# Business Analysis Report: Data-Driven Loan Personalization in Mobile Banking

01. Executive Summary

This report outlines a strategic solution to address the low uptake of loan products via the mobile banking application, despite high overall app engagement. The core objective is to leverage existing customer data to personalize and recommend suitable loan products, thereby increasing conversions and enhancing customer engagement within the mobile banking app. The proposed solution encompasses detailed analysis of stakeholders, process flows, functional and non-functional requirements, specific use cases, data needs, and success metrics, all geared towards a data-driven personalization engine.

02. Stakeholder Map

The following Mermaid diagram illustrates the key stakeholders involved in the project, demonstrating their interdependencies and relationships.
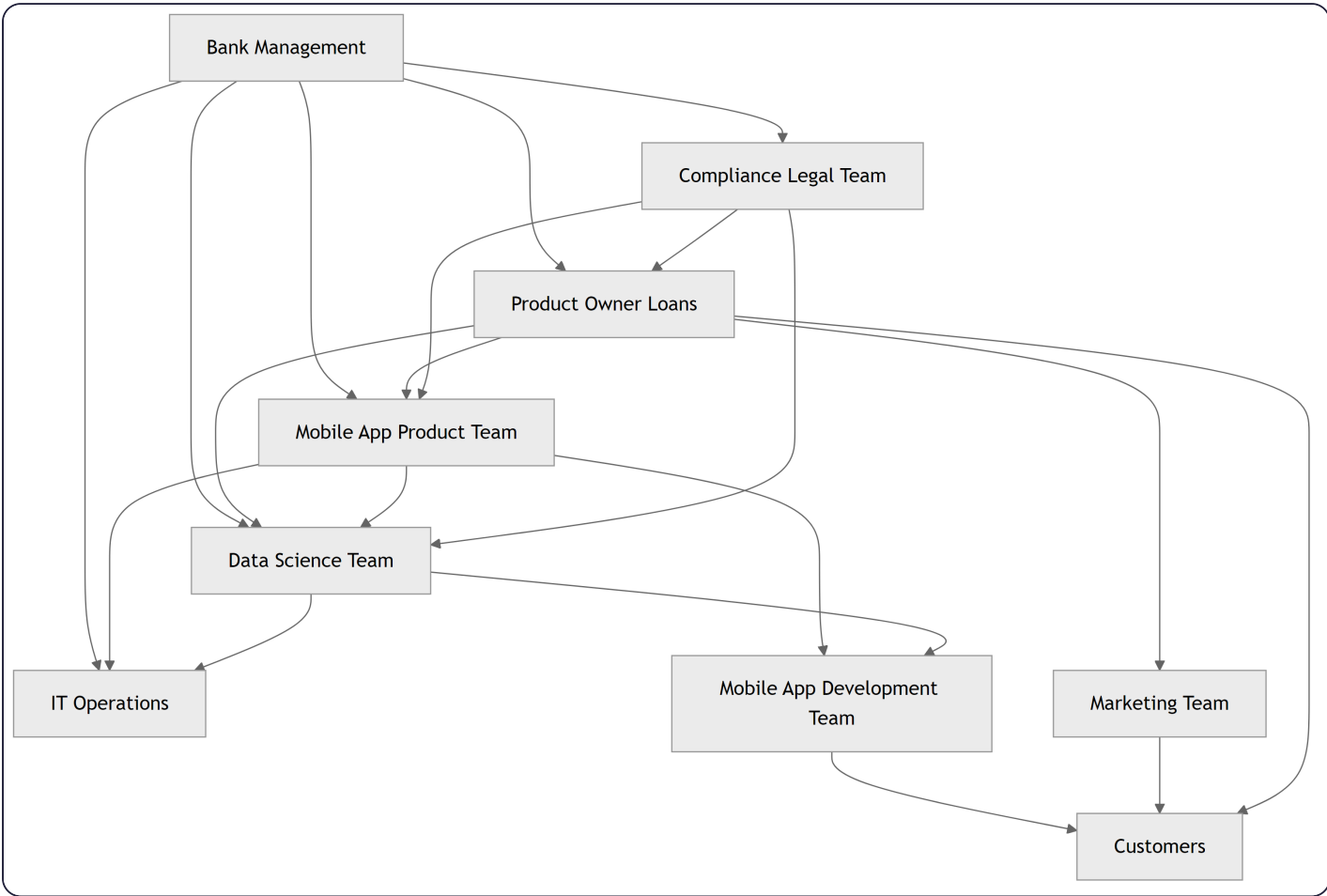
03. Process Flow for Personalized Loan Offer Uptake

