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Predictive Analysis for Financial Decision-Making: An Analysis of District-Wise Bank Credit in India

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Abstract

In Today's data-driven business environment, Predictive analytics has become an important approach for supporting financial decision-making by identifying patterns in historical data and providing insights into future trends. This study examines district-wise outstanding bank credit in India using secondary data obtained from the Reserve Bank of India for the period 2021–2025. The study aims to analyse trends and variations in outstanding credit across states, districts, regions, and occupational categories, and to apply predictive analytics for forecasting future credit trends.

The study employs data preprocessing, exploratory data analysis, descriptive analysis, trend analysis, regional and occupational analysis, correlation analysis, and machine learning techniques. Linear Regression, Decision Tree, Random Forest, and XGBoost regression models were developed and evaluated using R^2, Mean Absolute Error (MAE), and Root Mean Square Error (RMSE). The results show a continuous increase in outstanding bank credit during the study period, along with substantial variation across states, districts, regions, and occupational categories. Account volume showed a strong association with outstanding credit and emerged as the dominant predictive factor in the feature-importance analysis. Among the models evaluated, XGBoost recorded the highest R^2 value of 0.9218, followed by Random Forest (0.9154), Linear Regression (0.9055), and Decision Tree (0.9005).

Model-based forecasts for 2026–2028 indicate a continued increase in outstanding credit after the projected 2026 period. The findings demonstrate the potential of predictive analytics and machine learning to identify underlying credit patterns and provide forward-looking information that can support credit planning, resource allocation, and financial decision-making. However, the forecasts are dependent on historical patterns and the variables included in the dataset. The study therefore highlights the value of combining historical credit analysis with predictive techniques while recognizing the need for additional economic and financial variables in future research.

Keywords: Predictive Analytics, Bank Credit, Financial Decision-Making, Machine Learning, District-Wise Analysis, RBI, Credit Forecasting, XGBoost, India.

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Introduction

In today's highly competitive and technology-driven business environment, making the right financial decisions has become more important than ever. Every decision related to investments, budgeting, cost management, or resource allocation has a direct impact on an organization's growth and long-term success. While businesses have traditionally relied on historical financial reports and managerial experience to make such decisions, these approaches are often not enough to address the uncertainties of today's dynamic markets. Organizations now need smarter and more proactive ways to understand financial trends and prepare for future challenges.

The increasing availability of financial data, along with advancements in data analytics and machine learning, has transformed the way businesses approach financial decision-making. Predictive analytics has emerged as a valuable tool that helps organizations analyze past financial performance, identify hidden patterns, and forecast future outcomes with greater accuracy. Instead of simply looking back at what has happened, businesses can now anticipate potential risks, recognize growth opportunities, and make well-informed decisions based on data-driven insights.

In India, the rapid adoption of digital technologies and the growing emphasis on data-driven business strategies have encouraged organizations to explore predictive analytics across various industries. However, many businesses still face challenges in effectively utilizing financial data due to issues such as poor data quality, limited analytical expertise, and the complexity of advance analytical techniques. As a result, there is a growing need for practical approaches that can convert financial data into meaningful information for better decision-making.

Against this backdrop, the present study examines how predictive analytics can support financial decision-making using an original financial dataset. By analyzing financial variables and applying predictive analytical techniques, the study seeks to understand the factors that influence financial performance and how these insights can assist managers in making more informed and strategic decisions. It also aims to demonstrate the practical value of predictive analytics as a reliable tool for improving financial planning, reducing uncertainty, and supporting sustainable business growth in the Indian business context.

Review of Literature

1. Artificial Intelligence in Financial Analysis

Cao (2023), in the study "AI in Finance: Challenges, Techniques, and Opportunities", provided a broad review of the use of artificial intelligence in finance. The study discussed financial data, AI techniques, applications, challenges, and opportunities associated with AI-driven financial analytics. The author emphasized the importance of artificial intelligence while also highlighting challenges related to interpretability, data quality, and implementation. The study is relevant to the present research because it supports the use of predictive modelling and emphasizes the importance of obtaining interpretable and reliable insights for financial decision-making.

