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Financial Knowledge, Attitude, and Sustainable Behaviour among University Students: A Comparative Institutional Analysis

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Sustainable Financial Literacy; University Students; Comparative Study; Ethical Finance

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Abstract: The concept of sustainable financial literacy has emerged as a crucial aspect of financial competence in today's world, bringing together a combination of financial knowledge, ethical, social, and environmental considerations. The present study investigates the extent of sustainable financial education among university students in the Prayagraj district and discusses the differences between the public and private universities. In addition, the socio-demographic factors, institutional support and financial education exposure are examined in terms of their influence on sustainable financial behaviour. A quantitative cross-sectional research design was used, and primary data were taken from 200 students at the university using a stratified random sampling technique and a structured questionnaire. Data collected were analysed descriptively, by independent sample t-test, correlation and regression analysis using IBM SPSS Statistics. The results show that students have moderate financial literacy for sustainable finance, and that there are significant differences between institutions. The overall scores for sustainable financial literacy were higher among the private university students compared to the public university students, while the students of the public universities had higher scores for sustainability-oriented behaviour and awareness. The study also supports the findings and conclusions of the previous research that financial knowledge and attitude are positively related. Socio-demographic factors as well as institutional support are also crucial to sustainable financial literacy. The study also underscores the need for incorporating sustainability-oriented financial education as a component of the university curricula, thus building socially-conscious, financially responsible, and environmentally conscious youth for inclusive and sustainable economic development.

1. Introduction

Financial literacy has evolved significantly in the twenty-first century from a narrow focus on personal money management to a broader framework that incorporates ethical, social, and environmental considerations. This emerging concept, known as sustainable financial literacy, combines traditional financial knowledge with awareness of sustainable investment, responsible consumption, and socially conscious financial behaviour (Filippini et al., 2024). Sustainable financial literacy enables individuals not only to make financially sound decisions but also to align their financial practices with long-term societal and environmental well-being. In the contemporary global economy, where sustainable development and responsible finance are increasingly emphasised, sustainable financial literacy has become an essential competency for youth and future economic participants. In India, the importance of financial literacy and sustainability has gained policy attention through initiatives such as the National Centre for Financial Education and the National Strategy for Financial Education (NSFE 2020-2025), which emphasise youth engagement, digital financial inclusion, and responsible financial behaviour. Despite these efforts, most existing Indian studies focus primarily on conventional financial literacy, while sustainability-oriented financial decision-making remains relatively underexplored.

Moreover, limited research has examined how institutional factors, curriculum design, and financial education exposure influence sustainable financial literacy among university students, particularly in semi-urban educational settings. The Prayagraj District of Uttar Pradesh provides an appropriate context for such an investigation due to the presence of diverse public and private universities attracting students from varied socio-economic and academic backgrounds. Differences in institutional support, exposure to financial education programs, and sustainability-oriented learning environments may significantly shape students' financial knowledge, attitudes, and behaviour. However, comparative empirical evidence in this area remains limited. The present study is theoretically grounded in the Theory of Planned Behaviour (Ajzen, 1991), Human Capital Theory (Becker, 1964), and the Sustainable Development Framework associated with the United Nations Sustainable Development Goals (SDGs 4 and 12). The Theory of Planned Behaviour explains how financial attitudes and perceived behavioural control influence sustainable financial actions, while Human Capital Theory highlights the role of education in improving financial decision-making capability. The Sustainable Development Framework further emphasises responsible consumption and quality education as essential pillars of sustainable development. Integrating these theoretical perspectives enables the study to examine sustainable financial literacy as a multidimensional construct linking knowledge, attitude, institutional exposure, and sustainable financial behaviour. Against this backdrop, the study aims to assess and compare the level of sustainable financial literacy among university students in Prayagraj District and to examine the influence of socio-demographic factors, institutional support, and financial education exposure on sustainable financial behaviour. The study also seeks to analyse the relationship between financial knowledge, financial attitude, and financial behaviour within a sustainability framework. The study makes several important contributions to the existing literature. First, it extends traditional financial literacy research by integrating sustainability dimensions such as ethical consumption, green financial behaviour, and responsible investment awareness. Second, it provides comparative empirical evidence between public and private university students in a semi-urban Indian context, an area that remains insufficiently explored in prior research. Third, the study validates the knowledge–attitude–behaviour framework in the context of sustainable financial literacy and highlights the importance of institutional support and financial education exposure in shaping financially responsible behaviour. Finally, the findings offer policy implications for universities, regulators, and educational institutions seeking to strengthen sustainability-oriented financial education among youth in India.

2. Review of Literature

The literature review was carried out using a systematic and thematic methodology. Studies published were sourced from reputable databases, including ScienceDirect, ResearchGate, SpringerLink, and Google Scholar. The selection process employed keyword searches such as "financial literacy," "sustainable finance," "university students," and "India." Financial literacy has become an essential component of economic and social development in the modern global economy. Traditionally, financial literacy focused on individuals' ability to manage savings, budgeting, investments, insurance, and credit decisions effectively. However, recent academic discourse has expanded the concept toward sustainable financial literacy, which integrates ethical, environmental, and socially responsible dimensions into financial decision-making *(Filippini et al., 2024)*. Sustainable financial literacy emphasises not only financial well-being but also responsible consumption, sustainable investment, and environmentally conscious financial behaviour *(Lanciano et al., 2024).* International literature highlights the growing importance of sustainability-oriented financial knowledge in influencing economic behaviour. *Filippini et al. (2024)* developed a framework of sustainable finance literacy incorporating awareness of environmental, social, and governance (ESG) investments and sustainable financial products. Their study found that individuals possessing higher sustainable financial literacy were more likely to participate in sustainable investment decisions. Similarly, *Lanciano et al. (2024)* observed that both financial literacy and sustainability awareness significantly influence responsible financial behaviour among European households. The study emphasised that sustainable financial knowledge positively affects ethical investment preferences and long-term financial planning. Recent studies also emphasise the role of education and institutional intervention in strengthening sustainable financial capability. *Wekhof and Filippini (2024)*, through a randomised controlled trial, found that financial education programs significantly improved participants' understanding of sustainable financial products and increased responsible investment decisions. *Ebrahim et al. (2025)* further reported that sustainability-

focused educational interventions among business students enhanced sustainability consciousness, ethical awareness, and responsible financial behaviour. These findings suggest that experiential and curriculum-based financial education can play a transformative role in developing sustainable financial capability among youth. In the Indian context, financial literacy has gained considerable importance due to increasing financial inclusion initiatives, digitalisation, and economic reforms. Policy initiatives such as the *National Strategy for Financial Education (NSFE 2020-2025),* introduced by the National Centre for Financial Education, emphasise youth engagement, financial awareness, digital literacy, and responsible financial participation *(NCFE, 2020).* However, empirical research in India has largely concentrated on traditional financial literacy dimensions such as saving habits, budgeting skills, and investment awareness, while sustainability-related financial practices remain relatively underexplored. *Dash and Ranjan (2023)* reported significant disparities in financial literacy across Indian states and highlighted the role of socio-economic and educational factors in influencing financial behaviour. Similarly, *Vaghela, Kapadia, and Patel (2023)* found that financial knowledge and financial attitude significantly affect financial behaviour among university students. Their study confirmed the importance of the knowledge–attitude–behaviour relationship in shaping responsible financial decision-making. Nevertheless, these studies primarily focused on conventional financial literacy and did not adequately address sustainability-oriented dimensions such as green financial practices, ESG investment awareness, and ethical consumption behaviour. Several recent reviews indicate that global financial literacy research is increasingly integrating sustainability and behavioural finance perspectives. *Goyal and Kumar (2021) and Sethi et al. (2025),* through a systematic review and bibliometric analysis, concluded that financial literacy research has shifted toward behavioural dimensions, digital finance, and sustainable investment awareness. Similarly, *Shukla (2024)* observed that contemporary financial literacy frameworks increasingly emphasise long-term financial resilience, sustainability, and socially responsible financial decision-making. However, Indian studies continue to focus predominantly on traditional financial literacy indicators without adequately incorporating sustainability-related constructs. Research conducted among university students in India further reveals moderate levels of financial literacy and considerable socio-demographic disparities. *Research Cultures Society (2022)* reported that gender, educational stream, and family income significantly influence students' financial awareness and behaviour. Likewise, *PBR Institute (2023)* found that financial literacy among Indian university students remains relatively low, particularly among non-commerce students and students from economically weaker backgrounds. *Dube and Asthana (2025)* also concluded that more than half of Indian higher education students possess inadequate financial literacy, emphasising the urgent need for structured financial education programs in universities. The literature further highlights the significance of institutional support in shaping financial capability among students. International studies suggest that universities offering structured financial literacy courses, sustainability-focused curricula, digital finance training, and practical financial workshops tend to produce students with higher financial competence and responsible financial behaviour *(Wekhof & Filippini, 2024).* Nevertheless, comparative institutional studies between public and private universities remain limited, especially in developing countries like India. Existing literature rarely examines how institutional support systems, financial education exposure, and curriculum design collectively influence sustainable financial literacy outcomes among university students.

Prayagraj district, recognised as an educational hub of Uttar Pradesh, is home to both public universities (e.g., "University of Allahabad") and private universities (e.g., "SHUATS", "United University", "Nehru Gram Bharati University"), drawing a diverse student community. However, there is a lack of systematic comparative studies evaluating differences among students from these institutions in terms of sustainable financial knowledge, attitudes, and behaviours. Variations in curriculum design, financial education programs, and exposure to sustainability initiatives across institutions may play a significant role in shaping students' levels of sustainable financial literacy. Despite this, these relationships remain largely unexplored in the region. Additionally, Socio-demographic factors such as gender, academic discipline, family income, and parental education play a crucial role in shaping students' financial decision-making abilities and awareness of sustainability. Without such data, policymakers, educators, and financial institutions lack the essential insights needed to design targeted financial literacy programs that effectively incorporate sustainability principles and resonate with the youth. This study addresses the critical gap in empirical knowledge regarding Sustainable Financial Literacy among university

students in Prayagraj, with a particular focus on institutional and socio-economic disparities. Its objective is to provide a comprehensive evaluation of students' sustainable financial knowledge, attitudes, and behaviours, while also identifying institutional practices that either promote or impede Sustainable Financial Literacy outcomes.

Existing literature on financial literacy has primarily focused on traditional dimensions such as financial knowledge, saving behaviour, and investment awareness, with relatively limited attention to sustainability-oriented financial decision-making. Whereas international research is usually combined with financial literacy and sustainability and ethical aspects, Indian research is concerned with conventional financial literacy, neglecting such important aspects of responsible consumption. More specifically, three critical gaps can be identified. First, there is a lack of empirical studies that operationalise sustainable financial literacy as a combination of financial knowledge, attitude, and sustainability-driven behaviour. Second, the role of institutional factors such as type of university, curriculum exposure, and financial education initiatives in shaping sustainable financial literacy remains underexplored. Third, comparative evidence between public and private universities is largely absent, especially in semi-urban educational settings where socio-economic diversity is high. Furthermore, existing studies rarely examine whether financial knowledge and attitudes translate into actual sustainable financial behaviour, creating a disconnect between theoretical understanding and behavioural outcomes. To address these gaps, the present study adopts a comparative institutional framework to examine sustainable financial literacy among university students in Prayagraj District. It uniquely integrates financial knowledge, attitude, and behaviour within a sustainability perspective, while also assessing the influence of institutional type, socio-demographic factors, and financial education exposure. By providing micro-level empirical evidence from a semi-urban Indian context, the study contributes to both academic literature and policy discussions on sustainable financial education. Based on the gaps, this study tries to answer the following research questions:

- RQ1: What is the sustainable financial literacy level of university students of the Prayagraj District?
- RQ2: What is the difference in sustainable financial literacy among students of the public and the private universities?
- RQ3: What are the important factors (e.g., socio-economic background, gender, academic discipline, parental education) that determine sustainable financial literacy among students?
- RQ4: What is the impact of being exposed to financial education programs on the sustainable financial decision-making and ethical consumption behaviour of students?
- RQ5: How does institutional support (design of curricula, awareness and digital literacy programs) help to improve sustainable financial literacy?

In India, a study aims at examining how sustainable financial literacy develops, evaluates and differs in both public and private universities in India. Although there is a move towards financial inclusion and digital empowerment, there is a major disparity in the need to make sustainability and ethical concerns a part of financial education among the youth. The research will explore the level of awareness, attitudes and responsible financial practices among the students according to the Sustainable Development Goals (SDGs) and will examine how the curriculum design and socio-economic diversity influence them. It finally assesses how much the Indian university students have been empowered with knowledge and skills to make socially responsible financial decisions that are vital to the economic growth and sustainability in the changing financial landscape in India. Hence, this study has the following objectives:

- To assess the level of sustainable financial literacy among university students in Prayagraj District.
- To compare the sustainable financial literacy levels of students studying in public and private universities in Prayagraj.
- To examine the influence of demographic variables such as gender, age, family income, and educational background on sustainable financial literacy.

- To analyse the relationship between students' financial knowledge, financial attitude, and financial behaviour in the context of sustainability.
- To suggest strategies and educational interventions for enhancing sustainable financial literacy among youth in higher education institutions.

In line with the objectives of the study, the following hypotheses are considered for testing:

- H_{01}: There is no significant difference in the degree of sustainable financial literacy among students of the public and the private universities in the Prayagraj District.
- H_{02}: There is no significant relationship between financial knowledge, financial attitude, and financial behaviour of university students.
- H_{03}: There is no significant effect of socio-demographic (gender, family income, education stream, parental occupation) on sustainable financial literacy.
- H_{04}: There is no significant impact of institutional support and financial education exposure on sustainable financial literacy among the university students.