This Mermaid diagram illustrates the proposed new process flow for a customer interacting with personalized loan offers within the mobile banking app.
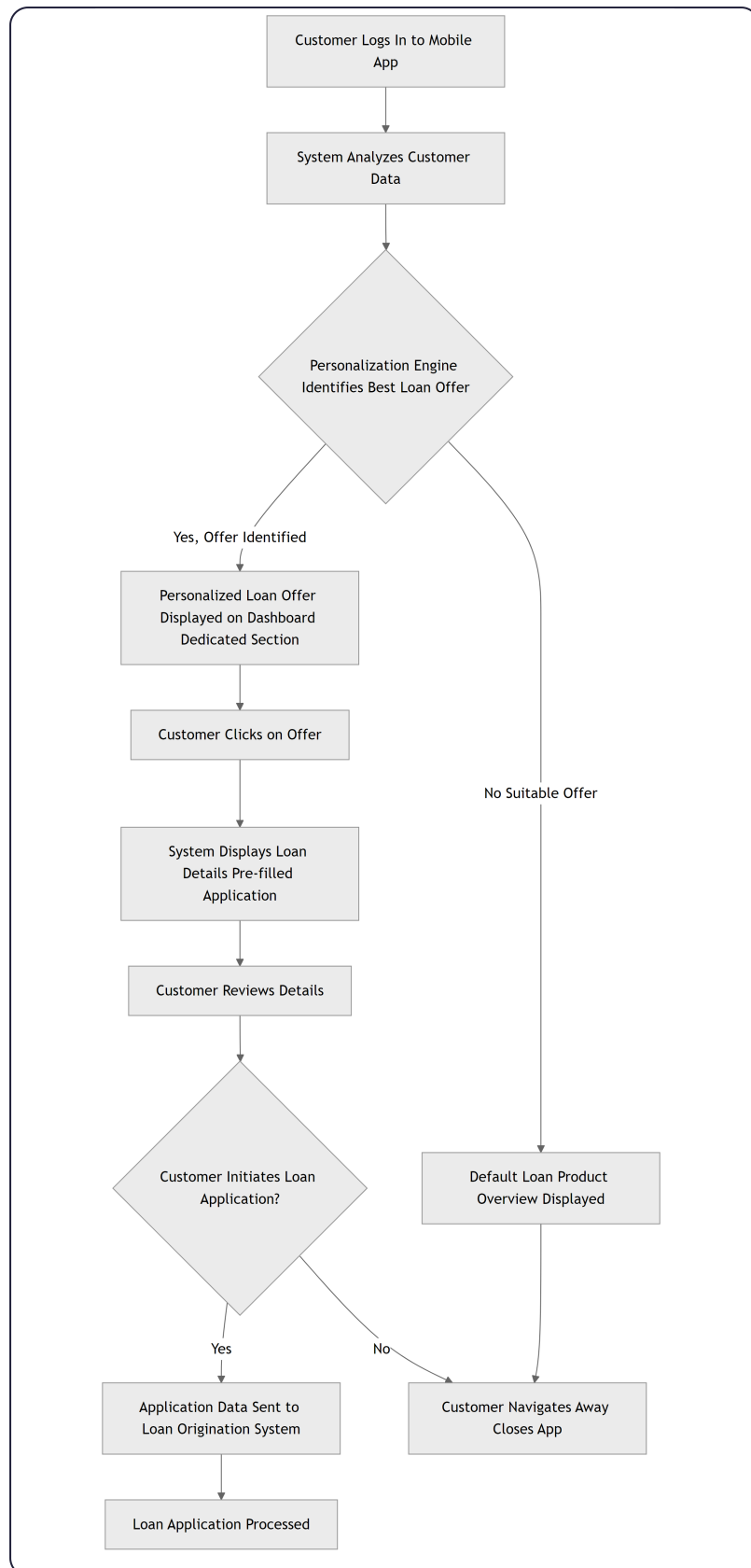
04. Business Requirement Document (BRD)

4.1. Project Overview

- **Project Title:** Data-Driven Loan Personalization in Mobile Banking
- **Problem Statement:** Low loan product uptake via the mobile banking app despite high general app engagement.
- **Business Goal:** Increase loan application conversions and enhance customer engagement through personalized loan recommendations on the mobile banking app.
- **Vision:** To empower customers with relevant financial solutions at the right time, fostering trust and improving the utility of the mobile banking platform.

4.2. Business Objectives

1. Increase the mobile app loan application conversion rate by at least 15% within 6 months of launch.
2. Improve customer engagement with loan-related features by 20% (e.g., click-through rates, time spent on loan pages).
3. Enhance customer satisfaction by providing relevant and timely loan product information.
4. Leverage existing internal customer data sources effectively to drive business growth.
5. Establish a scalable and compliant personalization framework for future product offerings.

4.3. Business Scope (High-Level)

- **In Scope:**
  - Development of a personalization engine to identify suitable loan products.
  - Integration of the personalization engine with the mobile banking application.
  - Display of personalized loan recommendations on the mobile app dashboard or a dedicated loan section.
  - Tracking of customer interactions with personalized offers (clicks, views, applications started).
  - Utilization of existing customer data (KYC, income, transaction history, app engagement).

- **Out of Scope:**
  - Changes to the core loan origination system or backend credit approval workflows.
  - Development of new loan products.
  - Integration with external third-party data sources (unless explicitly required and approved later).
  - Offline marketing activities related to loans.

4.4. Success Metrics (High-Level)

- Percentage increase in loan applications initiated via the mobile app.
- Conversion rate of personalized loan offer views to applications.
- Click-through rate (CTR) on personalized loan recommendations.
- Customer satisfaction scores related to mobile app experience and financial recommendations.

