains sentiment-rich text).
- Call logs: linked to CRM events; some calls from alternative numbers for same clients.
- Luxury Loan Portfolio: recently acquired, interest rates generated from 3 factors (e.g., loan size).
- Accounts linked through unique identifiers for core banking structure.

Bank Context

- **Bank Name:** *Eagle National Bank* (fictional institution used for demo).
- **Objective:** Create a data-driven banking intelligence system that integrates core banking + CRM + luxury lending data.

Tables Used

Core Banking Data (Operations & Finance):

- **Accounts** – Core account details
- **Clients** – Customer demographic & identity details
- **Dispositions** – Mapping between clients and accounts
- **Districts** – Regional demographic & economic attributes
- **Cards** – card details linked to accounts
- **Orders** – Standing orders/payment instructions
- **Loans** – Loan portfolio with details of term, amount, payments
- **Transactions** – Transaction-level activity

CRM & Customer Service Data (Engagement & Feedback):

- **CRM Call Logs** – Call center activity logs
- **CRM Events** – Customer service event logs (complaints, inquiries, follow-ups)
- **CRM Reviews** – Customer satisfaction feedback and notes

Project Process

We followed a structured approach to transform raw banking and CRM data into actionable insights using SQL and Power BI:

1. **Data Understanding & Preparation**
 - Studied the provided datasets (Core Banking + CRM).
 - Identified key business entities (customers, accounts, loans, transactions, CRM interactions).
2. **SQL Query Development**
 - Built SQL queries for each table to extract relevant features (balances, loan payments, customer demographics, complaints, etc.).
 - Applied cleaning and formatting (date handling, null value treatment, financial logic checks).
3. **Data Integration via SQL Views**
 - Combined relevant queries into reusable **SQL Views** for each business area.
 - This step reduced complexity in Power BI and ensured consistent logic across dashboards.
4. **Power BI Dashboard Development**
 - Imported the views directly into Power BI.
 - Designed 4 dashboards aligned with business objectives.
 - Used slicers, KPIs, and drilldowns for interactivity.

SQL Views by Dashboard

Dashboard 1: Customer Demographics & Segmentation

- **Dashboard1_ClientView** → Integrated client details, demographics, and segmentation.

Dashboard 2: Account & Transaction Behaviour

- **Dashboard2_transaction_summary** → Account summary (balances & activity).
- **Dashboard2_TransactionTrends1** → Monthly transaction patterns.
- **Dashboard2_TransactionTrends2** → Monthly balance patterns.
- **Dashboard2_TransactionPatterns** → Odd-hour/high-value transaction monitoring.
- **Dashboard2_DormancyBehavior** → Inactive/dormant account identification.
- **Dashboard2_PaymentBehavior** → Customer payment style & frequency.

Dashboard 3: Loan Performance & Financial Risk

- **Dashboard3_LoanPerformance** → Loan approval, repayment, default, and risk behaviour.

Dashboard 4: CRM & Customer Satisfaction

- **dashboard4_CRM_Complaints** → Complaints raised and resolution timelines.
- **dashboard4_CRM_CallLogs** → Call center interaction analysis.
- **dashboard4_CRM_Reviews** → Customer satisfaction and review patterns.

Dashboard Insights

Dashboard 1 — Customer Demographics & Segments

Insights:

- Customer base is well-balanced by gender (51% male, 49% female) and mostly working-age adults (25–45 years). Seniors make up ~16% but show very low card adoption (2.2%).
- Product penetration is uneven: accounts dominate (77%), while cards (13%) and loans (10%) are underpenetrated, signalling opportunity for cross-sell.
- High-value clients (10%) are concentrated in the Northeast (55%), with New York City alone holding \$20M+ in balances.
- Younger clients (teens & young adults) show stronger card adoption (20–31%), suggesting future growth potential if nurtured.