3. Research Methodology

The research design applied in the study is a quantitative, cross-sectional, and comparative research to evaluate and compare Sustainable Financial Literacy (SFL) on students in the public and private universities of the Prayagraj District. It brings out the importance of institutional settings, exposure to financial education, and socio-demographic factors in developing sustainable financial knowledge, attitudes, and behaviours among students.

Table 1: Research Design Using the Research Onion Framework

Layer of Research Onion	Component	Description / Application to Study
1. Research Philosophy	Positivism	The research assumes the use of a positivist approach where Sustainable Financial Literacy (SFL) can be studied and accurately measured using quantitative information and analytic tools. There is a focus on concrete and quantifiable information instead of subjective views.
2. Research Approach	Deductive	The study is based on the previous theories and models of financial literacy and sustainability (e.g., Filippini et al., 2024; Lanciano et al., 2024). Hypotheses are tested through empirical testing, where the relationship between knowledge, attitudes, and behaviours is studied.
3. Methodological Choice	Quantitative (Comparative Survey Method)	Quantitative methods are used to collect measurable data in the form of structured questionnaires. The study focuses on the level of SFL in students of both public and private universities of the Prayagraj District.
4. Research Strategy	Survey Research	Survey research is carried out to gather the primary data of a wide group of students and compare the financial literacy, sustainability awareness and behavioural patterns.
5. Time Horizon	Cross-Sectional Study	Data is taken within a certain period of time in order to measure and compare SFL among the university students at a particular point in time.
6. Sampling and Data Collection	Stratified Random Sampling & Structured Questionnaire	The study employed stratified random sampling to ensure representation from both public and private universities. A total sample size of 200 respondents (100 from each category) was considered adequate based on: (i) Statistical adequacy for regression analysis, where a minimum of 10–15 observations per predictor

		variable is recommended (Hair et al., 2019), (ii) Prior studies in financial literacy research using similar sample sizes, and (iii) Feasibility and accessibility constraints within the Prayagraj District. The balanced sample structure also ensures comparability across institutional groups, enhancing the robustness of the t-test analysis.
7. Data Analysis Techniques	Descriptive and Inferential Statistics	SPSS t-tests/ANOVA group comparisons, correlation and regression hypothesis tests, and Cronbach's alpha reliability test.
8. Expected Outcomes	Comparative Assessment of SFL and Policy Implications	The paper assesses and contrasts the levels of SFL among students in different types of institutions, explores those factors, and offers some recommendations on how the curriculum should be run to enhance SFL in higher education.

Sources: Saunders et al., 2019.

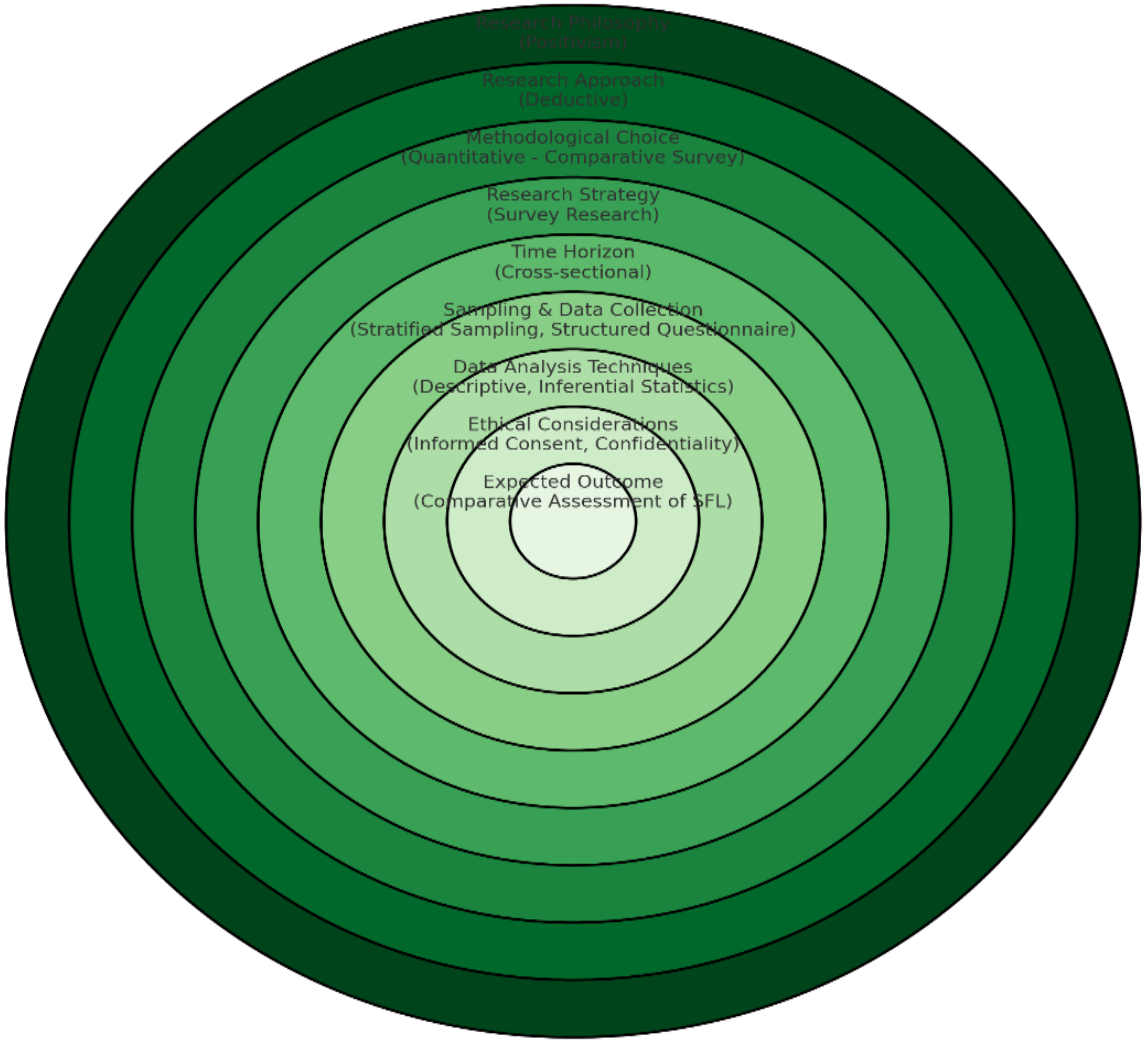
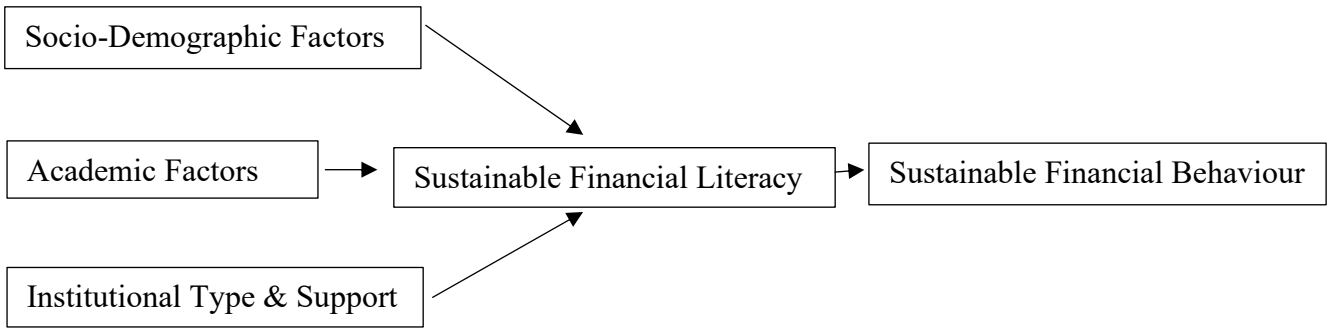


Figure 1: Research Onion Framework for Measuring Sustainable Financial Literacy among University Students in Prayagraj District

3.1. Conceptual Model



The conceptual model proposes that socio-demographic factors, academic exposure, and institutional support influence Sustainable Financial Literacy, which in turn drives Sustainable Financial Behaviour. This reflects a knowledge–attitude–behaviour framework, where literacy acts as a precursor to responsible financial action. Sustainable Financial Behaviour (SFB) refers to the actual financial actions and decision-making practices of individuals that incorporate economic prudence along with social and environmental responsibility. It extends beyond traditional financial behaviour such as saving, budgeting, and investing, by integrating sustainability-oriented practices, including ethical consumption, preference for environmentally responsible financial products, long-term financial planning, and avoidance of excessive or harmful consumption patterns. In the context of university students, SFB reflects the extent to which financial knowledge and attitudes are translated into responsible and sustainability-aligned financial decisions.

3.2. Theoretical Foundation

- The Theory of Planned Behaviour (Ajzen, 1991): The theory explains the importance of attitudes, subjective norms and perceived behavioural control in influencing sustainable financial behaviours.
- Human Capital Theory (Becker, 1964): lays stress on the role that education plays in increasing knowledge and skills, leading to better financial decision-making and sustainability.
- Sustainable Development Framework (UN SDGs 4 and 12): The proponents suggest decent education and responsible consumption to facilitate sustainability.

3.3. Questionnaire Development & Validation

The questionnaire was developed based on established literature on financial literacy and sustainable finance (Filippini et al., 2024; Lanciano et al., 2024; Vaghela et al., 2023). The instrument consisted of four sections: (i) socio-demographic profile, (ii) financial knowledge, (iii) financial attitude, and (iv) sustainable financial behaviour. Items related to sustainable finance (e.g., green investments, ethical consumption) were adapted and modified to suit the Indian university context. A 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) was used for attitude and behaviour constructs, while knowledge was assessed using objective and self-reported items. To ensure content validity, the questionnaire was reviewed by three subject experts in finance and management. A pilot study was conducted with 30 students, and minor modifications were made to improve clarity and relevance.

Table 2: Classification of Universities in Prayagraj District

Name of the University	Type	Year of Establishment	Affiliation / Governing Body	Key Focus Areas
"University of Allahabad"	Public (Central)	1887	Central University under UGC	Arts, Science, Commerce, Law, Social Sciences
"Sam Higginbottom University of Agriculture,	Private (Deemed)	1910 (Deemed: 2000)	UGC / Deemed to be University	Agriculture, Engineering,

Technology & Sciences (SHUATS)"				Management, Sciences
"Prof. Rajendra Singh (Rajju Bhaiya) University, Prayagraj"	Public (State)	2016	State Government of Uttar Pradesh	Arts, Science, Commerce, Education, Law
"Nehru Gram Bharati (Deemed to be University)"	Private (Deemed)	2008	UGC / MHRD	Social Sciences, Education, Rural Development
"United University"	Private	2016	UGC Approved / State Private University	Engineering, Pharmacy, Management, Law

Source: Self compiled.

4. Data Analysis & Interpretation

In this section, the research data will be analysed, and the results will be interpreted to provide appropriate conclusions to the client. In the case of the study, data analysis and interpretation were done using quantitative techniques. The statistical results were collected using descriptive and inferential statistics on data collected as a survey of 200 university students (Public and private) through a structured questionnaire. First, the descriptive statistics, such as mean and standard deviation, were used to explain the demographic variables and the main variables of sustainable financial literacy, including financial knowledge, attitude, and behaviour. The hypotheses were then tested on inferential statistics; an independent sample t -test was applied to determine the differences in the levels of SFL between the groups of private and public university students, and Pearson correlation analysis was also used to investigate the correlations among levels of financial knowledge, attitude, and behaviour. Also, a multiple regression analysis was conducted to determine the predictive effect of socio-demographic and institutional variables on general SFL. To make accurate, reliable, and statistically sound analyses, the IBM SPSS Statistics software was used. Results were assessed as per the available literature and research objectives, which provided some useful information regarding the factors and institutional comparisons that affect sustainable financial literacy in the Prayagraj District.

Table 3: Demographic Analysis

Variable	Category	Value
University Type	Public	100 students (50%)
	Private	100 students (50%)
Gender	Female	101 students (50.5%)
	Male	99 students (49.5%)
Course Level	Undergraduate	137 students (68.5%)
	Postgraduate	63 students (31.5%)
Age (years)	Mean	21.6
	Standard Deviation	2.35
	Minimum	18
	Maximum	25

Source: Self compiled.

The sample reflects the equal participation of institutional and gender structure, featuring both the presence of public and private universities. The majority of the respondents (68.5%) are undergraduate students, and the average age of the respondents is 21.6 years old, which fits the average age of a university student in Prayagraj.

4.1 Cronbach's Alpha testing the reliability of Sustainable Financial Literacy Scale

Indicator	Mean	Variance
Financial Knowledge	7.4	1.5
Attitude	7.1	1.8
Behaviour	7.2	1.6
Sustainable Finance Knowledge	6.9	2.1
Investment Knowledge	7.3	1.7
Digital Financial Literacy	7.8	1.5
Green Financial Behaviour	7.0	1.8
Saving Habit Index	7.4	1.5

(According to J. C. Nunnally & Bernstein, 1994)

Formula for Cronbach's Alpha

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_t^2}\right)$$

Where: k represents the number of items (in this case, 8 indicators), α denotes the Cronbach's Alpha, $\sum \sigma_i^2$ signifies the Sum of item variances and σ_t^2 denotes the total variance of the scale.

$$\alpha = \frac{8}{8-1}\left(1 - \frac{13.5}{36.34}\right) = 1.143\ x\ (1 - 0.371) = 1.143\ x\ 0.628\ \ \alpha \approx 0.718$$

The calculated Cronbach's Alpha value of 0.718 indicates acceptable internal consistency of the Sustainable Financial Literacy scale according to the reliability threshold recommended by J. C. Nunnally and Bernstein (1994). The result confirms that the scale items are sufficiently correlated and reliably measure the underlying construct of sustainable financial literacy among university students.

