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Assessment Case Study

Application of credit risk models in the banking industry

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1. Introduction to Credit Risk

1.1. What is Credit Risk?

Credit risk is the risk of financial loss if a counterparty to a transaction does not make the required payments (amount or timing) as per the terms of the transaction. Credit risk arises when a transaction involves goods or services delivered in return for consideration receivable in the future or when money is exchanged with the objective of obtaining a larger sum in the future.

Following are a few examples of credit events that give rise to financial risk:

- A consumer may fail to make a payment due on a mortgage loan, credit card, line of credit, or other loan.
- A company is unable to repay a fixed or floating charge debt.
- A business or consumer does not pay a trade invoice when due.
- A business does not pay an employee's earned wages when due.
- A business or government bond issuer does not make a payment on a coupon or principal payment when due.
- An insurance company does not pay a policy obligation.
- A bank won't return funds to a depositor.
- A government grants bankruptcy protection to an insolvent consumer or business.

1.2. Fundamentals of Credit Risk Measurement

While the definition of credit risk may be straight forward, managing and measuring it is not. Many factors can influence an obligor's credit risk and in varying degrees depending on the type of transaction, obligor characteristics, economic state etc. Credit risks are calculated based on the borrower's overall ability to repay.

Credit analysis is the methodology used to assess the creditworthiness of an obligor. It might be carried out using a subjective or statistical approach. Certain approaches also employ a mix of the two with weights assigned. The approach chosen will need to be suitable to the obligor(s) being assessed and the specific purpose for which the assessment is being done.

Credit risk can be measured as the expected amount of loss that might arise from a credit event occurring. The expectation of loss is a function of three parameters:

- Probability of default("PD"): The probability that the default event occurs for an obligor or a set of obligors
- Loss given default("LGD"): The proportion of money that is not recoverable in the event of default.
- Exposure at default("EAD"): The amount of money that was owed by the obligor at the time of the time of default.

1.3. Credit Risk Models used in the Industry

Probability of Default:

- Pooling approach
- Regression based models
- Structural or reduced form models

Loss given default:

- Workout LGD
- Market implied LGD

Exposure at default:

- Current exposure method
- Credit Conversion Factor

2. Application of Credit Risk Models in the Banking Industry

2.1. Background

In recent years, the ratio of Non-Performing Assets ('NPAs') across the Indian Banking Industry, has increased significantly. Industry experts attribute the increase to the following reasons:

- Inadequate internal processes for credit risk assessment.
- The currently prevailing regulatory framework which does not incentivize banks to design & implement robust credit risk assessment processes.

You have recently joined the credit risk team of a small-sized commercial bank which has been experiencing significant losses due to increase in NPAs. An annual internal audit exercise revealed that the loan underwriting team of the bank currently follows an extremely crude & subjective approach to assess creditworthiness of Obligor.

Additionally, the internal audit report highlighted that the currently employed incentive & commission mechanism for relationship managers & underwriters in the bank did not give much weightage to creditworthiness of potential obligors.

2.2. Implementation of a New Regulation

The recent significant increase in NPAs across the banking industry has led the regulator to impose a new regulatory requirement for credit risk management.

As per the new requirement, all banks are expected to adopt one of the following approaches to enhance their currently employed credit risk management processes:

- Use a standardized framework designed by the regulator ("Standardized Approach")
- Design, develop and implement robust internal credit risk models for loan underwriting and credit risk provisioning. ("Internal Model Approach")

In light of the new regulatory requirement, the Credit Risk Board Committee of your bank has decided to go ahead with the internal model approach for credit risk assessment.

As a result, your team has been mandated to develop a credit risk model that can be used to underwrite loans for new obligors and assess creditworthiness of existing obligors in the banking book. The internally developed model would then be subsequently used by the bank to make important credit decisions such as:

- Loan disbursement to new obligors
- Restructuring disbursed facilities of existing obligors

2.3. Expected Deliverables

The head of the Credit Risk Department has asked you to perform the following activities as part of the internal model development exercise:

- Liaison with the data collection team of the bank to gather required raw data for model development
- Conduct a detailed exploratory data analysis and subsequently transform / cleanse raw data (if required)
- Calibrate the model using transformed / cleansed data
- Conduct robust statistical testing to assess underlying model assumptions
- Conduct thorough performance testing to assess model accuracy & stability
- Determine metrics and thresholds for the same to assist in taking the aforementioned decisions
- Document the model methodology, assumptions and results in a format that can be used by auditors to assess the model integrity and effectiveness. Additionally, you would also need to provide them with the working files (spreadsheets or codes) in a presentable format that were used to develop the model.
- Additionally, provide the following information as part of the credit risk team

Solutions that you are expected to provide as a part of the documentation:

1. Basis the information provided, list down and briefly explain the steps you would follow as part of the end-to-end process to develop the internal credit scoring model for the retail portfolio.

2. Analysis and cleansing of raw data is critical to develop an robust model. Explain the data cleansing, exploratory analysis and transformation activities you would perform out as part of the model development exercise.

3. List down and explain various modelling methodologies / frameworks that could be adopted for developing the credit scoring model.

4. Explain the activities & control-checks you would carry to ensure that explanatory variables selected as part of the variable selection process are optimal

5. Suggest possible uses / applications of a credit scoring model across various departments in a bank

2.4. Input Data Requirements

Upon your request, the data collection team of the bank has provided you with historical default data at a facility level. The data has been collected from different source systems used for accounting and credit administration. Hence, there might be data inconsistencies which need to be corrected/taken into consideration before using the data for any analysis.