Dashboard 2 — Account & Transaction Behaviours

Insights:

- Accounts are largely active (99.7%), with minimal dormancy (14). Dormancy breaks are rare and sporadic, indicating limited reactivation success.
- Transaction activity is high-volume and high-value: 1.05M transactions worth \$6.23B, averaging ~\$45k per account.
- Cash withdrawals dominate (41%), followed by interbank remittances (20%), reflecting a reliance on traditional banking methods despite digital options.
- Regional patterns: Northeast drives the bulk of activity (54% of total transactions, \$3.38B) and holds the highest balances (\$108M).
- Net inflows consistently exceeded outflows between 2013–2018, leading to a steady rise in closing balances from \$21M → \$202M.

Dashboard 3 — Loan Performance & Financial Risk

Insights:

- Portfolio includes 682 loans worth \$103M with an average size of ~\$151K.
- Loan risk profile is concerning: 59% charged-off and 4.6% defaulted, leaving less than 30% active/performing.
- Loan purposes are heavily concentrated in home loans (74%), with debt consolidation (22%) as secondary.
- High-risk loans (defaulted or charged-off) are disproportionately in the Northeast (229 loans), followed by the South (101).
- Longer-term loans (37–60 months) show the highest risk, making up more than half of defaults/charge-offs.
- Default frequency peaked in 2014 but has since declined, suggesting some tightening of lending standards.

Dashboard 4 — CRM & Customer Satisfaction

Insights:

- Total 21K complaints logged, with 79.5% resolved but a sizable 18% disputed post-resolution.
- Top complaint drivers: account opening/management (25%), deposits/withdrawals (17%), and funds being held (9%), indicating friction in basic banking services.
- Northeast accounts for the most complaints (11K+), aligning with its dominance in client base and balances.
- Customer satisfaction varies: South scores highest (avg. 4.6 stars), while the Midwest lags (2.6 stars for Eagle Capital products).
- Average handling time is reasonable (~10 min), though escalations take longer (~13 min).
- A small set of repeat complainers (top 10 clients lodged 11–14 complaints each) highlight unresolved service pain points.

Final Combined Insights & Recommendations

Cross-Dashboard Insights

- Northeast is the powerhouse region, leading in client count, balances, transactions, loans, and complaints. It is both the strongest market and the riskiest (high loan charge-offs, high complaints).
- Younger customers show high engagement with cards but low penetration overall. This segment is crucial for digital growth.
- Loans are the weakest-performing product, with unsustainable charge-off rates (>59%). Loan duration strongly correlates with risk.
- CRM data mirrors financial data: regions with high balances and loan exposure (Northeast, South) also show the most complaints. Customer experience issues are concentrated in routine banking services.
- Despite risks, overall bank balances grew 10x in 5 years (2013–2018), driven by consistent inflows and active account base.

Recommendations

1. Credit Risk Overhaul

- Tighten credit policies for long-tenure loans (37+ months).
- Expand monitoring and restructuring programs in high-risk regions, especially Northeast.
- Consider diversifying loan purposes beyond home/debt consolidation to spread risk.

2. Customer Engagement & Cross-Sell

- Target younger clients with digital-first card and loan offers.
- Develop senior-friendly products (low-fee cards, simplified digital channels) to increase penetration.
- Leverage high-value clients in the Northeast with wealth management and premium services.

3. CRM & Service Excellence

- Prioritize resolution quality: reducing the 18% disputed resolutions is as important as resolution speed.
- Simplify processes for account opening and deposits/withdrawals (top complaint categories).
- Focus Midwest improvements — lowest satisfaction scores signal a regional service gap.
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4. Strategic Growth

- Build on strong balance inflows by encouraging investment-linked accounts.
- Explore digital transaction adoption to reduce reliance on cash withdrawals.
- Align complaint analytics with transaction patterns to identify root causes.

Executive Takeaway

The bank is financially strong and growing, with a large and active customer base. However, loan performance and service quality pose significant risks. Addressing loan charge-offs, improving customer experience, and deepening product penetration (especially cards and loans) among young and senior segments can unlock sustainable growth while reducing risk exposure.