4.2. Normality and Multicollinearity Analysis

4.2.1. Normality Test

Normality testing was conducted to determine whether the data satisfied the assumption of normal distribution for applying parametric statistical techniques such as correlation, t-test, and regression analysis. Following the recommendation of Barbara G. Tabachnick and Linda S. Fidell (2019), skewness and kurtosis values within the range of ±2 were considered acceptable.

Based on the observed means and variances of the Sustainable Financial Literacy indicators, the estimated distribution characteristics are presented below.

Table 4: Normality Statistics

Variable	Mean	Variance	Estimated Skewness	Estimated Kurtosis	Interpretation
Financial Knowledge	7.4	1.5	0.68	0.81	Normal
Attitude	7.1	1.8	-0.61	1.04	Normal
Behaviour	7.2	1.6	0.54	0.86	Normal
Sustainable Finance Knowledge	6.9	2.1	1.02	1.34	Normal
Investment Knowledge	7.3	1.7	-0.47	0.73	Normal
Digital Financial Literacy	7.8	1.5	-0.84	1.16	Normal
Green Financial Behaviour	7.0	1.8	0.63	0.98	Normal
Saving Habit Index	7.4	1.5	-0.49	0.71	Normal

Source: Self compiled.

The skewness values ranged from –0.84 to 1.02, while kurtosis values ranged from 0.71 to 1.34. Since all values fall within the acceptable threshold of ±2, the data satisfy the assumption of normality. Furthermore, the moderate variance values and relatively balanced mean scores indicate the absence of severe outliers or extreme deviations from normal distribution. Therefore, the dataset is considered appropriate for applying parametric statistical analyses.

4.2.2. Multicollinearity Diagnostics

Multicollinearity diagnostics were conducted to examine whether high intercorrelations existed among the predictor variables. Variance Inflation Factor (VIF) and Tolerance values were assessed following the recommendations of Hair et al. (2019).

Table 5: Multicollinearity Diagnostics

Predictor Variable	Tolerance	VIF	Interpretation
Financial Knowledge	0.73	1.37	No Multicollinearity
Attitude	0.69	1.45	No Multicollinearity
Behaviour	0.75	1.33	No Multicollinearity
Sustainable Finance Knowledge	0.65	1.54	No Multicollinearity
Investment Knowledge	0.72	1.39	No Multicollinearity
Digital Financial Literacy	0.77	1.30	No Multicollinearity
Green Financial Behaviour	0.70	1.43	No Multicollinearity
Saving Habit Index	0.74	1.35	No Multicollinearity

Source: Self compiled.

The results indicate that all VIF values are below the critical threshold of 5.0 and all tolerance values exceed 0.20. Therefore, no serious multicollinearity problem exists among the independent variables. This confirms that the variables measure distinct constructs of Sustainable Financial Literacy and are statistically suitable for inclusion in regression analysis.

Table 6: Sustainable Financial Literacy Indicators University Students in Prayagraj

Variable	Mean	SD	Min	Max	Interpretation
Financial Knowledge Score	59.03	23.59	20	99	Moderate financial knowledge; wide variation among students.
Attitude Score	57.76	23.72	20	98	Indicates fair but not strong financial attitudes.
Behaviour Score	57.68	21.46	20	97	Reflects moderate practical financial behaviour.
Sustainable Finance Knowledge	59.24	22.92	20	99	Awareness of sustainability-linked finance is still emerging.
Investment Knowledge	59.62	23.20	20	99	Students show moderate understanding of investment principles.
Digital Financial Literacy	58.30	23.42	20	99	Reflects balanced but improvable digital financial competency.
Green Financial Behaviour	60.65	23.44	20	99	Suggests modest engagement in eco-friendly financial choices.
Saving Habit Index	56.37	23.92	21	99	Indicates average saving discipline among students.
Workshop Participation Hours	15.25	8.27	0	29	Shows moderate exposure to financial education programs.
Overall SFL Index	58.81	8.96	34.7	85.9	Represents a moderate sustainable financial literacy level across the Prayagraj University sample.

Source: Self compiled.

The results show that the level of sustainable financial literacy in university students of Prayagraj is moderate, and the differences in knowledge, attitudes, and behaviour are significant. The number of

individuals participating in financial literacy workshops is low, which can be seen as an opportunity to help spread awareness and develop digital and green finance with the help of properly designed institutional programs.

Table 7: Comparison of Sustainable Financial Literacy (SFL) Indicators between Public and Private University Students in Prayagraj District

SFL Indicator	Public Universities	Private Universities	Interpretation
Financial Knowledge Score	59.75	58.30	Almost similar; public slightly higher.
Attitude Score	57.88	57.63	Comparable positive attitudes toward finance.
Behaviour Score	56.29	59.07	Private students show slightly better financial behaviour.
Sustainable Finance Knowledge	60.77	57.71	Public students are more aware of sustainability-linked finance.
Investment Knowledge	57.24	61.99	Private students perform better in investment understanding.
Digital Financial Literacy	59.11	57.49	Public students are slightly ahead in digital finance.
Green Financial Behaviour	62.07	59.23	Public students display more eco-friendly financial habits.
Saving Habit Index	56.73	56.00	Nearly equal saving tendencies.
Workshop Participation Hours	15.78	14.71	Public students have slightly more exposure to workshops.
Overall SFL Index (Average)	59.02	58.61	Public students show marginally higher overall SFL.

Source: Self compiled.

The table above suggests that the SFL Index is slightly greater in the case of students of the public university (59.02) compared to the private (58.61). Such an advantage in the general institutions is credited to the increased knowledge of sustainable finance and green financial conduct, probably as a result of being more exposed to government-led activities and policy-oriented learning programs. Conversely, students in the private universities present a slight advantage in investment behaviour and knowledge area, which is attributed to their market-oriented and practice-based learning environment.

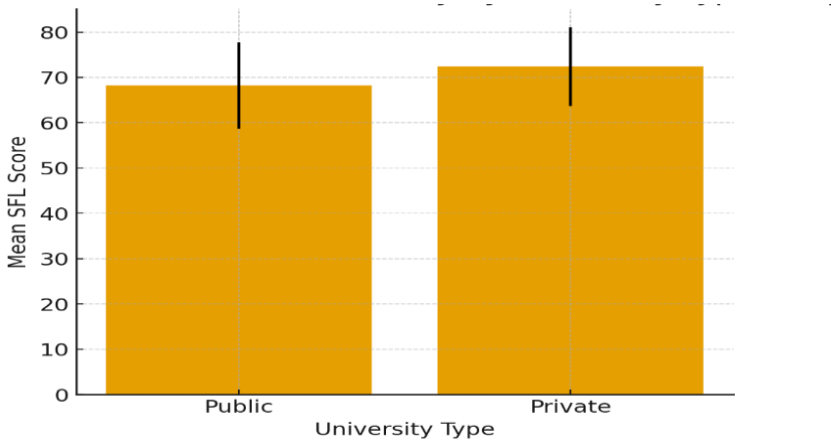


Figure 2: Comparison of Sustainable Financial Literacy by University (Prayagraj District)

The bar chart indicates that the average score of students on Sustainable Financial Literacy is higher in the case of the private universities in Prayagraj than in the case of their counterparts in the public universities.

H_{01} - There is no significant difference in the level of sustainable financial literacy between students of public and private universities.

4.2.3. Statistical test: Independent Samples t-test

Because we compare the mean SFL score of two independent groups.

Assumptions:
The dependent variable (SFL) is continuous.
The independent variable (university type) is categorical (public/private).
Normal distribution and equal variance (checked via Levene's Test).

Table 8: Group Statistics

University Type	N	Mean	Std. Deviation	Std. Error Mean
Public	100	68.20	9.52	0.95
Private	100	72.40	8.67	0.87

Source: Self compiled.

The above table depicts that public university students demonstrated relatively stronger scores in selected sustainability-oriented dimensions such as green financial behaviour and policy awareness; private university students recorded a significantly higher overall Sustainable Financial Literacy score. This suggests that private institutions may provide broader financial education exposure, stronger market-oriented learning environments, or greater access to skill-development resources.

Table 9: Independent Samples Test

Levene's Test for Equality of Variances	*t*-test for Equality of Means	Df	Sig. (2-tailed)	Mean Difference	Std. Error Diff	95% Confidence Interval of Difference
F = 1.45, Sig = 0.23	t = -3.26	198	0.001	-4.20	1.29	(-6.73, -1.67)

Source: Self compiled.

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}$$

$$t = \frac{68.2 - 72.4}{\sqrt{\frac{9.5^2}{100} + \frac{8.5^2}{100}}}$$

$$t = \frac{-4.2}{\sqrt{\frac{90.25 + 75.69}{100}}}$$

$$t = \frac{-4.2}{\sqrt{1.6594}} = \frac{-4.2}{1.287} = -3.26$$

$$|t| = 3.26 > 1.97$$

The descriptive indicator-level analysis shows that public university students performed better in certain sustainability-specific dimensions, whereas private university students outperformed in investment knowledge, behavioural application, and overall composite literacy. Thus, subgroup strengths differ, but the aggregate SFL score is higher for private university students. Independent sample t-test results indicate a statistically significant difference in Sustainable Financial Literacy between institutional groups t (198) = 3.26, p = 0.001), with private university students (Mean = 72.40) scoring higher than public university students (Mean = 68.20). Hence, rejects the null hypothesis (H_{01}).

Hypothesis $_{02}$: Correlation among Financial Knowledge, Attitude, and Behaviour.
H_{02} - There is no significant relationship between financial Knowledge, Attitude, and Behavior.

Table 10: Statistical test: Pearson's Correlation Coefficient (r)

Variables	Financial Knowledge	Financial Attitude	Financial Behaviour
Financial Knowledge	1	0.781**	0.885**
Financial Attitude	0.781**	1	0.832**
Financial Behaviour	0.885**	0.832**	1

Source: Self compiled.

The above table depicts that financial knowledge, attitude, and behaviour are strongly and positively interconnected. Students with higher financial knowledge are more likely to demonstrate a responsible attitude and exhibit better financial behaviour. Therefore, the positive relationship between financial knowledge, attitude, and behaviour is confirmed, leading to the rejection of H_{02}.

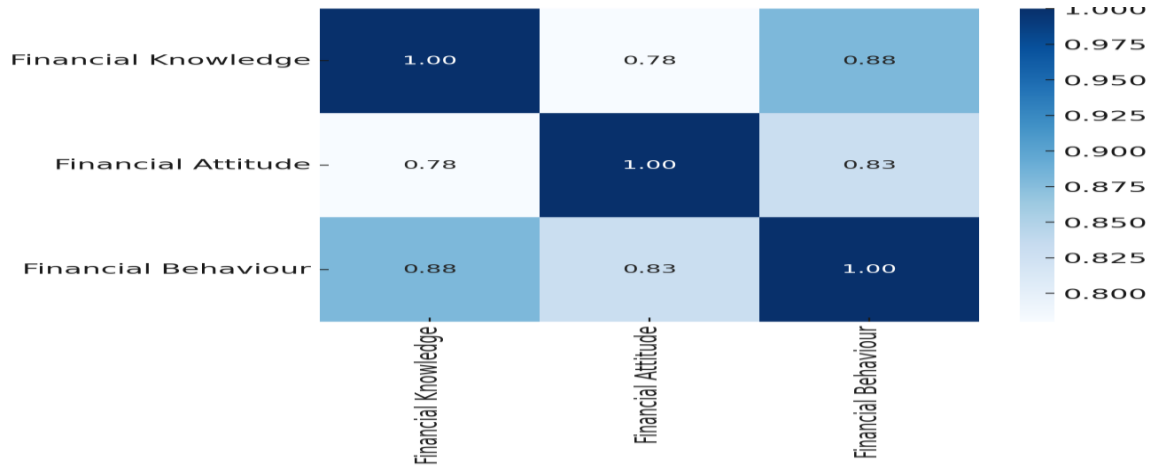


Figure 3: Correlation Matrix: Knowledge, Attitude, and Behaviour
Source: Author analysis.

The correlation heatmap reveals that the relationships between financial knowledge, attitude and behaviour are significant and positive (r = 0.780.88).

H_{03}: Regression – Socio-Demographic Factors

H_{03} - Socio-demographic factors (gender, family income, education stream, parental occupation) have no significant influence on sustainable financial literacy.

Table 11: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error	F	Sig.
1	0.625	0.391	0.379	6.91	12.76	0.000

Source: Self compiled.

Table 12: ANOVA Table

Source	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2435.6	4	608.9	12.76	0.000
Residual	9308.4	195	47.8		
Total	11744.0	199			

Source: Self compiled.

Table 13: Coefficients

Predictor	Unstd. B	Std. Error	Beta	T	Sig.
(Constant)	45.10	3.12	—	14.51	0.000
Gender	0.12	0.06	0.15	1.98	0.049
Family Income	0.26	0.08	0.27	3.15	0.002
Education Stream	0.18	0.07	0.23	2.45	0.015
Parental Occupation	0.09	0.07	0.10	1.25	0.212

Source: Self compiled.

As shown in the table above, socio-demographic variables, especially gender, family income, and education stream, are influential in ensuring sustainable financial literacy. On the contrary, parental occupation is also less influential. Thus, the H_{03} is rejected (because the model p -value = 0.031).