2. Artificial Intelligence and Machine Learning in Finance

Ahmed, Alshater, El Ammari, and Hammami (2022), in the study "Artificial Intelligence and Machine Learning in Finance: A Bibliometric Review", examined the development and application of artificial intelligence and machine learning in the financial sector. The study identified major research themes and applications of AI and machine learning in areas such as financial prediction, risk management, and investment-related decision-making. The authors highlighted the growing importance of AI and machine learning in modern financial analytics. The study supports the use of machine learning approaches for improving financial analysis and decision-making.

3 Predictive Analytics in Financial Decision-Making

Broby (2022), in the study "The Use of Predictive Analytics in Finance", examined how predictive analytics has transformed financial decision-making by enabling organizations to forecast future outcomes using historical and real-

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time data. The study discussed the application of statistical methods, machine learning, and data mining in areas such as credit risk assessment, fraud detection, customer analytics, and financial forecasting. The author concluded that predictive analytics improves the accuracy and speed of financial decisions while reducing uncertainty. However, the study also emphasized that the effectiveness of predictive models depends on high-quality data, appropriate model selection, and continuous validation.

4. Machine Learning for Indian Stock Market Prediction

Kumar, Ravi, and Miglani (2021), in the study "Predicting Indian Stock Market Using the Psycho-Linguistic Features of Financial News", examined the use of machine learning techniques to predict movements in the Indian stock market. The researchers used financial news and psycho-linguistic features as inputs for prediction. The study demonstrated the application of machine learning in an Indian financial context and showed how predictive models can support financial and investment decision-making. The findings are relevant to the present study as they highlight the potential of data-driven predictive techniques in financial analysis.

5. Machine Learning Techniques for Financial Market Prediction

Henrique, Sobreiro, and Kimura (2019), in the study "Literature Review: Machine Learning Techniques Applied to Financial Market Prediction", reviewed the application of machine learning techniques in financial market prediction. The study examined different financial markets, assets, predictive variables, machine learning models, and performance measures. The authors highlighted the importance of machine learning in identifying patterns and improving financial prediction. The study provides a methodological foundation for applying machine learning models to financial prediction and is relevant to the present research on predictive analysis for financial decision-making.

Research Gap

The existing literature demonstrates that predictive analytics, machine learning, and artificial intelligence have significantly improved financial forecasting, risk assessment, and investment decision-making. Previous studies have primarily focused on banking applications, stock market prediction, fraud detection, and conceptual discussions of AI adoption. While these studies establish the importance of predictive technologies, many rely on secondary datasets or focus on specific financial sectors.

In the Indian business context, there is limited empirical research that applies predictive analytics to original financial datasets for supporting practical business decision-making. Furthermore, only a few studies compare multiple machine learning models while examining the importance of financial variables in influencing organizational performance. There is also a lack of research that combines predictive modelling with explainable analytics to provide transparent and actionable insights for managers.

To address these gaps, the present study uses an original financial dataset to develop a predictive analytics framework for financial decision-making. The study compares different predictive models and identifies the key financial factors that influence business performance, thereby providing practical insights for managers and decision-makers.

Research Objectives

The study aims to:

1. **Apply predictive analytics and machine learning techniques** to forecast future credit trends and generate insights for effective financial decision-making, credit planning, and resource allocation.
2. **Analyse and identify trends, patterns, and variations** in outstanding bank credit across different regional and occupational categories in India.

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Data and Research Methodology

1 Data Source

The dataset used in the study was obtained from the Reserve Bank of India (RBI) and covers the period from 2021 to 2025. The original dataset contained 70,127 observations and 11 variables, including year, region, state, district, occupation, number of accounts, amount outstanding, record type and occupation group.The data provides information on bank accounts and outstanding credit, allowing the study to examine variations and patterns in credit distribution.

2 Data Processing

The dataset contained no missing values and no duplicate observations. Since the study focuses on comparable occupation-level credit observations, records classified as "Occupation group" were retained for the main analysis. This resulted in a final analytical dataset of 29,726 observations. The amount outstanding was originally reported in ₹ thousands and was converted into ₹ crores for interpretation.