05. Functional Requirement Specification (FRS)

5.1. Functional Requirements (FRs)

The system **shall** be able to:

- **FR-001: Data Ingestion & Processing:** Ingest customer data from various source systems (e.g., Core Banking, CRM, Transaction Database, Mobile App Analytics) in near real-time or scheduled batches.
- **FR-002: Personalization Engine:** Analyze ingested customer data (e.g., income bracket, transaction behavior, existing loan products, app engagement patterns) to identify and rank the most suitable loan products for each individual customer.
- **FR-003: Recommendation Logic Configuration:** Allow business users (e.g., Product Owners) to configure and fine-tune recommendation rules and priorities (e.g., prioritize high-margin products, exclude already held products).
- **FR-004: Recommendation Display:** Display personalized loan offers prominently on the mobile banking app dashboard or a dedicated 'Loans' section.
- **FR-005: Offer Details View:** Allow customers to tap on a recommended loan offer to view detailed information (e.g., interest rates, terms, eligibility criteria, required documents).
- **FR-006: Pre-filled Application:** Pre-fill relevant sections of the loan application form with available customer data (e.g., name, address, existing account details) upon customer initiation.
- **FR-007: Call to Action:** Provide clear call-to-action buttons (e.g., "Apply Now," "Learn More") for each recommendation.
- **FR-008: Tracking & Analytics:** Track customer interactions with personalized offers, including views, clicks, and application initiation events.
- **FR-009: Offer Expiration/Validity:** Support setting validity periods for specific offers or campaigns.
- **FR-010: Feedback Mechanism (Optional):** Allow customers to provide feedback on the relevance of recommendations (e.g., "Not interested," "Already have this").
- **FR-011: Campaign Management:** Enable the marketing team to launch and manage targeted campaigns using the personalization engine.

## 5.2. Non-Functional Requirements (NFRs)

- **NFR-001: Performance:**
  - **Response Time:** Personalized recommendations shall be displayed within 2 seconds of the user logging into the mobile app.
  - **Data Processing:** The personalization engine shall process and update customer data profiles for recommendations within 4 hours of new data availability.

- **NFR-002: Security:**
  - **Data Encryption:** All sensitive customer data (PII, financial details) shall be encrypted both in transit (TLS 1.2+) and at rest (AES-256).
  - **Access Control:** Access to the personalization engine and its underlying data shall be restricted to authorized personnel based on the principle of least privilege.
  - **Authentication:** The mobile app shall require strong user authentication before displaying any personalized financial information.
  - **Vulnerability Management:** The system shall undergo regular security audits and penetration testing.

- **NFR-003: Data Privacy & Compliance:**
  - **Consent Management:** The system shall respect customer consent preferences regarding data usage for personalization and marketing.
  - **Anonymization/Pseudonymization:** Where possible and appropriate, data used for training models or analytics shall be anonymized or pseudonymized.
  - **Regulatory Compliance:** The solution shall comply with all relevant banking regulations (e.g., local data protection laws, consumer protection laws).
  - **Data Retention:** Data shall be retained only for as long as necessary, adhering to bank policies and regulatory requirements.

- **NFR-004: Scalability:**

- The personalization engine shall be capable of handling an increase in customer base by 50% over 3 years without significant performance degradation.
- The mobile app display mechanism shall scale to accommodate increased traffic during peak hours.
- **NFR-005: Reliability/Availability:**
  - The personalization service shall have an uptime of 99.9% during banking hours.
  - The system shall incorporate robust error handling and logging mechanisms.

- **NFR-006: Usability:**
  - Personalized offers shall be presented clearly and intuitively within the mobile app interface.
  - The navigation to view offer details and initiate applications shall be seamless.

- **NFR-007: Auditability:**
  - All changes to recommendation rules and parameters shall be logged and auditable.
  - Customer interactions with personalized offers shall be traceable.