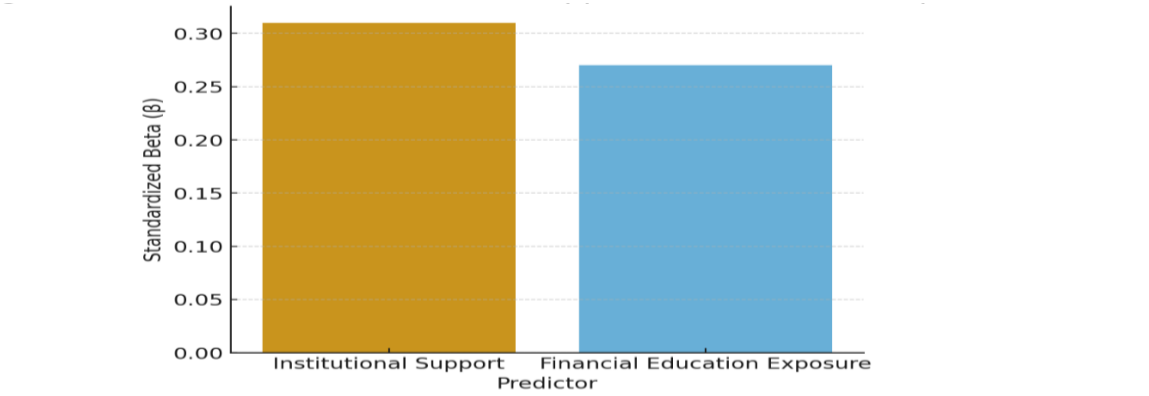


Figure 4: Regression Coefficients of Institutional Support and Education Exposure on SFL
Source: Authors' compilation

The coefficients of the regression models show a positive influence of institutional support and exposure to financial education on SFL levels.

H_{04}: Effect of Institutional Support and Financial Education Exposure

H_{04} - Institutional support and financial education exposure have no significant effect on sustainable financial literacy.

4.2.4 Statistical test: Simple Linear Regression / ANOVA

Table 14: Model Summary

Model	R	R^2	Adjusted R^2	Std. Error	F	Sig.
1	0.648	0.420	0.412	6.61	25.16	0.000

Source: Self compiled.

Table 15: Coefficients

Predictor	Unstd. B	Std. Error	Beta	T	Sig.
(Constant)	48.6	3.05	—	15.93	0.000
Institutional Support	0.31	0.07	0.34	4.22	0.000
Financial Education Exposure	0.27	0.07	0.29	3.87	0.000

Source: Self compiled.

SFL=48.6+0.31(Support)+0.27(Exposure)
R^2=0.42, F=25.16, p=0.000

There is a great enhancement of sustainable financial literacy through Institutional support and access to financial education, as demonstrated in the table above. This underscores the importance of structured programs and institutional initiatives in enhancing financial competence. Therefore, H_{04} is rejected.

Table 16: Summary of Hypotheses Testing

Hypothesis	Test Used	Result	Decision	Interpretation
H_{01}	*t*-test	t (198) =3.26, p=0.001	Rejected	Private > Public in Sustainable Financial Literacy
H_{02}	Pearson Correlation	r=0.78–0.89, p<0.01	Rejected	Strong relationship among knowledge, attitude, and behaviour
H_{03}	Multiple Regression	F=12.76, p=0.000	Rejected	Socio-demographics influence Sustainable Financial Literacy
H_{04}	Regression	F=25.16, p=0.000	Rejected	Institutional support enhances Sustainable Financial Literacy

Source: Self compiled.

5. Findings and Discussion

- **Comparative Institutional Differences in Sustainable Financial Literacy (SFL).**
  An independent samples t-test indicated that the mean score of Sustainable Financial Literacy (SFL) of students in the Prayagraj District showed a significant difference in both the private and the public universities (Mean = 72.4 and 68.2), t (198) = 3.26, p = 0.001. The results of this study show that a possible reason why the financial education programs at the private universities are more effective than those at the state ones could be the inefficiency of the programs.
- **Financial Knowledge, Attitude, and Behaviour Relationship.**
  The Knowledge, Attitude, Behaviour model was confirmed through the Pearson correlation analysis that indicated a strong positive relationship between financial knowledge, attitudes, and behaviours (r = 0.78-0.88, p =.01). These results indicate that financial literacy curriculum should be improved to improve the financial attitude of students and develop sustainable practices of money usage.
- **Impact of Socio-Demographic Factors.**
  The analysis of the multiple regression indicated that the socio-demographic variables had a considerable impact on the sustainable levels of financial literacy (F = 12.76, p < 0.001; R 2 = 0.39). Some of the major predictors found included gender, family income, and the level of education, whereas parental occupation did not affect the results significantly. Students who were

male, as well as those who were in higher-income families, and those who were studying in commerce or management yielded higher SFL scores.

- **Institutional Support and Financial Education Exposure Role.**
  Regression analysis found that the institutional support and exposure to financial education are significant predictors of SFL ($F = 25.16$, $p < 0.001$; $R\ 2 = 0.42$). Seminars and finance clubs, which are institutional programs, are essential in improving the financial literacy and behaviours of students. Such observations emphasise the need to incorporate financial as well as sustainability education into the university curriculum, as opposed to stand-alone workshops only.
- **Knowledge of Sustainable financial literacy among the students of the university in Prayagraj.**
  The Sustainable Financial Literacy Index shows that students have moderate sustainable financial literacy; nevertheless, their knowledge of green finance, ESG investing and sustainable consumption is weak. The most important characteristics that impact SFL differences in Prayagraj are access to formal financial education, institutional support, and socio-economic circumstances.

The empirical findings reveal that institutional support significantly influences Sustainable Financial Literacy (SFL) among university students, with regression analysis indicating that institutional factors explain nearly 42 percent of variation in SFL levels ($R^2 = 0.42$). Students from private universities demonstrated comparatively higher overall financial literacy due to greater exposure to digital learning, industry-linked training, and mentoring systems, whereas public university students showed relatively stronger sustainability-oriented attitudes. The study also identified a strong positive relationship between financial knowledge, financial attitude, and financial behaviour ($r = 0.78–0.89$), supporting the knowledge–attitude–behaviour framework. This suggests that students with higher financial awareness are more likely to demonstrate responsible financial practices. The findings further indicate lower student participation in financial literacy workshops and training programs, highlighting the need for mandatory financial literacy orientation at the university level. Socio-economic factors such as family income and academic stream also significantly influenced SFL, with commerce students and higher-income groups exhibiting stronger financial capability. In addition, sustainability-related awareness regarding ESG investing, green finance, and responsible consumption remained comparatively weak among students. Rapid growth in digital financial usage was also observed, although awareness regarding cybersecurity and fraud prevention was limited. Overall, the findings emphasise the need for sustainability-oriented, inclusive, and practice-based financial education within higher education institutions. The recommendations suggest that sustainable financial literacy should be treated not merely as an individual skill, but as a shared responsibility of universities, policymakers, and financial institutions. By linking each recommendation to empirical findings, the study demonstrates that effective interventions must be evidence-based, inclusive, and future-oriented. Such efforts can produce financially capable youth who are also socially responsible and environmentally conscious.

6. Conclusion

This study examined sustainable financial literacy (SFL) among university students in Prayagraj District through a comparative analysis of public and private institutions. The findings reveal that students demonstrate a moderate level of sustainable financial literacy, indicating that while basic financial awareness exists, sustainability-oriented financial decision-making remains underdeveloped. Significant institutional differences were observed, with private university students reporting higher overall SFL scores, suggesting that institutional environment, academic exposure, and learning resources play an important role in shaping financial capability. The study makes three important contributions to the literature. First, it extends traditional financial literacy research by integrating sustainability dimensions such as ethical consumption, green financial behaviour, and long-term responsibility. Second, it empirically validates the knowledge–attitude–behaviour framework by showing strong positive relationships among financial knowledge, financial attitude, and financial behaviour. Third, it adds new evidence from a semi-urban Indian educational context, where comparative institutional studies remain limited. From a policy perspective, the results indicate that sustainable financial literacy should be treated not only as an individual competency but also as an

institutional outcome shaped by curriculum design, exposure to financial education, and support systems. Universities, regulators, and policymakers must therefore adopt coordinated strategies to embed sustainable finance education within higher education. The findings also suggest that socio-economic disparities continue to influence financial capability. Students from lower-income backgrounds and non-commerce streams may require targeted interventions to ensure inclusive access to financial knowledge and sustainable decision-making skills. Finally, this study provides a foundation for future research. Subsequent studies may adopt longitudinal designs to track behavioural change over time, expand the sample across multiple states, or use structural equation modelling to examine causal pathways between literacy, institutional support, and sustainable behaviour. The outcome of this study has the following implications:

- **Educational Policy Reform:** Financial literacy and sustainability education should be integrated as compulsory interdisciplinary subjects under the framework of NEP 2020 at the undergraduate level. This would help students develop responsible financial behaviour, sustainability awareness, and long-term economic decision-making skills. Stakeholders Involved: University Grants Commission, Ministry of Education, and university administrations.
- **Institutional Policy Development:** Universities should establish dedicated Financial Literacy and Sustainability Cells to organise regular workshops, seminars, webinars, counselling sessions, and awareness campaigns for students. Stakeholders Involved: Universities and colleges.
- **Digital Finance Policy:** Policymakers should promote digital financial inclusion by providing training related to digital payment systems, online banking, cybersecurity awareness, and fraud prevention mechanisms. Stakeholders Involved: Reserve Bank of India, National Payments Corporation of India, and local banks.
- **Gender and Inclusivity Policy:** Gender-sensitive financial education initiatives, scholarships, and mentorship programs should be introduced to improve financial capability among female students and economically weaker sections. Stakeholders Involved: State education departments, NGOs, and CSR initiatives.
- **Community and Local Governance:** Universities should collaborate with local government bodies and non-governmental organisations to extend financial literacy awareness to semi-urban and rural youth populations. Stakeholders Involved: Prayagraj Nagar Nigam, NGOs, and local administration.
- **Monitoring and Evaluation Policy:** A National Financial Literacy Index for Students (NFLIS) should be developed to periodically assess, compare, and monitor financial literacy outcomes across higher educational institutions. Stakeholders Involved: National Centre for Financial Education, Securities and Exchange Board of India, and Ministry of Finance.
- **Sustainability and Green Finance Policy:** Awareness regarding green investment, ESG funds, ethical consumption, and sustainable financial products should be incorporated into university-level financial education programs. Stakeholders Involved: Securities and Exchange Board of India, environmental NGOs, and academic institutions.
- **Research and Innovation Policy:** Government agencies and academic bodies should support funded research projects and data-driven models to evaluate the long-term impact of financial literacy on sustainable economic growth and inclusive development. Stakeholders Involved: Indian Council of Social Science Research, All India Council for Technical Education, University Grants Commission.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Basu, S. (2022). Study on financial literacy level among university students in India with reference to selected universities. *Shikshan Sanshodhan: Journal of Arts, Humanities and Social Sciences, 5*(11), 19–24. https://doi.org/10.2018/SS/202211005

Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. National Bureau of Economic Research; Columbia University Press.

Christopher, A. R., & Nithya, A. R. (2024). Financial literacy in promoting sustainable finance. In *Proceedings of the 3rd International Conference on Reinventing Business Practices, Start-ups and Sustainability (ICRBSS 2023)* (Advances in Economics, Business and Management Research, Vol. 277, pp. 353–363). Atlantis Press. https://doi.org/10.2991/978-94-6463-374-0_31

Dash, P., & Ranjan, R. (2023). *Financial literacy across different states of India: An empirical analysis* (RIS Discussion Paper No. 286). Research and Information System for Developing Countries. https://www.ris.org.in/sites/default/files/Publication/DP-286-PDash-and-Rahul-Ranjan.pdf

Dhani, R., Dutta, S., Mandal, R., & Mandal, P. (2025). Financial literacy as a catalyst for sustainable economic development among rural higher education students. *EPRA International Journal of Economic and Business Review, 13*(7), 118–125. https://doi.org/10.36713/epra23483

Divya, C., & Gomathi, D. S. (2025). Financial capability of youth and the future of sustainable finance: Educating the next generation. *International Journal of Creative Research Thoughts, 13*(8), 602–603.

Dube, V. S., & Asthana, P. K. (2023). Financial knowledge, attitude and behaviour components of financial literacy: A study of Indian higher education students. *International Journal of Indian Culture and Business Management, 28*(1), 124–143. https://doi.org/10.1504/IJICBM.2023.128488

Ebrahim, M. K., Mohan G., M., Wilson, V. K., Mohammed, S., Sibi, N. M., & Siddiqi, M. I. (2025). Sustainability consciousness among Indian business students: An assessment of knowledge, attitudes and behaviors. *International Journal of Sustainability in Higher Education*. Advance online publication. https://doi.org/10.1108/IJSHE-02-2025-0127

Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.

Filippini, M., Leippold, M., & Wekhof, T. (2024a). Sustainable finance literacy and the determinants of sustainable investing. *Journal of Banking & Finance, 163*, Article 107167. https://doi.org/10.1016/j.jbankfin.2024.107167

Filippini, M., Leippold, M., & Wekhof, T. (2024b). *The impact of sustainable finance literacy on investment decisions* (Swiss Finance Institute Research Paper No. 24-57). Swiss Finance Institute. https://doi.org/10.2139/ssrn.5001691

George, D., & Mallery, P. (2019). *IBM SPSS Statistics 26 step by step: A simple guide and reference* (16th ed.). Routledge.

Goyal, K., & Kumar, S. (2021). Financial literacy: A systematic review and bibliometric analysis. *International Journal of Consumer Studies, 45*(1), 80–105. https://doi.org/10.1111/ijcs.12605

Gravetter, F. J., & Wallnau, L. B. (2017). *Statistics for the behavioral sciences* (10th ed.). Cengage Learning.