The final dataset contained observations covering 36 states/Union Territories, 824 districts and eight occupation groups. For predictive modelling, the analysis used year, number of accounts, region and occupation group as explanatory variables, with outstanding credit transformed using a logarithmic transformation.

3 Predictive Modelling

To develop a forward-looking analysis, four machine learning models were applied:

- **Linear Regression**
- **Decision Tree**
- **Random Forest**
- **XGBoost**

These models were used to predict outstanding bank credit based on the available financial and categorical information in the dataset.

4 Model Evaluation

The performance of the predictive models was compared using three evaluation measures:

- **R^2 (Coefficient of Determination):** Measures how well the model explains the variation in the target variable.
- **Mean Absolute Error (MAE):** Measures the average absolute difference between actual and predicted values.
- **Root Mean Squared Error (RMSE):** Measures prediction error while giving greater weight to larger errors.

Feature importance analysis was also performed to identify the variables that contributed most to predicting outstanding credit.

5 Tools Used

The analysis was carried out using **Python/Google Colab**, with libraries including **Pandas, NumPy, Matplotlib, Scikit-learn, and XGBoost**. These tools were used for data processing, visualization, statistical analysis, predictive modelling, and model evaluation.

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Analysis and Interpretation

Year-Wise Analysis of Outstanding Bank Credit

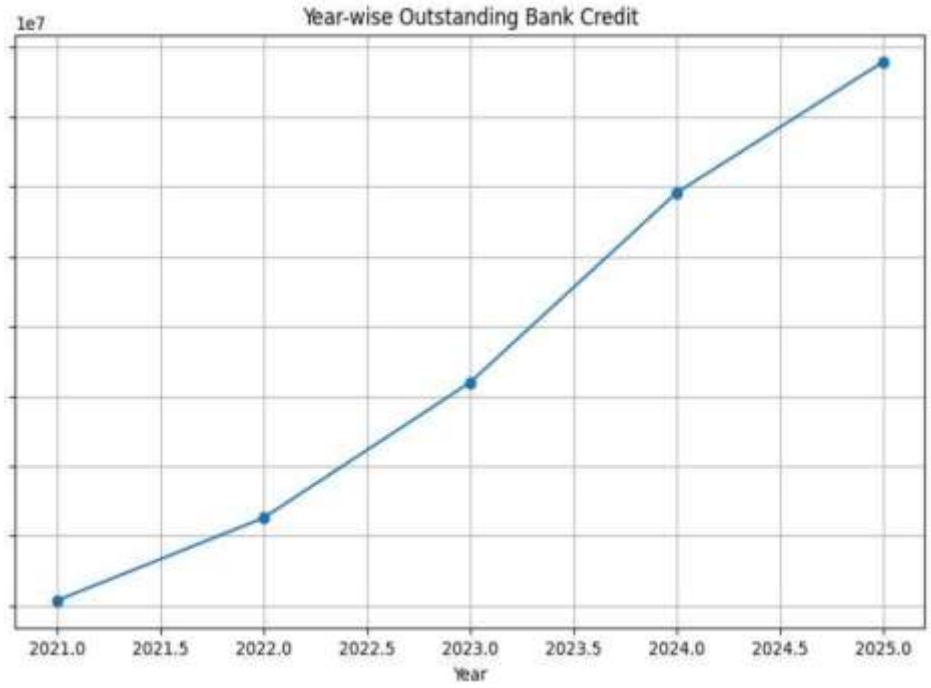

Figure 1. Year-wise outstanding bank credit, 2021–2025

The year-wise analysis shows a continuous increase in outstanding bank credit from ₹11,078,049.64 crore in 2021 to ₹18,786,865.49 crore in 2025. Year-on-year growth was 10.66% in 2022, 15.82% in 2023, 19.13% in 2024 and 11.07% in 2025. The highest annual growth was therefore observed between 2023 and 2024.The year-wise analysis was conducted to examine changes in outstanding bank credit during 2021–2025. The annual totals are presented in Table 1.

