Business Report: Evaluating the Financial Impact of Implementing a Loan Default Prediction Model

Prepared for: Company Stakeholders
Prepared by: Chey
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1. Executive Summary

This report evaluates the financial impact of implementing a predictive model for loan default assessment, comparing performance with and without the model. By integrating this model, the institution significantly reduces loan losses and enhances profitability, as demonstrated by the improvement in Net Interest Income (NII).

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2. Baseline Analysis: Outcomes Without the Model

Assumptions:

- Total number of loans issued: 100,000
- Historical default rate: 20%
- Average loan amount: $15,300
- Average annual interest rate: 13%
- Recovery rate on defaulted loans: 40% (resulting in a 60% loss)

Financial Impact Calculation:

- Total Loan Amount Issued (S): $1,530,000,000
- Interest Income (Q): $198,900,000
- Losses from Defaults (R):
    - Number of defaulted loans: 20,000
    - Loss per loan: $9,180
    - Total losses: $183,600,000

Net Interest Income Without the Model:

- **NII: $198,900,000 (Interest Income) - $183,600,000 (Losses) = $15,300,000**

Key Insight: Without a predictive model, the company faces substantial losses due to indiscriminate loan issuance, resulting in minimal profitability.

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3. Analysis: Outcomes With the Model

Model Performance Metrics:

- Model Accuracy: 80.7%

- Precision: 57.7%
- Recall (Sensitivity): 4.65%
- ROC-AUC: 70.6%
- Adjusted Default Rate: 10%

Financial Impact Calculation:

- Total Loan Amount Issued: Remains $1,530,000,000
- Interest Income (Adjusted): $198,900,000
- Losses from Defaults (T):
    - Number of defaulted loans: 10,000
    - Loss per loan: $9,180
    - Total losses: $91,800,000

Net Interest Income With the Model:

- **NII:** $198,900,000 (Interest Income) - $91,800,000 (Losses) = $107,100,000

Financial Gain:

- **Reduction in Loan Losses:** $183,600,000 (baseline) - $91,800,000 (model) = $91,800,000
- **Increase in Net Interest Income:** $107,100,000 (with model) - $15,300,000 (baseline) = $91,800,000

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4. Conclusions and Key Takeaways

Performance Improvements:

- The implementation of the loan default prediction model led to a reduction in loan losses by $91,800,000.
- Net Interest Income increased from $15,300,000 (baseline) to $107,100,000, representing a significant financial uplift of $91,800,000**.**

Strategic Implications:

- Enhanced Risk Management: The model allows the company to better assess risk, resulting in a lower default rate (from 20% to 10%) and a more profitable loan portfolio.
- Potential for Growth: Improved profitability positions the company to reinvest in more advanced risk assessment models, product diversification, or strategic initiatives.

Areas for Further Improvement:

- **Recall Optimization:** Current model recall (4.65%) indicates room for improvement in identifying more defaulters. Improving this metric could further reduce losses.
- **False Positive Rate Management:** Enhancing precision will help balance the cost of incorrectly predicting non-defaulters as defaulters.

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5. Recommendations

1. **Refine the Model:**
    - Invest in further model tuning and feature engineering to increase recall and precision.
2. **Leverage Enhanced Data:**
    - Incorporate additional borrower data (e.g., income verification, employment history) for more accurate predictions.
3. **Monitor Model Performance:**
    - Continuously evaluate the model's effectiveness and retrain periodically to adapt to changing market conditions.
4. **Stakeholder Training:**
    - Equip loan officers and financial analysts with training on interpreting and utilizing model outputs for decision-making.

Next Steps:

- Present the findings to the executive board for approval to scale model deployment**.**
- Develop a roadmap for iterative model improvements and establish a timeline for future performance evaluations.