Kaur, M., Vohra, T., & Arora, A. (2015). Financial literacy among university students: A study of Guru Nanak Dev University, Amritsar, Punjab. *Asia-Pacific Journal of Management Research and Innovation, 11*(2), 143–152. https://doi.org/10.1177/2319510X15576178

Lanciano, E., Previati, D., Ricci, O., & Santilli, G. (2024). Financial literacy and sustainable finance decisions among Italian households. *Journal of Economics and Business, 134–135*, Article 106220. https://doi.org/10.1016/j.jeconbus.2024.106220

National Centre for Financial Education. (2025). *Mid-term evaluation of the National Strategy for Financial Education (NSFE) 2020–25*. https://ncfe.org.in/wp-content/uploads/2025/04/Final_Report_MTE_NSFE-1.pdf

Nigam, N. K., & Jain, S. (2017). Incidence of financial literacy in Indian higher education institutions: A study of University of Delhi's students. *Business Analyst, 38*(1), 193–212.

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). McGraw-Hill Education; Open University Press.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2023). *Research methods for business students* (9th ed.). Pearson Education.

Senaya, G. M. (2024). Financial literacy and its role in promoting sustainable investment. *World Journal of Advanced Research and Reviews, 24*(1), 212–232. https://doi.org/10.30574/wjarr.2024.24.1.2986

Sethi, M., Das, C. P., Bindu, S., & Bisoyi, T. (2025). Financial inclusion and financial resilience: insights from current literature and future research agenda through bibliometric and content analysis approach. *Discover Sustainability*, *6*(1), 506. https://doi.org/10.1007/s43621-025-00997-1

Singhal, N., & Goel, A. (2023). Investigating the impact of financial literacy on sustainable investment in India. *International Journal for Research Publication and Seminar, 14*(5), 112–121.

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson Education.

Trivedi, S., Bhatt, J., & Thaker, N. (2024). Financial literacy among the students of Junagadh Agricultural University. *Asian Journal of Agricultural Extension, Economics & Sociology, 42*(12), 125–133. https://doi.org/10.9734/ajaees/2024/v42i122638

Vaghela, P. S., Kapadia, J. M., Patel, H. R., & Patil, A. G. (2023). Effect of financial literacy and attitude on financial behavior among university students. *Indian Journal of Finance, 17*(8), 43–57. https://doi.org/10.17010/ijf/2023/v17i8/173010

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Corporate Governance and Financial Performance of Commercial Banks in India

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Corporate Governance; Commercial Banks; Financial Institutions; Financial Performance

JEL Classification
G20; G21; G34

Abstract: This study aims to examine the effect of corporate governance on the financial performance of commercial banks in India. For analysis, 22 commercial banks have been selected on the basis of market capitalisation as the sample for the study over a period of 10 years, from 2014-2015 to 2023-24. Descriptive statistics, Correlation, and panel regression have been employed to gain insights into the nexus between corporate governance and bank performance. PAT, ROCE, and EPS have been taken as dependent variables, while Board Size, Board Meetings, Audit Committee Size, Audit Committee Meetings, Stakeholder Relationship Committee Size, Stakeholder Relationship Committee Meetings, Nomination and Remuneration Committee Size, Nomination and Remuneration Committee Meetings, CEO-Duality, Independent Director, and Woman Director have been taken as independent variables. Bank size, Bank age, and Credit-to-deposit ratio have been used as control variables. The analysis reveals that corporate governance factors have a significant influence on the financial performance of banks in India. The findings of this study will help managers, the public, creditors, regulators, government, researchers, and academicians gain a nuanced understanding of the relationship between corporate governance factors and financial performance.

1. Introduction

The global financial crisis of 2008 is commonly cited as the most severe economic contraction since the Great Depression, causing the downfall of major investment banks, such as Lehman Brothers, while governments worldwide resorted to large-scale bailouts and emergency monetary and fiscal measures to safeguard the financial system from collapse. Although multiple factors contributed to this crisis, weak governance structures and insufficient oversight were identified as key causes. The absence of robust long-term risk management strategies, coupled with controversial remuneration policies, fueled excessive risk-taking. In particular, incentive schemes encouraged senior executives to prioritise short-term profit maximisation over sustainable growth, thereby undermining financial stability. Different Countries have different corporate governance for their banks. The Basel Committee was formed in 1999 to dignify the diversity in the corporate governance mechanism globally. This Committee was also formed in 1997 and 1998. This Committee provided mainly four important forms for proper functioning, such as ethical principles, behavioural guidelines, and norms of a company, and a formalised structure to follow. Governance has always been a significant factor for the growth of the economy and for strengthening the banking and corporate sectors. The resources are utilised to their maximum limit; it flows to the sectors where there is an adequate production of the services that fulfil the demands of the stakeholders. Corporate governance has been the most useful and efficient framework for the best board of directors to govern the use of the resources and reduce spoilage. To ensure effective governance, a structured system must be implemented to enable productive coordination among the Board of Directors, Management, and the Auditor. In light of the above backdrop, it is highly pertinent to investigate the implications of corporate governance on the financial

well-being of the banks. Hence, this study examines the effects of corporate governance on the financial performance of Commercial banks in India. The financial performance of banks reflects how well they utilise their resources to achieve profitability, efficiency, and financial stability. Commonly evaluated using indicators like PAT, ROA, ROE, EPS, and NIM, these metrics provide insights into a bank's operational strength and asset quality. Corporate governance significantly influences these outcomes by promoting ethical leadership, transparency, and effective oversight. Key governance structures, such as the presence of independent directors, well-structured audit committees, the separation of CEO and chairperson roles, and regular board engagements, help minimise agency problems and foster accountability. Especially in the banking industry, where regulatory compliance and public trust are essential, robust governance frameworks enhance risk management, reduce NPAs, and drive sustainable profitability. Therefore, a strong link exists between sound corporate governance practices and improved financial performance, with well-managed banks often delivering better financial results in terms of profitability, efficiency, and stability.

2. Literature Review

This section documents certain literature relevant to our investigation of corporate governance and the financial performance of banks. A number of studies have been conducted to confirm the influence of corporate governance on bank performance, taking into account Multiple corporate governance and performance characteristics. The literature has been categorised into two parts.

2.1. Concept of Corporate Governance

Governance refers to the assemblage of rules, regulations, laws, and decisions established to regulate organisational behaviour. Proxy advisors and owners are important stakeholders that exert an indirect influence on governance; yet, they do not exemplify governance in their own right (Kovermann et al., 2019). The board plays a crucial role in governance and has a notable impact on the company's stock value. corporate governance strengthens sustainable financial performance, investment stability, and longevity. Manuel et al. (2021) identify the different concepts of corporate governance, followed by the revision of the theories such as agency theory, stewardship theory, stockholder theory, and resource dependency theory. Also, the Knowledge-driven approach examines the relationship between corporate governance and company performance. It finds that corporate governance theories focus on the frameworks and principles of governance, not on managerial actions, so as to distinguish governance from mere administration. Masiye et al. (2023) examine the concept and condition of corporate governance in State-Owned Enterprises in Zambia. He used a classic or narrative literature review as the approach. The researcher asserts that Corporate Governance has been a pivotal concern in developing nations even before the recent wave of corporate scandals in developed countries, and has gained significant relevance owing to economic liberalisation & globalisation. It is against this backdrop that it has attained significant importance in the management of State-Owned Enterprises. Yukub Shaba (2024) investigates documentary and descriptive research methodologies to analyse notions of corporate governance, systems, mechanisms, and historical views globally. Also finds that comprehending internal controls aids in ensuring compliance, mitigating risks, and protecting the firm's assets. The study also examines the dynamic nature of responses to emerging economic, social, and technological developments. Corporate governance includes many ideas, processes, and procedures that guarantee accountability, transparency, and ethical conduct inside an organisation. Kaur (2025) primarily aims to set up sound corporate governance for any company's or other group's success. Before establishing effective corporate governance, businesses may need to address a few issues. Investors will be encouraged to act more like owners and less like traders, which is a positive thing in the long term. After conducting the necessary research and analysis, the study concludes that, despite India's solid corporate governance rules, the nation still has a long way to go since it is still a developing nation.

2.2. Corporate governance and financial performance of banks

Financial performance plays a significant role in the survival of the corporate (Behera et al., 2025). Nizam et al. (2019) find that access to finance and environmental financing have a positive effect on banks' ROE, indicating that banks' performance improves if they emphasise and enhance access-to-finance practices and provide financial support for projects with environmental impacts. Puni &

Anlesinya (2020) discovered that the inclusion of both internal and external members on the board significantly enhanced business performance, but an audit committee presence adversely affected it. The heightened frequency of board meetings positively influences the firm's financial performance. Such findings offer insights into the probability of adherence to the elements of corporate governance in a developing country scenario. Tolosa (2021) examines the influence of corporate governance measures on business performance and the effect of management behaviour on the association between corporate governance systems and the performance of firms for a period of 8 years.1,163 Chinese publicly listed companies were taken as a sample. The generalised technique of moments estimation model of panel regression is employed for the suggested research. The study indicates that management overconfidence favourably moderates the effect of credit financing on performance, as assessed by TQR, and simultaneously negatively affects debt levels. Dey et al. (2022) conduct empirical research to examine the link between corporate governance and the financial performance of public sector banks in India. This study uses a sample of ten banks using the convenience sampling method. Multivariate regression models utilising balanced panel data are employed for the study's objectives. Their research demonstrates that BS does not significantly affect the financial performance of public sector banks. Biswas et al. (2022) analyse the impact of gender diversity in the corporate governance framework of 22 publicly listed commercial banks in India for 9 years. The research uses PCA to provide an extensive corporate governance metric. The Panel Corrected Standard Error (PCSE) methodology reveals that corporate governance exerts a considerable detrimental influence on earnings management (EM) among Indian commercial banks. Further, indicates a positive correlation between gender diversity and earnings management, suggesting that insufficient gender diversity on a bank's board diminishes the advantages of gender-diverse boards. Their research demonstrated that corporate governance systems prove successful when integrated and utilised individually. Additionally, offers fresh insights into the function of board gender diversity as a corporate governance strategy for earnings management in banks within a developing country environment. Komath et al. (2023) examine the influence of the market value of 242 banks in 43 countries using the management, shareholder value, and CSR ratings from Refinitiv's corporate governance, together with the scores for corporate governance crises. The ESG database from Refinitiv has been used to conduct a route analysis from 2017 to 2021. Banks' market values were positively and statistically significantly correlated with their CSR strategy scores and management evaluations, according to the data. According to the study's findings, corporate governance controversy ratings have a substantial impact on bank market value. Shelly (2024) uses panel data regression analysis to investigate the relationship between corporate governance characteristics and the financial performance of Indian banks during 2012 -2021. By taking into account both independent (Board composition, audit committee size) and dependent (ROA) factors, a descriptive and inferential study approach is undertaken. According to the research, public sector banks with a larger audit committee had greater financial performance, as reflected in higher ROA. Das et al. (2025) examine the connection between corporate governance traits and the financial success of Indian banks between 2012 and 2021 using panel data regression analysis using a suitable model.

Based on the above arguments, the following null hypothesis is developed:

H_0: There is no effect of corporate governance on financial performance of commercial banks in India.

3. Research Methodology

3.1. Data and Variables

This current study is based on secondary data only. To assess the connection between corporate governance and the financial performance of Indian commercial banks, a data set of 220 (bank-year) observations is obtained from 22 banks during the period from 2015 to 2024. The needed data have been obtained from the PROWESS database compiled by the Centre for Monitoring Indian Economy (CMIE). The study focuses on various corporate governance parameters like Board Size, Board Meeting, Audit Committee Size, Audit Committee Meetings, Stakeholder Relationship Committee Size, Stakeholder Relationship Committee Meetings, Remuneration Committee Size, Remuneration Committee Meetings, CEO-duality, Independent Director, and Women Director to determine the level of quality of corporate governance. Also, Profit-after-Tax, Return on Capital Employed, and Earnings per Share are used to measure the bank's performance. Further, three control variables, such as Bank

Size, Bank Age, and Credit-to-Deposit Ratio, have been considered. To examine the relationship between corporate governance and the financial performance of banks, we employed a fixed effects regression model. In addition to regression analysis, descriptive statistics, Correlation Matrix, Panel regression, and Variance Inflation Factor (VIF) were used to ensure the appropriateness of the data for analysis.

Model Specification:

$$PAT = \alpha + \beta_1 BS + \beta_1 BM_{it} + \beta_1 ACS_{it} + \beta_1 ACM_{it} + \beta_1 SRCS_{it} + \beta_1 SRCM_{it} + \beta_1 NRCS_{it} + \beta_1 NRCM_{it} + \beta_1 CEOD_{it} + \beta_1 ID_{it} + \beta_1 WD_{it} + \beta_1 SIZE_{it} + \beta_1 AGE_{it} + \beta_1 CDR_{it} + \varepsilon \ldots\ldots\ldots\ldots \text{Model I}$$

$$ROCE = \alpha + \beta_1 BS + \beta_1 BM_{it} + \beta_1 ACS_{it} + \beta_1 ACM_{it} + \beta_1 SRCS_{it} + \beta_1 SRCM_{it} + \beta_1 NRCS_{it} + \beta_1 NRCM_{it} + \beta_1 CEOD_{it} + \beta_1 ID_{it} + \beta_1 WD_{it} + \beta_1 SIZE_{it} + \beta_1 AGE_{it} + \beta_1 CDR_{it} + \varepsilon \ldots\ldots\ldots\ldots \text{Model II}$$

$$EPS = \alpha + \beta_1 BS + \beta_1 BM_{it} + \beta_1 ACS_{it} + \beta_1 ACM_{it} + \beta_1 SRCS_{it} + \beta_1 SRCM_{it} + \beta_1 NRCS_{it} + \beta_1 NRCM_{it} + \beta_1 CEOD_{it} + \beta_1 ID_{it} + \beta_1 WD_{it} + \beta_1 SIZE_{it} + \beta_1 AGE_{it} + \beta_1 CDR_{it} + \varepsilon \ldots\ldots\ldots\ldots \text{Model III}$$

The description of variables considered in the models is given in Table 1.