Table 1. Year-Wise Outstanding Bank Credit

Year	Total Accounts	Outstanding Credit (₹ Crores)	Year-on-Year Growth
2021	298,335,054	11,078,049.64	—
2022	320,845,183	12,258,746.95	10.66%
2023	360,243,543	14,198,008.20	15.82%
2024	403,169,077	16,913,690.00	19.13%
2025	410,220,585	18,786,865.49	11.07%

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State-Wise Analysis

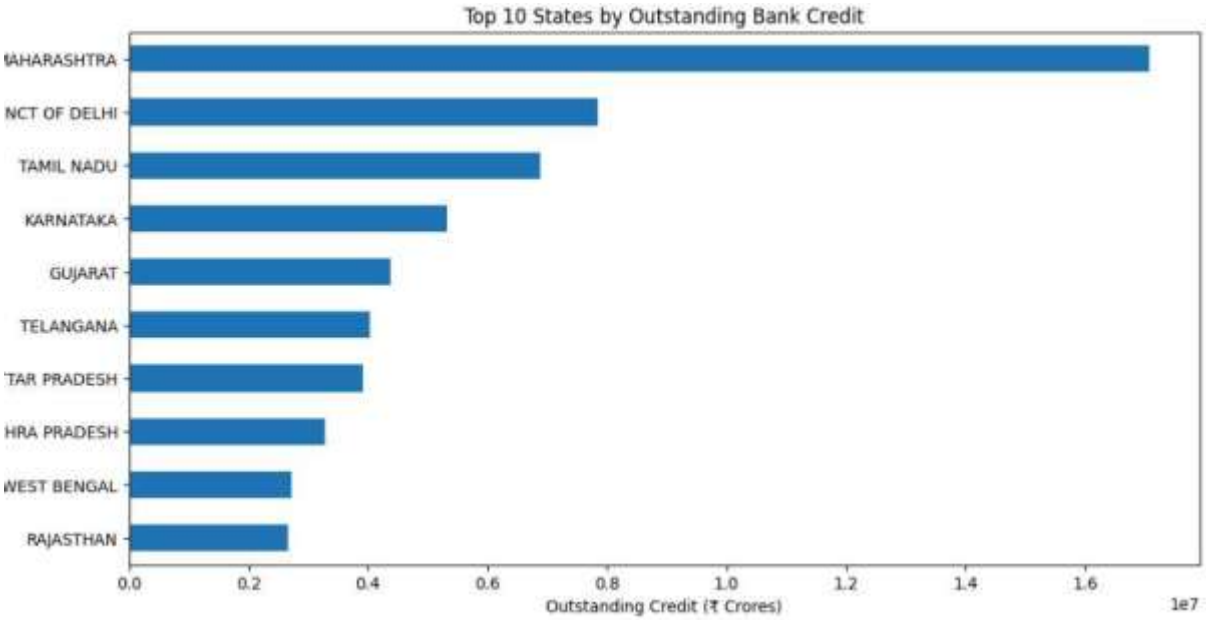

Figure 2. State-wise aggregate outstanding bank credit, 2021–2025

The state-wise analysis reveals substantial geographical variation in outstanding bank credit. Maharashtra recorded the highest aggregate outstanding credit at ₹17,068,760 crore, followed by NCT of Delhi (₹7,840,801 crore), Tamil Nadu (₹6,876,487 crore), Karnataka (₹5,320,453 crore) and Gujarat (₹4,367,157 crore). The results indicate that outstanding credit is concentrated in selected states rather than being uniformly distributed.