06. Use Case Diagrams and Detailed Scenarios

6.1. Use Case 1: Recommending loan offers based on income bracket and transaction behavior

Use Case Diagram:
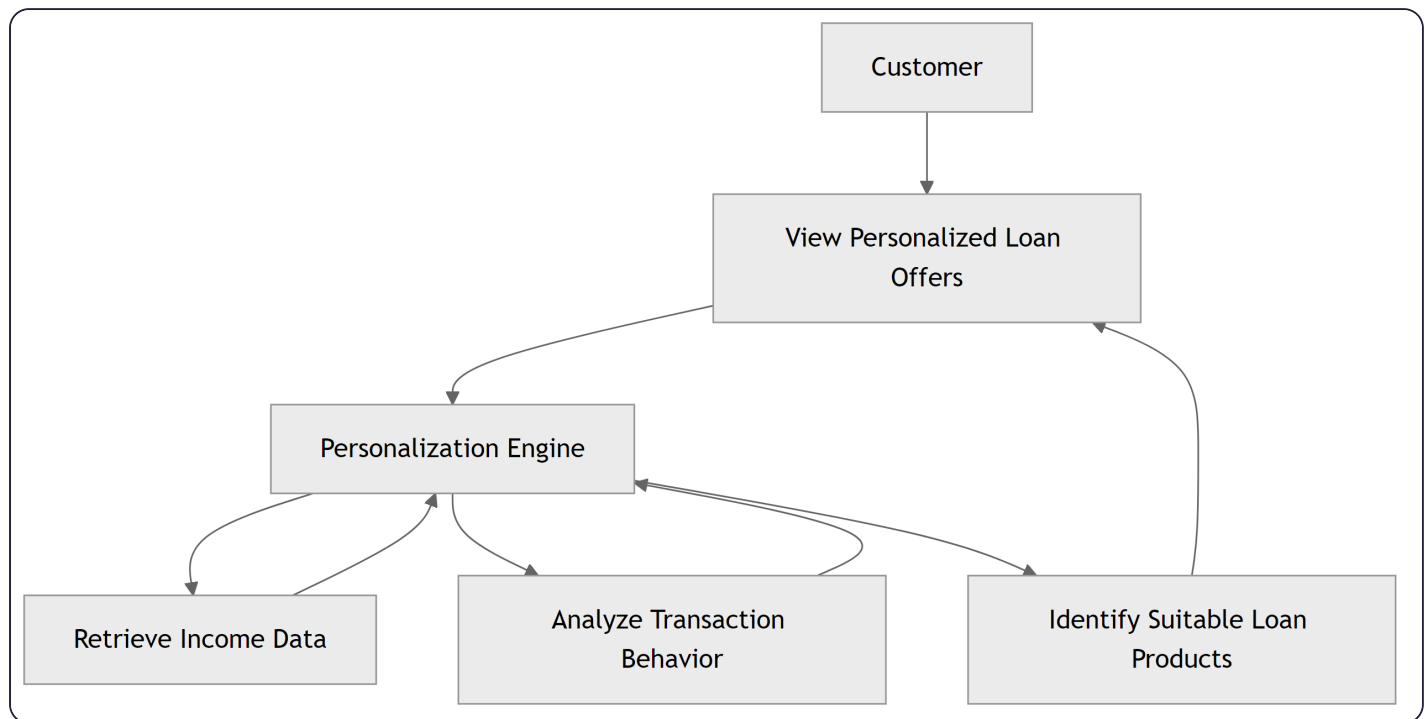
Detailed Scenario: Recommend Loan by Income & Transaction

- **Use Case Name:** Recommend Loan by Income & Transaction
- **Actor(s):** Customer, Personalization Engine, Core Banking System, Transaction History Database
- **Goal:** For the customer to see a loan offer relevant to their financial capacity and spending habits.
- **Pre-conditions:**
  - Customer is logged into the mobile banking app.
  - Customer's income data is available in Core Banking.

- Customer's transaction history is available in the Transaction History Database.
- Personalization engine is operational.
- **Trigger:** Customer logs into the mobile app OR navigates to the 'Loans' section.
- **Main Flow:**
    1. Customer logs into the mobile banking app.
    2. The Mobile App sends a request for personalized content to the Personalization Engine.
    3. The Personalization Engine retrieves the customer's latest income data from the Core Banking System.
    4. The Personalization Engine analyzes the customer's transaction behavior (e.g., high spending on retail, regular large deposits, existing debts) from the Transaction History Database.
    5. Based on income bracket and transaction patterns, the Personalization Engine identifies the most suitable loan product(s) (e.g., a higher-value personal loan for high income/responsible spending, or a debt consolidation loan for certain spending patterns).
    6. The Personalization Engine sends the recommended loan offer(s) to the Mobile App.
    7. The Mobile App displays the personalized loan offer(s) prominently on the dashboard or dedicated loan section.
    8. Customer views the recommended offer.

- **Alternate Flow 1 (No Suitable Offer):**
    - If the Personalization Engine identifies no suitable personalized offer based on current data, it displays a generic list of popular loan products or a message indicating no specific recommendations at this time (Refer to E in Process Flow).

- **Alternate Flow 2 (Data Unavailable):**
    - If income or transaction data is incomplete/unavailable, the Personalization Engine defaults to a broader set of rules or general product displays.

- **Post-conditions:**
    - Customer has viewed personalized loan offers.
    - Customer interaction with the offer (view/click) is logged for analytics.