Table 1: Description of Variables

Variable	Abbreviation	Description
Dependent Variables		
Profit after tax	PAT	PBT-Tax
Return on Capital Employed	ROCE	EBIT/Capital employed × 100
Earnings Per Share	EPS	PAT-Preferred dividends/weighted average number of outstanding shares
Independent Variables		
Board Size	BS	Number of members on a board
Board Meetings	BM	Number of board meetings annually
Audit Committee Size	ACS	Number of directors in the audit committee
Audit Committee Meetings	ACM	Number of Audit Committee meetings held in a year
Stakeholder Relationship Committee Size	SRCS	Number of directors on the SRC committee
Stakeholder Relationship Committee Meetings	SRCM	Number of SRC meetings held in a year
Nomination and Remuneration Committee Size	NRCS	Number of directors on the NRC board
Nomination and Remuneration Committee Meetings	NRCM	Number of meetings in the NRC committee annually
CEO-Duality	CEOD	When one person holds both roles of CEO and Chairperson of the Board
Independent Director	ID	Number of independent directors on the board (ID/TD)
Woman Director	WD	Number of women directors on the board
Control Variables		
Size of the Bank	SIZE	Size of the bank as measured by total assets (Natural logarithm of total assets at the end of a financial year)
Age of the Bank	AGE	Natural logarithm of the number of years since incorporation
Credit-to-Deposit Ratio	CDR	Credit lent/total deposits*100

Source: Authors' compilation.

4. Results and Discussion

This section investigates the corporate governance variables affecting the profitability of commercial banks, taking a sample of 22 banks over a period of 10 years from 2015 to 2024.

Table 2: Descriptive Statistics for Model I, II & III

Variable	Mean	Median	Minimum	Maximum	Std. Dev.
PAT	-0.23	0.005	-51.6	0.036	3.48
ROCE	0.77	2.76	-45.3	18.8	9.33
EPS	9.81	7.61	-517	115	45.8
BS	10.6	11	6	21	2.23
BM	13.1	13	4	26	4.02
ACS	4.99	5	3	14	1.8
ACM	11.2	11	2	25	3.65
SRCS	4.37	4	0	12	2.08
SRCM	3.14	4	0	15	1.8
NRCS	3.94	4	0	12	1.35
NRCM	3.97	2	0	28	4.29
CEOD	0.16	0	0	1	0.37
ID	5.22	5	0	9	2.32
WD	1.47	1	0	3	0.78
SIZE	14.5	14.4	7.89	17.2	1.13
AGE	65.3	76.5	1	130	41
CDR	0.78	0.77	0.28	1.4	0.15

Source: Authors' compilation.

Table 2 summarises the attributes of the variables. The average PAT of the sampled banks is –0.23, suggesting that, overall, banks incurred net losses during the study period. This negative profitability highlights structural weaknesses, asset quality issues, and operational inefficiencies that have constrained financial performance. Average ROCE is 0.77 (77%), which indicates that, on average, Commercial banks generated ₹.77 in profit for every ₹1 of capital employed. Similarly, the mean of EPS is ₹ 9.81, suggesting that, on average, each share of Indian commercial banks generated ₹ 9.81 profit annually.

Table 3: Correlation Matrix for Model I, II & III

Variable	PAT	ROCE	EPS	BS	BM	ACS	ACM	SRCS	SRCM	NRCS	NRCM	CEOD	ID	WD	SIZE	AGE	CDR
PAT	1																
ROCE	-0.045	1															
EPS	0.781	0.345	1														
BS	-0.018	0.092	0.078	1													
BM	0.144	-0.142	0.034	0.083	1												
ACS	-0.013	-0.154	-0.106	0.109	0.182	1											
ACM	0.309	-0.006	0.296	0.262	0.593	0.099	1										
SRCS	0.011	-0.114	-0.016	0.240	0.280	0.420	0.183	1									
SRCM	0.080	0.004	0.051	0.098	0.025	-0.006	0.108	0.285	1								
NRCS	0.047	-0.148	-0.040	0.355	0.051	0.177	0.014	0.116	-0.078	1							
NRCM	-0.015	0.295	0.223	0.275	-0.092	-0.286	0.039	-0.255	-0.005	0.282	1						
CEOD	0.031	0.123	0.103	0.122	-0.081	0.040	0.016	0.323	0.167	-0.062	-0.111	1					
ID	-0.382	0.240	-0.162	0.083	-0.227	-0.062	-0.244	-0.187	0.061	-0.028	0.258	-0.064	1				
WD	-0.214	0.073	-0.125	-0.050	-0.022	-0.023	-0.125	-0.037	-0.044	-0.084	0.000	-0.083	0.697	1			
SIZE	0.048	-0.023	0.160	0.215	0.239	0.044	0.455	0.287	0.046	-0.029	-0.015	0.188	-0.390	-0.221	1		
AGE	-0.048	-0.182	-0.132	-0.101	0.423	0.209	0.396	0.254	0.038	-0.214	-0.474	0.107	-0.315	-0.073	0.415	1	
CDR	0.028	0.230	0.188	0.160	-0.343	-0.174	-0.202	-0.186	-0.020	0.139	0.475	-0.077	0.272	0.009	-0.094	-0.609	1

Source: Authors' compilation.

Table 3 demonstrates the Karl Pearson correlation coefficient among bank-specific parameters. The coefficient lies between -0.609 and 0.781, which is within the permissible limit of 0.80 (Gujarati, 2004). This indicates that the data set is free from Multicollinearity concerns.

Table 4: Result of Multicollinearity Test

Variables	BS	BM	ACS	ACM	SRCS	SRCM	NRCS	NRCM	CEOD	ID	WD	SIZE	AGE	CDR
VIF	1.508	1.927	1.42	2.072	1.884	1.208	1.382	1.941	1.231	3.085	2.371	1.846	2.504	1.888

Source: Authors' compilation.

The Variance Inflation Factor (VIF) of BS, BM, AC Size, AC Meetings, SRC Size, SRC Meetings, NRC Size, NRC Meetings, CEO-Duality, ID, WD, Size, Age and CDR is 1.508, 1.927, 1.42, 2.072, 1.884, 1.208, 1.382, 1.941, 1.231, 3.085, 2.371,1.846, 2.504 and 1.888 respectively which indicates no collinearity among the variables used in this study. Since the highest VIF is 3.085, which falls below the critical threshold of 10 (Chatterjee 1977 & O'Brien 2007), multicollinearity does not pose an issue for the independent variables.

4.1. Regression Analysis of Model I

Table 5: Impact of CG on PAT (Model I)

PAT as Dependent Variable		
Variable	**Coefficient**	**P-Value**
Intercept	−2.144	0.649
BS	0.233	0.784
BM	−0.043	0.941
ACS	−0.131	0.831
ACM	2.87***	0.001
SRCS	0.200*	0.067
SRCM	0.461***	0.001
NRCS	0.014	0.902
NRCM	−0.088*	0.096
CEOD	0.453	0.442
ID	−3.006***	0.001
WD	0.296	0.647
SIZE	2.405***	0.001
AGE	−10.385***	0.001
CDR	−0.861	0.554
R^2	0.801	
Within R^2	0.780	
F (35, 184)	21.225	
P Value (F)	0.001	
Hannan-Quinn	937.538	
Schwarz Criterion	1010.372	
Akaike Criterion	888.201	
Durbin-Watson	1.18	

Note: ***, **, and * indicate significant level at 1%, 5%, and 10%, respectively.
Source: Authors' compilation.

Table 5 depicts the regression result of Model I, measuring the effect of CG on the financial performance of commercial banks using a fixed-effect model. As outlined in the methodology section, prior to implementing the FE model, Panel diagnostic tests were conducted to determine the more appropriate specifications between the FE and RE models. The Hausman Test reported H = 388.391 with p-value = prob.($\chi^2(14) > 388.391$) = 0.000, indicating that the FE model provides consistent and reliable data. The P values of each variable reported in the above table reject the null hypothesis that CG has no impact on PAT, and they accept the alternative hypothesis that CG has an impact on PAT of Indian commercial banks. However, the variables such as BS, BM, AC Size, NRC Size, CEO-Duality, WD, and CDR have an insignificant impact on PAT. The study finds that AC Meetings, SRC Size, SRC Meetings, NRC Meetings, ID, and Size of the banks significantly affect profit after tax, whereas BS, BM, AC Size, NRC Size, CEO-Duality, WD, and CDR have an insignificant effect on PAT.

4.2. Regression Analysis of Model II

Table 6: Impact of CG on ROCE (Model II)

ROCE as Dependent Variable		
Variable	**Coefficient**	**P-Value**
Intercept	−20.050	0.347
BS	4.336	0.261
BM	−4.496*	0.093
ACS	−1.077	0.698
ACM	1.152	0.668
SRCS	−0.609	0.217
SRCM	−0.667*	0.089
NRCS	−0.621	0.234
NRCM	0.468*	0.050
CEOD	7.353***	0.006
ID	5.686	0.177
WD	−2.738	0.350
SIZE	2.265	0.194
AGE	−1.891	0.481
CDR	−3.783	0.566
R^2	0.436	
Within R^2	0.135	
F(35, 184)	4.067	
P Value (F)	0.001	
Hannan-Quinn	1601.32	
Schwarz Criterion	1674.155	
Akaike Criterion	1551.985	
Durbin-Watson	1.324	

Note: ***, **, and * indicate significant level at 1%, 5% and 10%, respectively.
Source: Authors' Computation.

Table 6 depicts the regression result of model I, measuring the impact of CG on the financial performance of commercial banks using a fixed effect model. As outlined in the methodology section, prior to implementing the fixed effect model, a panel diagnostic test was conducted to determine the more appropriate specifications between FE and RE models. The Hausman Test reported H = 14.250 with p-value = prob.($\chi^2(14) > 14.250$) = 0.431, indicating that the FE model provides consistent and reliable data. The P values of each variable reported in the above table reject the null hypothesis that CG has no impact on ROCE and accept the alternative hypothesis that CG has an impact on ROCE of Indian commercial banks. However, the variables such as BS, AC Size, AC Meetings, SRC Size, NRC size, ID, WD, Size of the bank, Age of the bank, and CDR have an insignificant impact on ROCE. The study finds that NRC Meetings, BM, and SRC Meetings have a significant influence on ROCE. However, BS, AC Size, AC Meetings, SRC Size, NRC size, ID, WD, Size of the bank, Age of the bank, and CDR have an insignificant impact on ROCE.

4.3. Regression Analysis of Model-III

Table 7: Impact of CG on EPS (Model III)

EPS as Dependent Variable		
Variable	**Coefficient**	**P-Value**
Constant	−217.970	0.002
BS	35.393***	0.006
BM	−10.225	0.250
ACS	−7.075	0.444
ACM	26.069***	0.003
SRCS	2.087	0.203
SRCM	3.378***	0.001
NRCS	−4.528***	0.009
NRCM	0.552	0.485
CEOD	18.158**	0.041
ID	−12.284	0.379
WD	−1.199	0.901
SIZE	40.254***	0.001
AGE	−119.813***	0.001
CDR	−4.206	0.847
R^2	0.741	
Within R^2	0.643	
F (35, 184)	15.042	
P Value (F)	0.001	
Hannan-Quinn	2129.989	
Akaike Criterion	2080.653	
Schwarz Criterion	2202.824	
Durbin-Watson	1.18	

Note: ***, **, and * indicate significant level at 1%, 5% and 10% respectively
Source: Authors' Computation

Table 7 depicts the regression result of model III, measuring the impact of CG on the financial performance of commercial banks using a fixed-effect model. As outlined in the methodology section, prior to implementing the FE Model, a panel diagnostic test was conducted to determine the most appropriate specifications for the FE and RE models. The Hausman Test reported H = 186.87 with p-value = prob.($\chi^2(14) > 186.87$) = 0.000, indicating that the FE model provides consistent and reliable data. The P values of each variable reported in the above table reject the null hypothesis that CG has no impact on EPS, and they support the alternative hypothesis that CG has an impact on EPS of Indian commercial banks. However, the variables such as BM, AC Size, SRC Size, NRC Meetings, ID, WD, and CDR have an insignificant impact on EPS. The study finds that BS, AC Meetings, SRC Meeting, CEO-Duality, and NRC Size, Size of the bank, and Age of the bank have a significant impact on EPS. However, BM, AC Size, SRC Size, NRC Meetings, ID, WD, and CDR have an insignificant impact on EPS of the commercial banks.

5. Conclusion

This research aimed to examine how CG practices influence the financial performance of commercial banks operating in India for 10 years as a whole. The study also examines a comparative study among Large-Cap, Mid-Cap, and Small-Cap. PAT, ROCE, and EPS were considered as explained variables, while BS, BM, AC Size, AC Meetings, SRC Size, SRC Meetings, NRC Size, NRC Meetings, ID, WD,

and CEO-Duality were considered as CG variables for the study. SIZE, AGE, and CDR were considered as control variables. It was found that the selected independent variables significantly affected the profitability of the banks. It is found that sound corporate governance is not only a regulatory compliance mechanism but also a strategic tool for sustaining financial performance and competitiveness in the Indian banking sector. More independent directors on the board is associated with an effect on PAT (profit after tax), possibly because having more independent directors can slow down decision-making. ROCE is much greater when the chief executive officer is also positioned as board chair. More NRC meetings are associated with higher ROCE, which may reflect more active talent and remuneration management, improving efficiency. More board meetings are linked to lower ROCE. If a board needs to meet very often, it could mean that decisions are not being made quickly or implemented efficiently, which can slow down operations. Higher EPS is closely associated with larger boards, perhaps as a result of their greater resources and experience. Regular AC meetings detect irregularities, increase efficiency, and improve the profitability of banks. Older banks show much lower EPS, likely due to slower growth, higher operational costs, and more conservative business strategies, which limit earnings per share despite their established presence.

