# **Telecom Business Proposal: Refined Business Case Model with Profitability Analysis**

## **1. Confusion Matrix for Churn Prediction**

## 

## **Data Assumptions:**

**Average Monthly Price (paid by customer) per plan type** (values extracted from benchmark analysis)**:**

* Prepaid → 15,50 €
* Postpaid → 20,50 €
* Pay-as-you-go → 10,50 €

**Churn Rate per plan type:**

* Prepaid → 30.33%
* Postpaid → 31.32%
* Pay-as-you-go → 31.51%

**Past Record of Customer Count:**

* Prepaid → 7040
* Postpaid → 1973
* Pay-as-you-go → 987

## **Definition of Terms:**

* **True Positive (TP):** Correctly identified churners.
* **False Positive (FP):** Non-churners incorrectly predicted as churners.
* **False Negative (FN):** Churners incorrectly predicted as non-churners.
* **True Negative (TN):** Correctly identified non-churners.

## **2. Churn Probability Segments**

**Churn probability determines the intensity of retention strategies:**

* **Low-Intensity Strategy (S1):** T1 ≤ P(Ci) < T2
* **Medium-Low Strategy (S2):** T2 ≤ P(Ci) < T3
* **Medium-High Strategy (S3):** T3 ≤ P(Ci) < T4
* **High-Intensity Strategy (S4):** P(Ci) ≥ T4

Where:

* **P(Ci)**= Probability of churn for customer ii.
* **Tk**= Churn probability thresholds.

## **3. Financial Formulas for Revenue & Cost Analysis**

### **3.1 Lost Revenue from Churners**

Lost revenue is calculated as:

LR = ( CustomersPAYG × ChurnRatePAYG × 10.50 ) + ( CustomersPP × ChurnRatePP × 15.50 ) + ( CustomersPO × ChurnRatePO × 20.50 )

Where:

* **LR** = Total lost revenue due to churn.
* **CustomersPLAN** = Total customers in a specific plan type.
* **ChurnRatePLAN** = Percentage of customers who churn.
* **Plan-specific revenue per customer** = Monthly average revenue per customer for each plan.

### **3.1.1 Calculation**

For **Prepaid**:

LR = ( 7040 × 0.3033 × 15.50 ) = 33,096.10€

For **Postpaid**:

LR = ( 1973 × 0.3132 × 20.50 ) = 12,667.84€

For **Pay-As-You-Go**:

LR = ( 987 × 0.3151 × 10.50 ) = 3,265.54€

**Total**:

Total LR = 33,096.10€ + 12,667.84€ + 3,265.54€ = 49 029.48 €

### **3.2 Expected Revenue (ER) from Retained Customers**

ER = ∑ TPk × R × PRSk

Where:

* **ER** = Expected revenue from successfully retained customers.
* **TPk** = Number of true positives receiving retention strategy Sk.
* **R** = Revenue per retained customer.
* **PRSk** = Probability of successful retention using strategy Sk.

### **3.3 Expected Retention Costs (RC)**

#### **Retention Costs for Predicted Churners (TPs)**

RC1 = ∑ TPk × CSk × (1 − PRSk)

Where:

* **RC1** = Cost of retention for true positives.
* **TPk** = Number of true positives receiving retention strategy Sk.
* **CSk** = Cost per customer for strategy Sk.
* **1 − PRSk** = Probability of retention failure.

#### **Retention Costs for False Positives (FPs)**

RC2 = ∑ FPk × CSk

Where:

* **RC2** = Cost of unnecessary retention attempts.
* **FPk** = Number of false positives in segment k.
* **CSk** = Cost per customer for strategy Sk.

#### **Lost Revenue from False Negatives (FNs)**

LRFN = FN × CL

Where:

* **LRFN** = Lost revenue due to undetected churners.
* **FN** = Number of false negatives (missed churners).
* **CL** = Lost revenue per churned customer.

### **3.4 Brute-Force Intervention**

RCBF = ( CustomersPAYG + CustomersPP + CustomersPO ) × CBF

Where:

* **RCBF** = Total cost of brute-force retention.
* **CustomersPLAN** = Total customers in a specific plan type.
* **CBF** = Cost per customer contacted in brute-force intervention.