6.2. Use Case 2: Targeting customers with education expenses for educational loan promotions

Use Case Diagram:
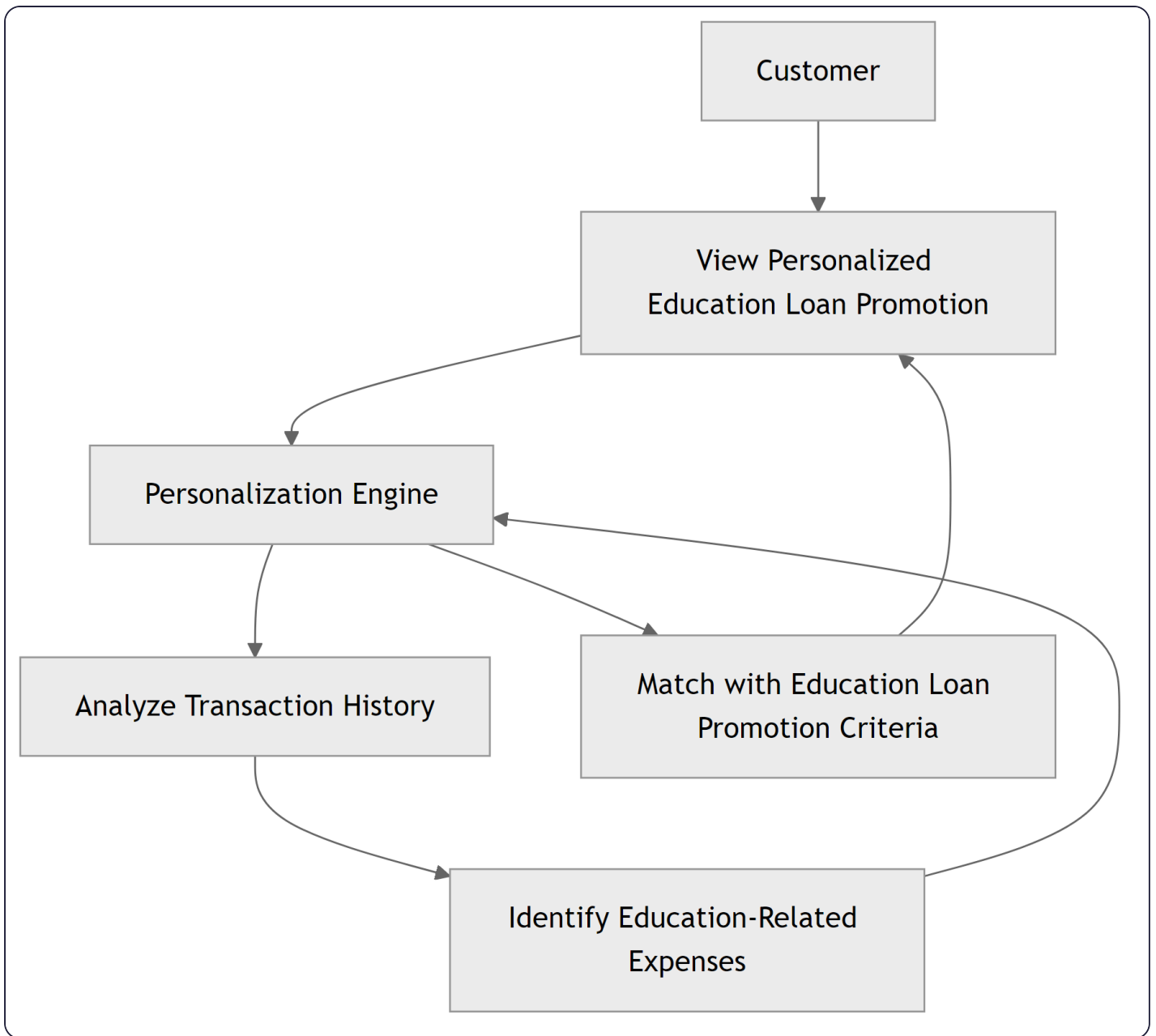
**Detailed Scenario: Target Education Loan Promotions**

- **Use Case Name:** Target Education Loan Promotions
- **Actor(s):** Customer, Personalization Engine, Transaction History Database
- **Goal:** For the customer to receive targeted promotions for educational loans based on their spending.
- **Pre-conditions:**
  - Customer is logged into the mobile banking app.
  - Customer's transaction history is available.
  - Educational loan promotion criteria are configured in the Personalization Engine.

- **Trigger:** Personalization Engine periodically processes customer data OR Customer logs into the mobile app.
- **Main Flow:**
  1. The Personalization Engine continuously (or on login) analyzes the customer's transaction history.
  2. The Personalization Engine identifies transactions categorized as education-related expenses (e.g., tuition fees, book purchases, educational software, payments to schools/universities).
  3. If a predefined threshold of education-related expenses is met or specific keywords/merchant categories are identified, the Personalization Engine flags the customer for educational loan promotion.

4. The Personalization Engine sends the specific educational loan promotion to the Mobile App.
5. The Mobile App displays the targeted promotion, potentially with a specific message like "Considering further studies? Our education loan might help!"
6. Customer views the targeted promotion.

- **Alternate Flow 1 (No Relevant Transactions):**
  - If no education-related transactions are identified, this specific promotion is not displayed to the customer.

- **Alternate Flow 2 (Customer Already Has Education Loan):**
  - If the customer already has an existing education loan with the bank, the Personalization Engine excludes them from this promotion unless rules specify otherwise (e.g., for refinancing).

- **Post-conditions:**
  - Customer has viewed a targeted educational loan promotion.
  - Customer interaction with the promotion is logged.