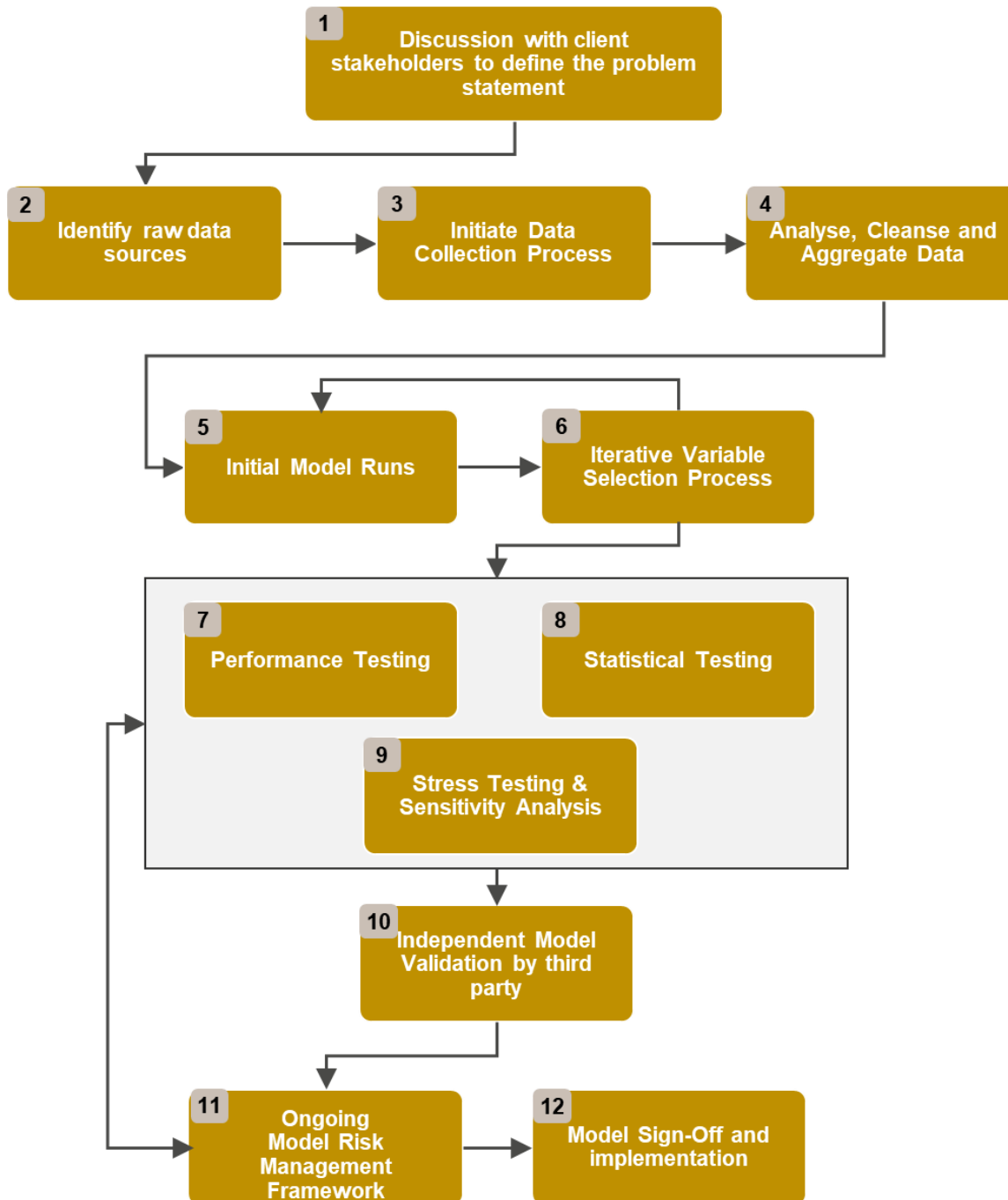
2.5. Definition of Input Data Variables

Following are the definitions of the variables provided to you:

- **checking_balance:** Amount held in the current account deposit of the obligor.
- **member_id:** Loan ID for each loan
- **loan_amount:** The amount of loan sanctioned
- **funded_amount:** The amount of loan disbursed
- **number_of_instalments:** Number of EMIs to be paid
- **interest_rate:** Rate of interest charged on the loan
- **installment_amount:** EMI payment amount
- **grade:** Rating grade assigned by external rating agency
- **sub_grade:** Rating sub-grade assigned by external rating agency

- **length_of_employment:** Duration that obligor has been in employment with current or all previous employers
- **home_ownership:** Whether housing is owned by obligor or rented
- **annual_income:** Annual income of borrower
- **purpose:** The purposes for which the loan disbursement amount will be utilised.
- **inquiries_last_6mths:** Number of loan inquiries in last 6 months by the borrower
- **open_credit_lines:** Number of open credit lines with the borrower
- **total_credit_lines:** Number of total credit lines with the borrower
- **os_principal:** Amount outstanding from the loan sanctioned
- **total_payment_recvd:** Total repayment made by the borrower till date
- **last_payment_recvd:** Amount of last EMI payment made by the borrower
- **acc_now_delinq:** Whether borrower has been late on EMI payments and is currently delinquent
- **total_current_bal:** Amount held in the current account of the obligor
- **loan_status:** Default status of obligor

3. Appendix A: A Standard model development process





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