### **3.5 Consideration of Customer Acquisition Cost (CAC) and Lifetime Value (LTV)**

∑ TPk × R × PRSk > CAC

PRk × LTV > Ck

Where:

* **TPk** = Number of true positives receiving retention strategy Sk.
* **R** = Revenue per retained customer.
* **PRSk** = Probability of successful retention using strategy Sk.
* **CAC** = Cost of acquiring a new customer.
* **PRk** = average retention probability for a segment (before deciding which strategy to use).
* **LTV** = Expected lifetime value of a retained customer.

### **3.5.1 Customer Acquisition Cost (CAC) and Lifetime Value (LTV)**

#### **Customer Acquisition Cost (CAC)**

CAC is calculated as:

CAC = Total Marketing and Sales Cost / Number of New Customers Acquired

Where:

* **CAC** = Average cost to acquire a new customer.
* **Total Marketing and Sales Cost** = Sum of all expenses on marketing, sales efforts, and promotions.
* **Number of New Customers Acquired** = Total customers gained from marketing and sales efforts.

#### **Customer Lifetime Value (LTV)**

LTV is calculated as:

LTV = ( ARPU x Gross Margin) / Churn Rate

Where:

* **LTV** = Expected total revenue generated by a customer before churn.
* **ARPU** = Average Revenue Per User (monthly or yearly revenue per customer).
* **Gross Margin** = Profit margin after removing operational costs.
* **Churn Rate** = Percentage of customers lost per period.

### **3.6 Breakeven Condition**

∑ TPk × R × PRSk = ∑ TPk × CSk × ( 1 − PRSk ) + ∑ FPk × CSk + FN × CL

Where:

* **TPk** = Number of true positives receiving retention strategy Sk.
* **R** = Revenue per retained customer.
* **PRSk** = Probability of successful retention using strategy Sk.
* **CSk** = Cost per customer for strategy Sk.
* **FPk** = Number of false positives in segment kk.
* **FN** = Number of false negatives (missed churners).
* **CL** = Lost revenue per churned customer.

## **4. Decision Framework for Intervention Strategies**

1. **Determine Minimum Viable Probability (MVP) for Profitability:**

PRk > ( Ck / R )

* + If PRk is below this threshold, the strategy is unprofitable.

Where:

* **PRk** = average retention probability for a segment (before deciding which strategy to use).
* **Ck** = cost per customer
* **R** = Revenue per retained customer.

1. **Calculate Cost-Effectiveness Score (CES):**

CESk = ( PRk × R ) / Ck

* + Rank strategies by CES to determine the best approach.

Where:

* + - **CESk** = cost-effectiveness score
    - **PRk** = average retention probability for a segment (before deciding which strategy to use).
    - **R** = Revenue per retained customer.
    - **Ck** = cost per customer

1. **Compare against CAC and LTV:**
   * If retention costs exceed CAC, consider new customer acquisition.
   * Ensure PRk × LTV > Ck for long-term sustainability.

## **5. Plan-Specific Formulas**

### **5.1 Prepaid (PP)**

* **Extra Data (PP1):** CPP1 , PRPP1
* **Free Higher Plan (PP2):** CPP2 , PRPP2

### **5.2 Postpaid (PO)**

* **Discount (PO1):** CPO , PRPO

### **5.3 Pay-As-You-Go (PAYG)**

* **Extra Data (PAYG1):** CPAYG1 , PRPAYG1
* **Free Higher Plan (PAYG2):** CPAYG2 , PRPAYG2

Where:

* **CPLAN** = cost per customer
* **PRPLAN** = probability of retention

### **5.0 Formula per Intervention Type**

## **1. Prepaid Plan Intervention Costs**

### **1.1 Extra Data Offer (PP1)**

RCPP1 = ∑ TPPP1 × CPP1 × ( 1 − PRPP1 )

Where:

* **RCPP1​** = Retention cost for prepaid customers given extra data.
* **TPPP1​** = Number of true positives (identified churners) receiving extra data.
* **CPP1​** = Cost per customer for extra data.
* **PRPP1​** = Probability of retention success using extra data.