6.3. Use Case 3: Pre-approval and alerting customers with consistent salary inflow for personal loans

Use Case Diagram:
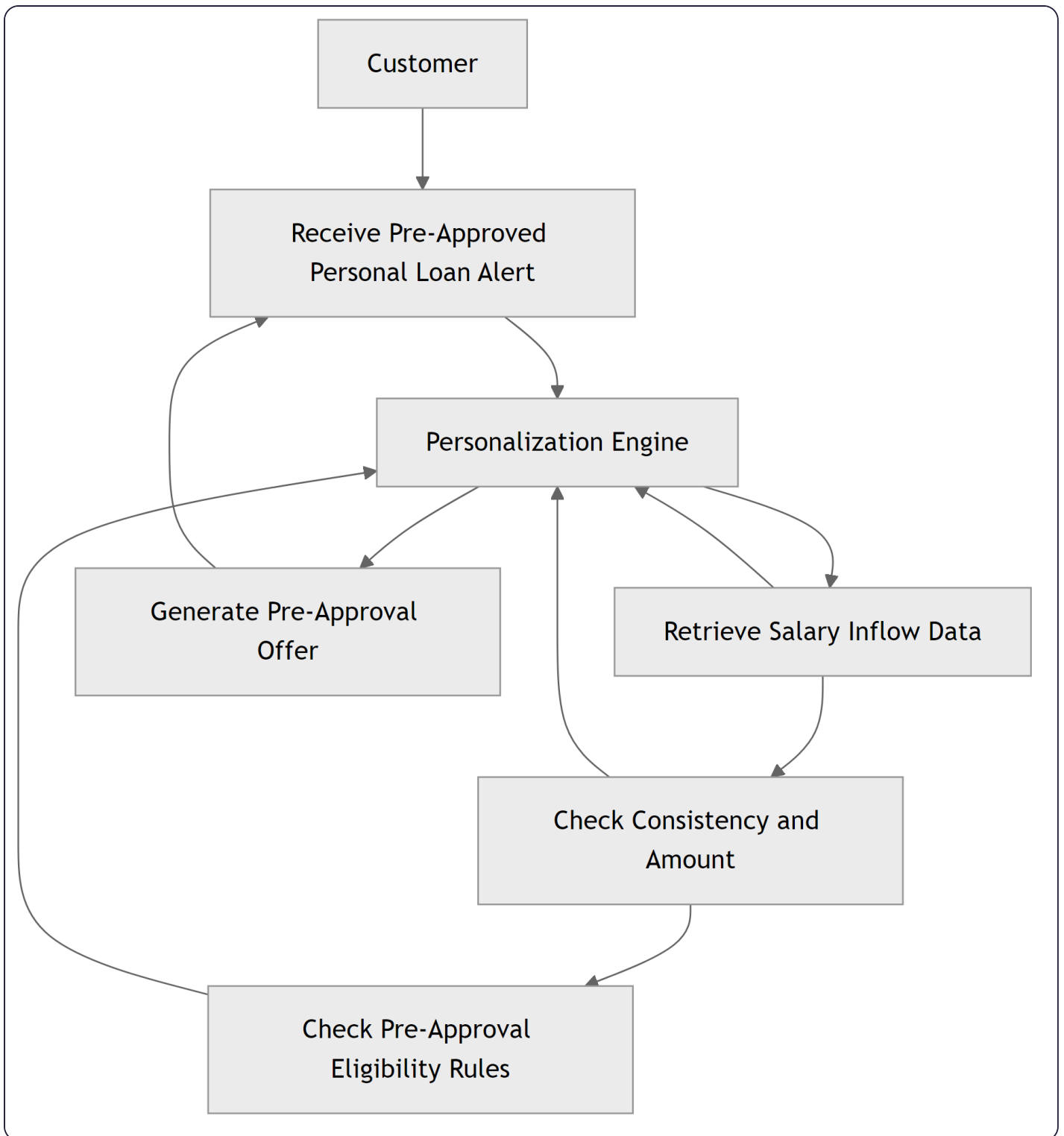
Detailed Scenario: Pre-Approved Personal Loan Alert

- **Use Case Name:** Pre-Approval Alert for Personal Loans
- **Actor(s):** Customer, Personalization Engine, Core Banking System, Credit Scoring System
- **Goal:** For the customer to be alerted about a pre-approved personal loan offer based on consistent salary deposits.
- **Pre-conditions:**
    - Customer has an active account with consistent salary deposits.
    - Customer's credit score data is accessible.
    - Pre-approval rules are configured in the Personalization Engine (or linked to Credit Scoring).

- **Trigger:** Personalization Engine periodically processes customer account activity for salary detection, OR Customer logs into the mobile app.
- **Main Flow:**

1. The Personalization Engine retrieves customer account transaction data from the Core Banking System.
2. The Personalization Engine analyzes deposit patterns to identify consistent salary inflows (e.g., same amount, same sender, regular frequency).
3. If consistent salary inflow is detected for a predefined period (e.g., 6 consecutive months) and meets a minimum threshold, the Personalization Engine then queries the Credit Scoring System (or its internal rules) for pre-approval eligibility.
4. If the customer meets the pre-approval criteria, the Personalization Engine generates a specific pre-approved personal loan offer (e.g., amount, interest rate).
5. The Personalization Engine sends a push notification or an in-app alert to the Mobile App, informing the customer about their pre-approved personal loan offer.
6. Customer taps on the alert/notification and views the pre-approved offer details within the app.