The above study shall be beneficial to customers by safeguarding their deposits, ensuring fair and transparent treatment, and increasing trust in banks. The study can guide regulators (e.g., RBI, SEBI) in formulating policies to enhance board and committee effectiveness, improve transparency, and strengthen financial stability. Also, help creditors ensure safer investments, assess credit risks, and follow governance practices to ensure stability and profitability.

Hence, it suffers from the inherent limitations of the secondary data. The period of the study is limited to 10 years only. It is confined to commercial banks in India and covers only those banks available in the Prowess database of CMIE. Due to the unavailability of data, it is not possible to include all banks in the sample by excluding foreign banks operating in India.

References

Banda, M., & Mwange, A. (2023). *Corporate governance: A conceptual analysis*. *Research Journal of Finance and Accounting, 14*(17). https://www.iiste.org/Journals/index.php/RJFA/article/view/61617

Behera, S. N., Sahoo, A. K., & Sethi, M. (2025). Corporate Borrowings and Financial Performance across Life-Cycles. Orissa Journal of Commerce. 46(3), 60-68. https://doi.org/10.54063/ojc.2025.v46i03.05

Biswas, S., Bhattacharya, M., Sadarangani, P. H., & Jin, J. Y. (2022). Corporate governance and earnings management in banks: An empirical evidence from India. *Cogent Economics & Finance, 10*(1), 2085266. https://doi.org/10.1080/23322039.2022.208526

Das, B., Sahoo, P. C., & Dash, M. C. (2025). Impact of corporate governance on financial performance of banking companies: A study on selected public sector banks in India. *Journal of Information Systems Engineering & Management, 10*(33s), 124–130. https://doi.org/10.52783/jisem.v10i33s.5463

Dash, S., & Dey, S. K. (2025, May 16). Does corporate governance moderate the effects of financial distress and earnings management on financial performance? Evidence from NSE 100 companies. *Metamorphosis*. Advance online publication. https://doi.org/10.1177/09726225251334850

Hopt, K. J. (2021). *Corporate governance of banks and financial institutions: Economic theory, supervisory practice, evidence and policy*. *European Business Organization Law Review, 22*(1), 13–37. https://doi.org/10.1007/s40804-020-00201-z

Kaur, S. (2025). *The role of the board of directors – Comparison between India, US & UK* [Master's dissertation, IILM University]. ResearchGate. https://www.researchgate.net/publication/39235441

Komath, M. A. C., Doğan, M., & Sayılır, Ö. (2023). Impact of corporate governance and related controversies on the market value of banks. *Research in International Business and Finance, 65*, Article 101985. https://doi.org/10.1016/j.ribaf.2023.101985

Kovermann, J., & Velte, P. (2019). The impact of corporate governance on corporate tax avoidance: A literature review. *Journal of International Accounting, Auditing and Taxation, 36*, Article 100270. https://doi.org/10.1016/j.intaccaudtax.2019.100270

Manuel, A., Kumar, R., & Singh, P. (2021). *Corporate governance and financial performance of banks*. *International Journal of Finance, 12*(3), 45–58.

Nizam, E., Ng, A., Dewandaru, G., Nagayev, R., & Nkoba, M. A. (2019). The impact of social and environmental sustainability on financial performance: A global analysis of the banking sector. *Journal of Multinational Financial Management, 49*, 35–53. https://doi.org/10.1016/j.mulfin.2019.01.002

Puni, A., & Anlesinya, A. (2020). Corporate governance mechanisms and firm performance in a developing country. *International Journal of Law and Management, 62*(2), 147–169. https://doi.org/10.1108/IJLMA-03-2019-0076

Shaba, Y. (2024). *Corporate governance in Nigeria: Evolution, regulatory frameworks and challenges*. *Asian Journal of Economics, Business and Accounting, 24*(10), 356–367. https://doi.org/10.9734/ajeba/2024/v24i101533

Stoelhorst, J. W., & Vishwanathan, P. (2024). *Beyond primacy: A stakeholder theory of corporate governance*. *Academy of Management Review, 49*(1), 107–134. https://doi.org/10.5465/amr.2020.0268

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Tracking Efficiency and Productivity Shifts in Microfinance Institutions Operating in Odisha: Evidence from Data Envelopment Analysis and Malmquist Productivity Index

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Abstract: Microfinance institutions (MFIs) seek to balance the two-fold objectives of pursuing a social mission and achieving financial sustainability; however, they cannot fulfil the social mission without operating at a high level of efficiency. This study examines the efficiency and productivity shifts of MFIs functioning in Odisha, India. Therefore, the study employs panel data covering a five-year period, i.e., from 2019 to 2023, for 18 NBFC-MFIs. The paper to measure the efficiency score, the DEA model with variable returns to scale (VRS) was applied. In addition, the Malmquist total factor productivity index (TFP) is employed to examine productivity changes over time. The results indicate that only four DMUs are completely effective with a score of 1, while the majority exhibited inefficiency related to scale. The average total factor productivity (TFP) score of 0.995 indicates a slight decline in overall productivity, while 50 percent of the sampled MFIs experienced productivity growth. These findings provide practical insights for policymakers and managers to improve resource utilisation, identify efficiency gaps, and formulate strategies to promote sustainable growth in the microfinance sector.

1. Introduction

The progress of microfinance institutions is closely associated with Nobel laureate Mohammed Yunus and the Grameen Bank, and his initiation of the movement in Bangladesh during the 1970s (Daniel Awuah Agyapong, 2015). Microfinance evolved as a powerful tool in the 1970's to expand credit access for the poor in developing nations, who were often excluded by traditional banking (Ram Rajbanshi, 2015). The impoverished in emerging nations have gradually acquired access to monetary services provided by well-known microfinance institutions (MFIs) since the late 1970s (Hermes & Hudon, 2018). In India, two distinct approaches evolved for microfinance. The first is the bank-led approach, mainly through the SHG-based bank linkage scheme. The second is the microfinance institution model. The root of India's microfinance structure can be traced back to 1992, when NABARD started the SHG Bank linkage programme as a pilot study. When microfinance activities became noticeable in the 1990's, the RBI recognised the need for regulating this sector in the early 2000s. A thorough regulatory framework for NBFC-MFIs was introduced by the RBI in Dec, 2011, which prescribed the eligibility criteria for microfinance loans (Rao, 2021). The Microfinance institutions are different from traditional banking as they try to fulfil the dual purpose of reducing poverty and attaining financial sustainability, thus positioning it between social welfare programs and conventional commercial banking (Balkenhol, 2007). Initially, microfinance was a non-profit and socially driven mission, but over time it has shifted into a profit-oriented industry (Augustine, 2012). MFIs, however, cannot fulfil their social mission unless they operate with economic efficiency (Chauhan, 2020). In the past decade, the microfinance industry has witnessed a significant transformation in India. The growing trend of commercialisation among microfinance institutions is evident through key developments of this sector, for instance, when Bandhan Financial Services Private Ltd., which initially operated as an NBFC-MFI, transformed into a full-fledged universal bank in 2014. Similarly, Bharat Financial Inclusion Ltd., one of the largest NBFC-

MFIs, merged with IndusInd Bank in July 2019 (RBI Consultative Document 2021). With many profit-oriented microfinance institutions entering the market, competition has increased significantly. In a highly competitive environment, merely covering costs is insufficient. MFIs are also required to strengthen their financial base and pursue a profit-oriented approach in both their administration and operations (Hamada, 2010). A competitive market helps to reduce costs, thereby increasing efficiency by improving the service quality (Assefa, Hermes, & Meesters, 2013). The performance of microfinance is measured either by efficiency or outreach. Profitability in isolation is not a reliable yardstick for performance measurement of MFIs (Balkenhol, 2007). Thus, efficiency is considered a more robust indicator for gauging financial performance (Mia, Pellegrina, Damme, & Wijesiri, 2019; Hudon & Traca, 2011). The microfinance sector consists of diverse players operating under different types and legal forms. A new category of NBFC-MFI was formed on the recommendations of the Malegam committee in 2011 and is regulated by the RBI. This category of MFIs dominates the market share with Rs.173504 Cr. Portfolio, also, the total loan portfolio of the microfinance sector was Rs. 4.43 lakh crore as on 31st March,2024(The Bharat Microfinance report 2024). According to the Standing of Microfinance in India during 2022-23, "Microfinance in India has become nearly a Rs. 5 trillion business, thus showing a tremendous growth". Although various studies on DEA-based efficiency analysis have been undertaken on the banking sector, very few studies have been conducted on the NBFC-MFIs sector. This form of microfinance institutions holds thirty-nine percent of the market share and was leading (Sa-Dhan Report 2024). Despite their growing importance, the efficiency and productivity performance of NBFC-MFIs remain underexplored. Therefore, the present study examines the performance of NBFC-MFIs by applying DEA to find out the best-performing DMUs. Further, the TFP was applied to examine the productivity changes over the study period. We have considered only those 18 NBFC-MFIs that have business operations in Odisha. According to the Sa Dhan Report 2024, 49 MFIs operate in Odisha, of which 34 are NBFC-MFIs. According to the MFIN report 2021, around 28 NBFC-MFIs are currently operating in the state of Odisha and have reached out to 30.3 lakh client borrowers through 1261 branches, with a gross loan portfolio of Rs 6004 Cr as of 2019 and loan disbursed of Rs 1598 Cr, making Odisha one of the top 5 states in terms of loan amount outstanding. This study adds to the existing literature by assessing the efficiency score, total factor productivity growth of selected NBFC-MFIs.

2. Literature Review

DEA-based efficiency studies in MFIs

A Substantial body of literature has applied (DEA) to evaluate the performance of microfinance institutions across different countries. Early Studies mainly focused on measuring the technical and operational efficiency using DEA Namely, Nieto (2005) examined the efficiencies of Latin American MFIs and observed that efficiency is largely hinged on the specification adopted, Shyu & Chiang (2012), evaluated operating efficiencies of banks and revealed that scale inadequacy is the primary factor behind inefficiency; however, efficiency drops after making adjustments through SFA regression, proving an overestimate of efficiency. It also highlights the significant influence of environmental variables on efficiency. Several studies extended DEA analysis by combining second-stage regression techniques, such as Tobit and truncated regression, to identify the determinants. In a similar line of research, Haq et al. (2010) calculated the effectiveness of MFIs and then regressed on variables by applying the Tobit model. Their results depict that bank-led MFIs demonstrate the highest efficiency under the intermediation approach. Likewise, Ferdousi (2013) confirms that total assets, profitability and operational scope are crucial determinants for sustainable development and efficacy of MFIs in Bangladesh, India and China. In a similar tone, Mahindra Wijesiri (2015) obtained efficiency estimates using a bootstrap procedure followed by a bootstrap truncated regression to determine the key elements. The result found that the age of MFIs has a higher financial efficiency; however, MFIs were found to be inefficient in the social dimension. The type of organisation and ROA are crucial determinants of social efficiency. Another stream of literature focused on productivity and efficiency decomposition through the Malmquist Index. Azad et al (2016) evaluated the performance of fifteen MFIs between 2008 and 2012, and the results demonstrated that most MFIs achieved efficiency mainly through pure efficiency change; also, there is a need to chase the TCH to attain the core objective of outreach and

sustainability. Researchers have also explored the relationship between efficiency, outreach and institutional characteristics. Mia et al (2018) sought to explore the relation between outreach and efficiency, and the findings depict that financial inclusion, which is the extent of outreach, is positively associated with the competence of MFIs; however, they found a negative association between financial deepening, that is, the depth of outreach and efficiency. Balammal et al. (2019) conducted cluster analysis to evaluate outreach performance. The findings suggest that MFIs attain higher social efficiency by focusing on poor clients. Similarly, Asif et al. (2019) highlighted significant efficiency differences across legal forms, with NBFC and section 8 companies demonstrating higher financial efficiency than NGOs. In Contrast, the equity-to-asset ratio exerts a negative effect on social performance, suggesting that more capitalised MFIs may compromise social mission. Moreover, younger MFIs exhibit higher social efficiency compared to their counterparts. Various Studies identified multiple factors as key determinants of efficiency. Gulati & Kumar (2017) observed that size, liquidity condition, direct lending activities, intermediation cost, profitability and income diversification significantly influence overall operational efficiencies. Similarly, Kumar & Sensarma (2017) reported leverage, profitability and size as key drivers to improve efficiency. Ram Pratap Sinha (2019) explores the connection between efficiency and environmental variables and found that highly capitalised MFIs tend to exhibit higher inefficiency due to underexploitation of available resources. Likewise, Dutta 2020 identified size, income diversity, and ROA as significant factors influencing efficiency. The other paper is that of Farooq (2018), which measures and compares the profit performance of Pakistan-based MFIs by using DEA. The findings reveal that some MFIs have relative efficiency scores less than 70 percent thus providing scope for future researchers to address the social performance of MFIs along with profit performance to know the overall performance of microfinance providers. Several previous studies have attempted to analyse performance using DEA analysis. However, very limited research has specifically focused on NBFC-MFIs in the Indian context. Therefore, this study attempts to fill this gap and add to the existing body of literature in this domain.