### **1.2 Free Higher Plan (PP2)**

RCPP2 = ∑ TPPP2 × CPP2 × ( 1 − PRPP2 )

Where:

* **RCPP2** = Retention cost for prepaid customers upgraded to a higher plan.
* **TPPP2​** = Number of true positives receiving a free plan upgrade.
* **CPP2​** = Cost per customer for a free plan upgrade.
* **PRPP2** = Probability of retention success using a plan upgrade.

## **2. Postpaid Plan Intervention Costs**

### **2.1 Discount Offer (PO1)**

RCPO1 = ∑ TPPO1 × CPO1 × ( 1 − PRPO1 )

Where:

* **RCPO1​** = Retention cost for postpaid customers given a discount.
* **TPPO1​** = Number of true positives receiving a discount.
* **CPO1​** = Cost per customer for the discount.
* **PRPO1​** = Probability of retention success using a discount.

## **3. Pay-As-You-Go Plan Intervention Costs**

### **3.1 Extra Data Offer (PAYG1)**

RCPAYG1 = ∑ TPPAYG1 × CPAYG1 × ( 1 − PRPAYG1 )

Where:

* **RCPAYG1** = Retention cost for pay-as-you-go customers given extra data.
* **TPPAYG1​** = Number of true positives receiving extra data.
* **CPAYG1** = Cost per customer for extra data.
* **PRPAYG1​** = Probability of retention success using extra data.

### **3.2 Free Higher Plan (PAYG2)**

RCPAYG2 = ∑ TPPAYG2 × CPAYG2 × ( 1 − PRPAYG2 )

Where:

* **RCPAYG2​** = Retention cost for pay-as-you-go customers upgraded to a free higher plan.
* **TPPAYG2** = Number of true positives receiving a plan upgrade.
* **CPAYG2​** = Cost per customer for a free plan upgrade.
* **PRPAYG2​** = Probability of retention success using a plan upgrade.

## **4. Total Retention Cost Per Plan**

To calculate **total retention costs for each plan type**, sum the individual intervention costs:

### **4.1 Prepaid Plan Total Cost**

RCPP = RCPP1 + RCPP2

### **4.2 Postpaid Plan Total Cost**

RCPO = RCPO1​

### **4.3 Pay-As-You-Go Plan Total Cost**

RCPAYG = RCPAYG1 + RCPAYG2 ​

## **5. Overall Total Retention Cost**

TCI = RCPP + RCPO + RCPAYG​

Where:

* **TCI** = Total cost of intervention across all plans.
* **RCPP​** = Total prepaid plan retention cost.
* **RCPO​** = Total postpaid plan retention cost.
* **RCPAYG​** = Total pay-as-you-go plan retention cost.

## **6. Decision Algorithm for Selecting Retention Strategy**

1. **Compute MVP Condition:**
   * If PRk < Ck / R , eliminate strategy kk.

Where:

* + - **PRk** = average retention probability for a segment (before deciding which strategy to use).
    - **Ck** = cost per customer
    - **R** = Revenue per retained customer.

1. **Calculate CES for each strategy:**
   * Choose the highest CES.
2. **Apply only profitable strategies:**
   * If no strategy meets MVP, avoid intervention.

## **7. Final Profitability Formula**

Profit / Loss = ∑ TPk × R × PRSk − ( ∑ TPk × CSk × (1 − PRSk) + ∑ FPk × CSk + FN × CL)

Where:

* **TPk** = Number of true positives receiving retention strategy Sk.
* **R** = Revenue per retained customer.
* **PRSk** = Probability of successful retention using strategy Sk.
* **CSk** = Cost per customer for strategy Sk.
* **FPk** = Number of false positives in segment k.
* **FN** = Number of false negatives (missed churners).
* **CL** = Lost revenue per churned customer.

## **8. Summary of Key Considerations**

* **Plan-Specific Strategies:** Prepaid and PAYG have two intervention types, while Postpaid has one.
* **Brute-Force vs. Targeted Approach:** Targeted interventions reduce costs, but brute-force ensures no churners are missed.
* **CAC vs. Retention Costs:** Retention is preferable if **cheaper than acquiring new customers**.
* **LTV Consideration:** Retention should aim to **maximize lifetime value**.
* **Break-even and Profitability:** The retention strategy should only be applied if it meets the MVP condition.