- **Alternate Flow 1 (Inconsistent Inflow):**
  - If salary inflow is inconsistent or below the threshold, no pre-approved offer is generated.

- **Alternate Flow 2 (Failed Credit Check):**
  - If the customer does not meet pre-approval credit criteria despite consistent salary, no pre-approved offer is generated, and a generic loan offer may be displayed instead if applicable.

- **Alternate Flow 3 (Customer Already Has Personal Loan):**
  - If the customer already has a personal loan, the Personalization Engine might offer a top-up or refinancing option if rules permit, or simply suppress the offer.

- **Post-conditions:**
  - Customer has received and viewed a pre-approved personal loan offer.
  - Customer interaction with the offer is logged.

07. Data Mapping Sheet and Data Requirements Analysis

This section outlines the essential data elements required for the personalization engine, their sources, characteristics, and considerations.

Data Element	Source System(s)	Data Type	Frequency/Freshness	Purpose for Personalization	Availability (Y/N)	PII/Sensitivity	Data Owner	Transformation/Processing	Remarks/Privacy Concerns
Customer ID (CIF)	Core Banking, CRM	String	Real-time	Unique customer identification	Y	PII	Core Banking Team	N/A	Essential for linking all data
Income (Declared)	KYC System, Core Banking	Numeric	As per KYC update	Income bracket-based loan eligibility	Y	PII, Sensitive	KYC Team	Normalization if varied formats	Requires explicit customer consent for use beyond KYC.

Data Element	Source System(s)	Data Type	Frequency/Freshness	Purpose for Personalization	Availability (Y/N)	PII/Sensitivity	Data Owner	Transformation/Processing	Remarks/Privacy Concerns
Income (Inferred - Salary)	Core Banking, Transaction History DB	Numeric	Daily/Real-time	Consistent salary inflow for pre-approvals	Y	Sensitive	Core Banking Team	Pattern recognition, aggregation	Requires robust anonymization for analytics.
Transaction History (Categories)	Transaction History DB	Categorical	Real-time	Spending habits, identifying needs (e.g., education, home improvement)	Y	Sensitive	Data Warehouse Team	Categorization (e.g., education, medical, auto)	Granular transaction data is highly sensitive.
Transaction History (Amounts)	Transaction History DB	Numeric	Real-time	Spending capacity, debt service ratio	Y	Sensitive	Data Warehouse Team	Aggregation, sum per category	Minimized retention, purpose limitation.
Existing Loan Products	Core Banking	List/String	Daily	Exclude already held products, suggest top-ups/refinance	Y	Sensitive	Loan Product Team	Filter existing products	Ensure accuracy to avoid irrelevant offers.
Account Balance (Avg.)	Core Banking	Numeric	Daily	Financial stability, liquidity assessment	Y	Sensitive	Core Banking Team	Averaging over time	Use with caution, can be highly volatile.
Credit Score/History	Credit Scoring System, Core Banking	Numeric	Monthly/On-request	Pre-approval eligibility, risk assessment	Y	Sensitive	Risk Management Team	N/A	Very high sensitivity, strict access control.

Data Element	Source System(s)	Data Type	Frequency/Freshness	Purpose for Personalization	Availability (Y/N)	PII/Sensitivity	Data Owner	Transformation/Processing	Remarks/Privacy Concerns
Demographics (Age, Family Status)	KYC System, CRM	Numeric/String	As per KYC update	Segment-based targeting (e.g., young families for home loans)	Y	PII	KYC Team, CRM Team	N/A	Ensure purpose limitation.
Mobile App Engagement (Last Login, Feature Usage)	Mobile App Analytics	Timestamp, String	Real-time	Active users, preferred features, channel preference	Y	Public	Mobile App Product Team	Aggregation, frequency calculation	Can be linked to PII, handle with care.
Location Data (Optional)	Mobile App Analytics	Geo-coordinate	Real-time	Geo-specific offers (if applicable)	N	PII	Mobile App Product Team	Aggregation to city/state	Requires explicit user consent, often opt-in.
KYC Status	KYC System	String	Real-time	Eligibility for certain products	Y	PII	KYC Team	N/A	Crucial for regulatory compliance.
Customer Preferences (Opt-in/out)	CRM, Marketing Automation	Boolean	Real-time	Respect marketing/privacy preferences	Y	PII	Marketing Team	N/A	Critical for compliance and customer trust.

7.1. Data Requirements Analysis:

- **Data Availability vs. Collection:** Most identified data points (Customer ID, Income, Transaction History, Existing Loans, Account Balance, Credit Score, Demographics, App Engagement, KYC Status, Customer Preferences) are generally available within the bank's existing systems. Location data might require explicit opt-in from users and may not be consistently available or fully utilized for loan products currently.
- **Data Minimum Requirement:** The absolute minimum data for basic personalization would be **Customer ID**, **Income**, and **Transaction History (categorized)**. Adding **Existing Loan Products** and **Credit Score** significantly enhances relevance and accuracy.

