Customer Churn Analytics & Predictive Revenue Protection

End-to-End Revenue Intelligence System (SQL → Tableau → Machine Learning)

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Executive Overview

This project builds a complete churn intelligence framework that transforms customer attrition from reactive reporting into proactive revenue protection.

Using structured SQL modeling, executive Tableau dashboards, and predictive machine learning, the system identifies high-risk customers before exit and enables financially optimized retention intervention.

Core Outcomes

- **26.54%** churn rate identified
- **1,869** churned customers
- **$139K** monthly recurring revenue at risk
- **86%** churn detection recall (optimized threshold)
- **4–6** percentage-point churn reduction potential
- **$660K–$1.0M** annual revenue protection opportunity

This is not a dashboard project. It is a revenue defense system.

Business Problem

A subscription-based telecom business faced elevated churn without:

- Clear visibility into structural drivers
- Quantified revenue exposure
- Lifecycle-based churn understanding
- Predictive intervention capability

Churn was forcing ongoing acquisition replacement spend and reducing revenue predictability.

The organization required:

- Structured churn segmentation
- Revenue-at-risk quantification
- Executive visibility into high-risk segments
- Predictive churn detection
- Financially aligned retention strategy

Phase 1 — SQL: Revenue Risk Quantification

Objective

Transform raw customer churn data into a clean, analytics-ready structure and identify concentrated churn drivers.

Key Actions

- Ingested and structured raw dataset in SQL Server
- Engineered tenure bands and lifecycle indicators
- Standardized categorical variables
- Computed churn KPIs and revenue exposure metrics
- Segmented churn by contract, payment method, tenure, and service adoption

Key Findings

- Overall churn rate: **26.54%**
- **$139K** monthly recurring revenue at risk
- Month-to-month contracts: **42.7%** churn
- Electronic check users: **45%** churn
- First 6 months: **53%** churn
- Bundled tech support & security reduced churn to single digits

Impact

*Approximately 30% of customers accounted for **~70%** of churn-related revenue exposure.*

Churn was concentrated, structural, and measurable.

Phase 2 — Tableau: Executive Decision Intelligence

Objective

Translate SQL insights into executive-ready dashboards for strategic decision-making.

Dashboards Built

- Executive KPI Overview
- Churn by Contract Type
- Churn by Payment Method
- Tenure Lifecycle Churn
- Service Adoption Impact
- Revenue Exposure Analysis

Executive Insights

- Approximately **$120K** in monthly recurring revenue risk is concentrated in month-to-month customers.
- Fiber customers: high ARPU and high churn risk
- Payment friction strongly correlated with attrition
- Early-tenure instability is the most critical intervention window
- Senior customers show elevated vulnerability

Impact

*Retention strategy shifted from broad discounting to targeted intervention across high-risk segments representing **>75%** of revenue exposure.*

Leadership gained real-time segmentation visibility.

Phase 3 — Machine Learning: Predictive Churn Engine

Objective

Move from descriptive analytics to proactive churn prediction.

Modeling Strategy

Models evaluated:

- Logistic Regression
- Random Forest
- XGBoost

Final model selected: ***XGBoost with revenue-aware threshold optimization***

Model Performance

Metric	ROC-AUC	Accuracy	Recall	Precision	Threshold
Value	0.838	71%	86%	47%	0.35

Evaluation conducted on 1,409 test observations, including 374 churners.

Why Threshold Optimization Matters

Lowering the classification threshold from 0.5 to 0.35:

- Increased churn recall from **76%** → **86%**
- Captured **~37** additional churners in test set
- Scales to **~185–250** additional churners annually
- Estimated incremental protection: **$150K–$220K** annually

This aligns model behavior with financial impact rather than raw accuracy.

Key Predictive Drivers

Consistent across SQL, Tableau, and ML:

- Contract Type (dominant predictor)

- Tenure (early lifecycle risk)
- Tech Support
- Online Security
- Internet Service (Fiber)
- Payment Method

Notably, churn was more structural and behavioral than purely price-driven.

12-Month Projected Business Impact

- **4–6** percentage-point churn reduction
- **300–420** customers retained annually
- **$660K–$1.0M** annual revenue preserved
- **12–18%** Customer Lifetime Value uplift
- **$250K–$400K** reduction in replacement acquisition costs

Retention-led optimization provides higher ROI than acquisition scaling.

The system is production-ready, scalable, and aligned with CRM-triggered retention workflows.

Technical Stack

- SQL Server (data modeling & transformation)
- Tableau (executive dashboards & segmentation)
- Python (Pandas, Scikit-learn, XGBoost)
- Jupyter Notebook

Final Conclusion

This project demonstrates the integration of structured data engineering, executive intelligence, and predictive machine learning into a cohesive revenue protection system.

Churn is now:

- *Quantified*

- *Segmented*
- *Predictable*
- *Financially aligned*
- *Operationally actionable*

The organization moves from observing churn to actively managing and controlling revenue risk.