District analysis

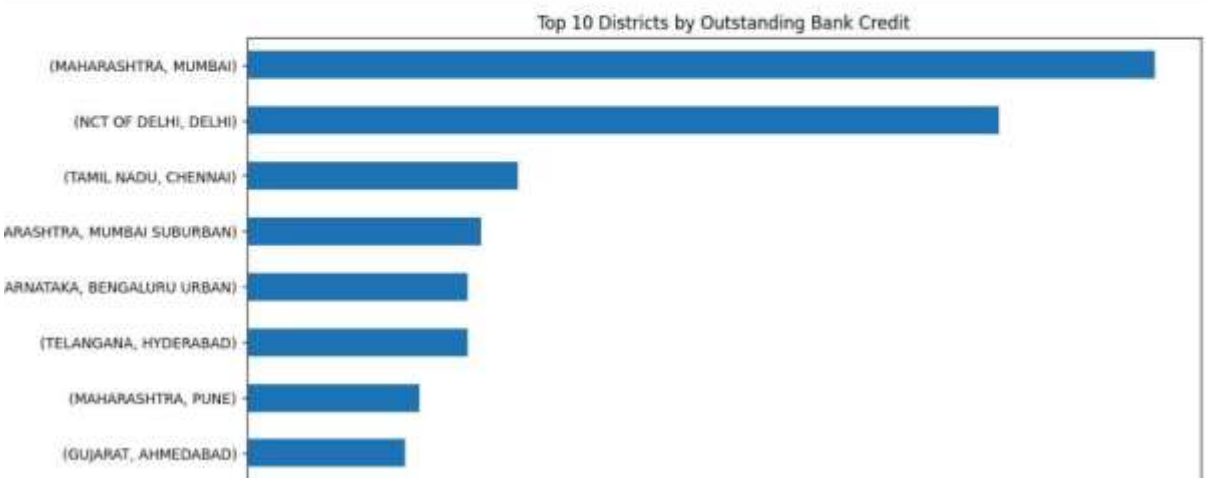

Figure 3. Top districts by aggregate outstanding bank credit, 2021–2025

The district-wise analysis further demonstrates geographical concentration. Mumbai recorded the highest aggregate outstanding credit at ₹9,464,595 crore, followed by Delhi (₹7,840,801 crore), Chennai (₹2,831,364 crore), Mumbai Suburban (₹2,446,585 crore) and Bengaluru Urban (₹2,305,624 crore). The concentration of high-credit districts in major metropolitan locations is a prominent feature of the dataset.

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Predictive Model Evaluation

Table 2 Model Performance

Model	R^2	MAE	RMSE
XGBoost	0.9218	0.4599	0.7005
Random Forest	0.9154	0.4790	0.7285
Linear Regression	0.9055	0.5231	0.7702
Decision Tree	0.9005	0.5350	0.7902

Four models were evaluated using R^2, MAE and RMSE. All models recorded R^2 values above 0.90. XGBoost recorded the highest R^2 at 0.9218, followed by Random Forest at 0.9154, Linear Regression at 0.9055 and Decision Tree at 0.9005. The results demonstrate that the evaluated models captured substantial variation in the transformed outstanding-credit data.