- **Data Quality:** High data quality (accuracy, completeness, consistency, timeliness) is paramount. Inaccurate income or miscategorized transactions will lead to irrelevant recommendations, damaging customer trust.
- **Data Freshness:** Real-time or near real-time data for transaction history and mobile app engagement is crucial for dynamic recommendations. Income and KYC data can be updated less frequently.
- **Data Transformation/Processing:**
  - **Normalization:** Income data may need to be normalized if captured in different formats or currencies.
  - **Categorization:** Raw transaction data needs robust categorization into meaningful segments (e.g., "Education," "Rent," "Utilities," "Shopping," "Salary Deposit"). This may involve AI/ML models or rule-based systems.
  - **Aggregation:** Sums and averages of transaction amounts over time, frequency of certain transaction types.
  - **Pattern Recognition:** For salary detection or identifying recurring expenses.
  - **De-duplication & Reconciliation:** Ensuring a single, consistent customer view across all sources.
- **Privacy Concerns:** Data privacy is paramount. All PII and sensitive data must be handled in strict compliance with banking regulations and data protection laws (e.g., GDPR, CCPA, local banking secrecy acts). Consent management for data usage, strong access controls, encryption, and anonymization/pseudonymization strategies are mandatory.

08. Functional Scope Summary (In/Out of Scope)

8.1. In Scope

- **Personalization Engine Development:** Design, build, and deploy a robust engine capable of processing customer data and generating relevant loan recommendations.
- **Mobile App Integration:** Integration of the personalization engine's output into the existing mobile banking application for display of personalized offers.
- **Recommendation Display UI/UX:** Development or modification of user interface elements within the mobile app to effectively present personalized loan offers (e.g., dashboard widgets, dedicated loan section cards).
- **Customer Data Ingestion:** Development of interfaces or connectors to ingest data from Core Banking, Transaction History DB, CRM, KYC, Credit Scoring, and Mobile App Analytics systems.
- **Click-Through & Application Initiation Tracking:** Implementation of tracking mechanisms to monitor customer interactions with personalized offers and the initiation of loan applications.
- **Basic Analytics & Reporting:** Capabilities to report on the performance of personalized recommendations (e.g., CTR, conversion rates).
- **Consent Management Integration:** Ensuring that the personalization engine respects customer privacy preferences and consent choices.

8.2. Out of Scope

- **Core Loan Origination System (LOS) Changes:** Any modifications to the bank's core LOS for loan application processing, underwriting, or disbursement. The project focuses solely on the *recommendation and initiation* phase.
- **New Loan Product Development:** Creation of any new loan products is outside this project's scope. The project utilizes existing loan products.
- **Backend Credit Approval Process Automation:** No changes to the automated or manual credit approval workflows behind the scenes.
- **Physical Document Collection/Processing:** This project focuses on digital interaction; physical processes are unchanged.

- **Branch/Call Center Staff Training (beyond basic awareness):** In-depth training for branch staff on new loan product features or LOS changes is not part of this scope. Training will be limited to how to address customer queries related to mobile app personalized offers.
- **Integration with External Third-Party Data Providers:** Unless explicitly identified as a *critical dependency* during detailed design and approved by stakeholders, leveraging external data is out of scope.
- **Full ML Model Retraining Automation:** While the engine will use ML, fully automated, unsupervised model retraining pipelines might be a future phase. Initial phases will involve more controlled model updates.

09. Suggested KPIs for Success Measurement

These Key Performance Indicators will be crucial for evaluating the success of the data-driven loan personalization initiative.

1. **Loan Application Conversion Rate (Mobile App):**
   - Formula: (Number of Loan Applications Initiated via Mobile App / Number of Unique Visitors to Loan Section) * 100
   - Target: Increase by X% (e.g., 15%) from baseline within 6 months.

2. **Personalized Offer Click-Through Rate (CTR):**
   - Formula: (Number of Clicks on Personalized Loan Offers / Number of Times Personalized Offers Were Displayed) * 100
   - Target: Achieve a CTR of Y% (e.g., 5-10%).

3. **Conversion Rate of Personalized Offers to Application:**
   - Formula: (Number of Applications Initiated from Personalized Offers / Number of Clicks on Personalized Offers) * 100
   - Target: Achieve a Z% conversion (e.g., 20%).

4. **Uptake Rate of Recommended Loan Products:**
   - Formula: (Number of Disbursed Loans Originating from Personalized Offers / Total Number of Personalized Offers Clicked) * 100
   - Target: Improve this rate by A% (e.g., 10%) compared to generic offers.

5. **Average Time Spent on Loan Product Pages:**
   - Measurement of user engagement with loan details pages after clicking on recommendations.
   - Target: Increase by B% (e.g., 10%) to indicate higher interest.

6. **Customer Satisfaction Score (CSAT) related to Mobile App/Recommendations:**
   - Measured through in-app surveys or post-interaction feedback.
   - Target: Maintain or improve CSAT scores related to mobile app experience.

7. **Number of Unique Loan Product Views per User:**
   - Indicates discovery and exploration of various loan products.
   - Target: Increase this metric over time.

8. **Revenue from Personalized Loan Products:**
   - Tracking the total value of loans disbursed that originated from personalized recommendations.
   - Target: Achieve C% (e.g., 5%) of total new loan revenue from personalized channels.