Figure 6. Predictive model comparison based on R^2

Historical And Predicted Outstanding Credit

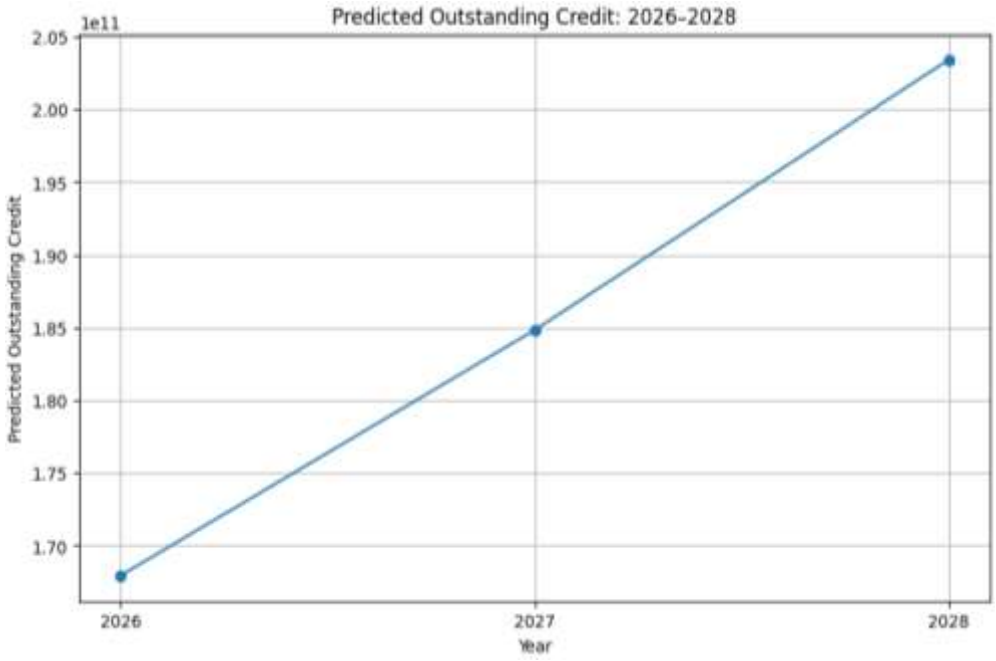

Figure 5. Historical and model-based projected outstanding bank credit, 2021–2028

Table 3 — Forecast

Year	Credit (₹ Crores)	Status
2025	18,786,865.49	Actual
2026	16,794,810	Predicted
2027	18,483,550	Predicted
2028	20,342,100	Predicted

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Historical outstanding credit increased from ₹11,078,049.64 crore in 2021 to ₹18,786,865.49 crore in 2025. The model-based projections indicate ₹16,794,810 crore for 2026,₹18,483,550 crore for 2027 and ₹20,342,100 crore for 2028. The projections therefore show a decline at the transition to 2026 followed by an upward movement through 2027 and2028.

Key Findings

The findings demonstrate that outstanding bank credit has experienced an overall expansion during the period 2021–2025. However, the distribution of credit is not uniform across geographical and occupational categories. The state-wise and district-wise analyses reveal substantial regional differences, with higher levels of outstanding credit concentrated in selected states and major metropolitan districts.

The district-level findings further indicate that metropolitan regions occupy prominent positions in terms of outstanding credit. At the same time, variation across occupational categories indicates that credit patterns also differ according to occupational or sectoral classification.

The predictive modelling results demonstrate the applicability of machine-learning techniques to historical credit data. All four models recorded R^2 values above 0.90, while XGBoost produced the highest R^2 among the models evaluated. The forecasts for 2026–2028 indicate a continued upward trajectory in projected outstanding credit after the transition into the forecast period.

Overall, the results demonstrate how historical banking data can be analysed to identify credit patterns and generate forward-looking insights. Such analysis can contribute to credit planning, resource allocation, risk management and targeted lending decisions.

Limitations of the Study

The study is based on secondary RBI data for the period 2021–2025 and is therefore subject to the availability and consistency of the reported data. The predictive analysis primarily considers account volume, region, occupation, and year, while other factors such as interest rates, inflation, income, employment, and economic conditions are not included. The machine learning forecasts are based on historical patterns and may vary if future economic or policy conditions change. A longer study period and the inclusion of additional economic and financial variables could further improve the robustness of future predictions.

Conclusion

The study examined outstanding bank credit in India using secondary data from the Reserve Bank of India for the period 2021–2025 and applied descriptive, regional, occupational, comparative and predictive analytical techniques. The analysis identified an overall increase in outstanding credit during the study period, along with substantial variations across states, districts and occupational categories.

The regional analysis showed that outstanding credit is concentrated in selected states and major metropolitan districts. The predictive analysis further demonstrated that machine-learning models can effectively capture patterns in historical credit data. Among the four models evaluated, XGBoost recorded the highest R^2 of 0.9218, followed by Random Forest, Linear Regression and Decision Tree.

The model-based forecasts indicate an upward trajectory in outstanding credit from 2026 to 2028. These findings demonstrate the potential of predictive analytics to transform historical banking data into forward-looking insights that can support financial decision-making, credit planning, resource allocation, risk management and targeted lending.

Future analysis can be strengthened through the use of updated data, advanced predictive models and additional economic factors. Improved identification of high-potential and underserved regions may also contribute to more effective credit distribution.

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