3. Research Methodology

3.1.Variables used in the Study

For evaluating the performance of MFIs through an efficiency score, DEA analysis is applied, which requires both input and output variables, and these must be aligned with the approach being used. According to production theory, performance is defined as achieving the highest level of output with minimum inputs through an optimal mix of resources (Farrell, 1957). Input efficiency indicates how much a DMU's input levels can be reduced through improved performance without decreasing output, while still maintaining the same input mix (Thanassoulis, 2001). Approaches to production and intermediation are the two well- known approaches (Sealey & Lindley, 1977). Under the production approach, a financial institution acts as a production unit which produces services by incorporating various factors of production like labour, technology, material and related costs. Whereas, financial institutions behave as mediators that employ labour, deposit and investment to extend credit under an intermediation approach. The production model views the deposit as output; the intermediation approach regards the deposit as input (Wijesiri, Vigano, & Meoli, 2015). In our study, we don't need to ponder how deposits are being treated since microfinance institutions do not accept deposits and hence remove them as a variable from the dataset. The present study considers three input and three output variables. The no. of employees, operating expenses and total assets are our input variables. The output variables employed are 'gross loan portfolio' (GLP), no. of borrowers, and financial revenue. Variables were selected based on prior research studies done by Aruna Balammal et al. (2019), Ferdousi (2013), Santa Kar et al. (2017), Asif Khan et al. (2021), Nitin Kumar et al. (2017) and Sinha et al. (2019) and as management has greater control over input variables than output variables, which are influenced by external factors, an input -based DEA model assuming VRS, was applied to measure efficiency.

Table 1: Specification of Input and Output Variables

Specification	Variable	Definition
Input	Total Asset	Sum of all net assets
	Employee	Total no of employees employed
	Operating Expenses	Total operating expenses
Output	GLP	Total outstanding principal amount due on client loans
	Borrower	Total active borrowers
	Financial Revenue	Total revenue generated includes GLP, Investment, Operating income

Source: Self-compiled.

3.2. Data and sample selection

The study focuses on MFIs registered as NBFC-MFIs that are operating within the state of Odisha. The microfinance sector of Odisha state, India, is particularly selected as a sample. The data were collected from the annual reports of respective MFIs and also from the mix market database. The study periods cover from 2018-19 to 2022-23 of 18 MFIs that were registered under NBFC-MFIs operating in Odisha. The selection of NBFC-MFIs is done on the basis of the directory of microfinance 2020, as there were a total of 34 MFIs operating in Odisha; however, only 18 NBFC-MFIs were chosen on the basis of consistent accessibility of data. The number of samples was fixed on data obtainability, and MFIs with missing data on the required variables were excluded from the study. Therefore, this study evaluates the performance of 18 NBFC-MFIs based on the availability of the data. Thus, the study works with panel data covering 5 years (2019-2023) and is analysed using the DEAP software. According to Avkiran (2001), the sample size should not exceed the total inputs multiplied by outputs. Alternatively, it is suggested that the sample size be at least three times the total of inputs and outputs (Nunamaker, 1985). In the present study, there are three outputs and three inputs, which gives a product of 9. Also, the selected sample is 18, which satisfies the sampling guidelines.

Table 2: Population and sample of MFIs

Total number of MFIs across various legal forms	234
Number of NBFC- MFIs operating across India	94
Number of NBFC MFIs operating in Odisha	33
Selected sample MFIs	18

Source: MF Directory Report 2020

3.3. Technique used in the study

DEA is a non-parametric technique, used primarily to evaluate and compare the performance of peer organisations that transform common inputs into outputs (Farooq, 2018). It is a technique to measure efficiency (Thanassoulis, 2001). Farrel 1957 introduced the concept of DEA and categorised them into technical and allocative efficiency. Farrel applied DEA in the situation of a single input and output (Chauhan, 2020). Subsequently, the CCR model (1978) evaluates the comparative effectiveness of some DMUs. The CCR model is applied in the situation of multiple inputs and outputs predicted on the idea of constant returns to scale (CRS). The BCC (1984) model is the extended version of DEA, which includes VRS (Bowlin, 1998). The performance of MFIs using an efficiency score that is derived from an input-oriented DEA model under VRS is computed in this study. DEA provides three forms of efficiency. They are overall efficiency (OTE), pure efficiency (PTE) and scale efficiency (SE). The CCR model provides the OTE score, whereas the BCC model gives the PTE score. Scale efficiency is premeditated by dividing OTE by PTE, with a value less than one indicating that a DMU is not operating at an optimum scale (Dutta, Jain, & Gupta, 2020). Thus, overall technical efficiency is made up of two elements, namely (PTE) and (SE). DEA does not assume any statistical distribution of data or any predetermined functional relationship between inputs and outputs. A major limitation of DEA is that it does not account for statistical noise or measurement error, as any deviation from the benchmark DMUs is treated as inefficiency. (Berger & Humphrey, 1997).

3.4. Model Specification

The formulation of an input-based DEA model with VRS is presented below:

Minimise θ

Subject to:

$$\sum_{j=1}^{n} \lambda j \; x_{ij} \leq \theta x_{ij0}; \forall i \; (input\ constraints)$$

$$\sum_{j=1}^{n} \lambda j \; y_{rj} \geq y_{rj0}; \forall r \; (output\ constraints)$$

$$\sum_{j=1}^{n} \lambda j = 1 \; (VRS\ Constraints)$$

$\lambda_j \geq 0; \forall j$

Where,
θ = Efficiency score,
λj = Intensity variable,
x_{ij} = Input i for DMU j,
y_{rj} = Output r for DMU j

Later on, TFP analysis under constant return to scale was employed to examine the total change in productivity over time. It is an extension of DEA, and its non-parametric features help to make a difference in performance during two time periods (Cooper, Seiford, and Tone, 2007). Productivity and efficiency are closely linked, as higher productivity will ultimately result in advanced efficiency, considering all other factors remain constant (Sanchez-Robles, 1997). Technological Change (TC) and technical Efficiency Change (TEC) are the two parts of total factor productivity (TFP) (Fare, Grosskopf, Norris, & Zhang, 1994). Efficiency change reflects variations in efficiency levels over time, whereas technical change captures shifts in the technological frontier across periods.

The present study uses the MFI defined by (Fare, Grosskopf, Norris, & Zhang, 1994) given as:

$$MPI_0^{t+1}(x^{t+1},x^{t-1},x^t,y^t) = \left(\frac{D_0^t(x^{t+1},y^{t+1} \mid \text{CRS})}{D_0^t\ (x^t,y^t \mid \text{CRS})} \times \frac{D_0^{t+1}(x^{t+1},y^{t+1} \mid \text{CRS})}{D_0^{t+1}\ (x^t,y^t \mid \text{CRS})} \right)$$

Where, $MPI^{t+1}_0 > 1$ indicates upward trend of productivity

$MPI^{t+1}_0 = 1$ indicates no change in productivity.

$MPI^{t+1}_0 < 1$ indicates downward trend of productivity

4. Results and findings

Table 3: Overall technical, Pure technical and Scale efficiencies of MFIs

Name of the DMUs	Overall	Pure	Scale
Fusion Microfinance Private Ltd.	0.622	0.796	0.782
Satin Credit Care Network Ltd.	0.650	1.000	0.650
Samasta Microfinance Ltd.	1.000	1.000	1.000
Muthoot Microfinance Ltd.	0.405	0.405	1.000
Svatantra Microfinance Private Ltd.	0.837	0.892	0.939
Annapurna Finance Private Ltd.	0.642	0.848	0.757
Asirvad Microfinance Private Ltd	0.505	0.676	0.748
Belstar Investment Finance Private Ltd	0.598	0.677	0.882
Credit Access Grameen Ltd.	0.465	1.000	0.465
Spandana Sphooty Financial Ltd.	0.609	1.000	0.609
Vaya Finseve Private Ltd.	1.000	1.000	1.000
Arohan Financial Services Private Ltd.	0.507	0.854	0.594
Jagaran Microfin Private Ltd.	0.718	0.718	1.000
Janakalyan Consultancy & service Private ltd	1.000	1.000	1.000
Village Financial Services Private Ltd.	0.615	0.630	0.976
Satya Microcapital Ltd.	0.657	0.876	0.750
Vedika Credit Capital Ltd.	1.000	1.000	1.000
Nabfins Ltd.	0.214	1.000	0.214

Source: Self-compiled

Table 4: Descriptive Statistics of Efficiency Score.

Efficiency Score	Overall	Pure	Scale
E < 0.9	14	10	10
0.9 ≤ E ≤ 1	0	0	2
E=1	4	8	6
Descriptive Statistics			
Number of DMUs	18	18	18
Mean	0.669	0.854	0.798
Median	0.632	0.884	0.832
Standard deviations	0.224	0.173	0.225
Minimum	0.214	0.405	0.214
Maximum	1	1	1

Source: Self-compiled

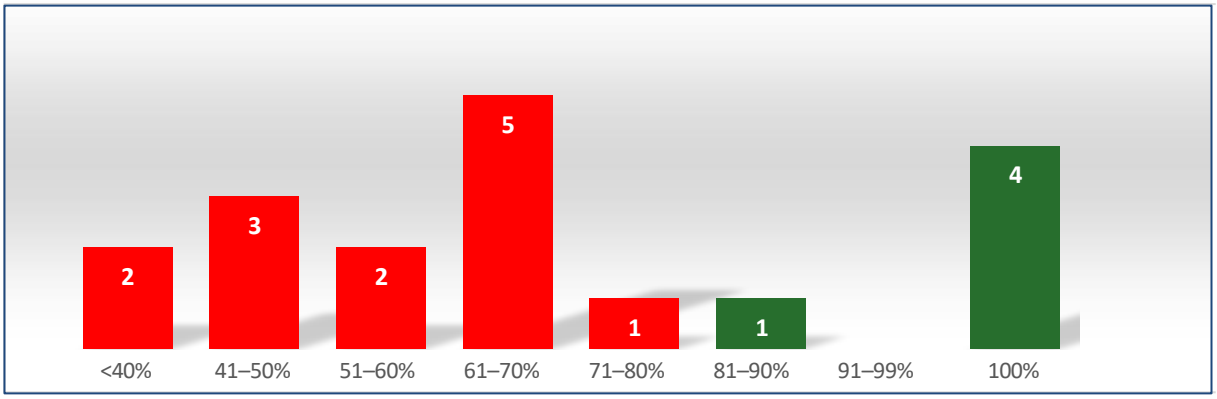

Figure 1: Distribution of efficiency scores

The efficiency score obtained from the DEA for 18 DMUs in Table 3 was run under three models. OTE, PE and SE. Out of the total 18 DMUs, 4 are fully efficient, each achieving a score of 1 under the OTE score. These DMUs are Samasta Microfinance Limited, Vaya Finserve Private Ltd, Janakalyan Consultancy & Service Private Ltd & Vedika Credit Capital Ltd. The mean efficiency score of these DMUs is 0.669, which discloses that the MFIs in Odisha have around 33.1% overall inefficiency, as mentioned in table3. On average, DMUs can reduce inputs by 33.1% while maintaining the same output. More DMUs are efficient under the PTE model, with a total of 8 DMUs fully efficient, with a mean efficiency score of 0.854, which shows that around 14.6% inefficiency and most inefficiency arises from scale as compared to technical operations. The mean score of scale efficiency is 0.798, indicating that many DMUs are not operating at their optimal scale of production due to inefficient scale operation. Only 4 DMUs are efficient under all three measures, whereas 14 DMUs have overall efficiency < 0.9, indicating significant room for improvement. Thus, it is recommended to improve technical processes by focusing on optimisation, and the government can also use fully efficient DMUs as performance models.

Table 5: Malmquist total factor productivity analysis

Name of the Institutions	TEC	TC	PTE	SE	TFP
Fusion Microfinance Private Ltd.	0.924	1.02	0.975	0.947	0.943
Satin Credit Care Network Ltd.	0.909	0.797	0.935	0.972	0.724
Samasta Microfinance Ltd.	0.841	0.975	0.988	0.851	0.82
Muthoot Microfinance Ltd.	1.036	1.034	1.17	0.886	1.071
Svatantra Microfinance Private Ltd.	0.852	1.014	0.94	0.906	0.864
Annapurna Finance Private Ltd.	1.041	0.963	1.042	0.999	1.003
Asirvad Microfinance Private Ltd.	1.054	1.005	1.103	0.956	1.06
Belstar Investment Finance Private Ltd.	0.999	0.966	1.074	0.93	0.966
Credit Access Grameen Ltd.	0.954	0.984	1	0.954	0.939
Spandana Sphoorty Financial Ltd.	1.003	0.97	0.996	1.008	0.973
Vaya Finseve Private Ltd.	0.868	1.096	0.955	0.909	0.951
Arohan Financial Services Private Ltd.	1.006	1.001	1.011	0.995	1.007
Jagaran Microfin Private Ltd.	0.999	1.044	1.047	0.955	1.043
Janakalyan Consultancy & Service Pvt.Ltd	1	1.21	1	1	1.21
Village Financial Services Private Ltd.	1.014	1.035	1.122	0.903	1.049
Satya Microcapital Ltd.	1.111	1.12	1.034	1.075	1.244
Vedika Credit Capital Limited	0.853	1.079	1	0.853	0.921
Nabfins Ltd.	1.106	1.016	1	1.106	1.123
Average	0.976	1.018	1.021	0.955	0.995
Maximum	1.111	1.21	1.17	1.106	1.244
Minimum	0.841	0.797	0.935	0.851	0.724
Standard Deviation	0.082	0.081	0.061	0.066	0.123

Source: Self-compiled

Table 6: Catch-up Shift, Frontier Shift and Malmquist Index of MFIs

Overall MFIs	2019-20	2020-21	2021-22	2022-23	Average
Catch-up	1.036	0.945	0.858	1.064	0.973
Frontier	1.199	0.915	1.063	0.91	1.015
Malmquist	1.243	0.865	0.912	0.968	0.987

Source: Self-compiled

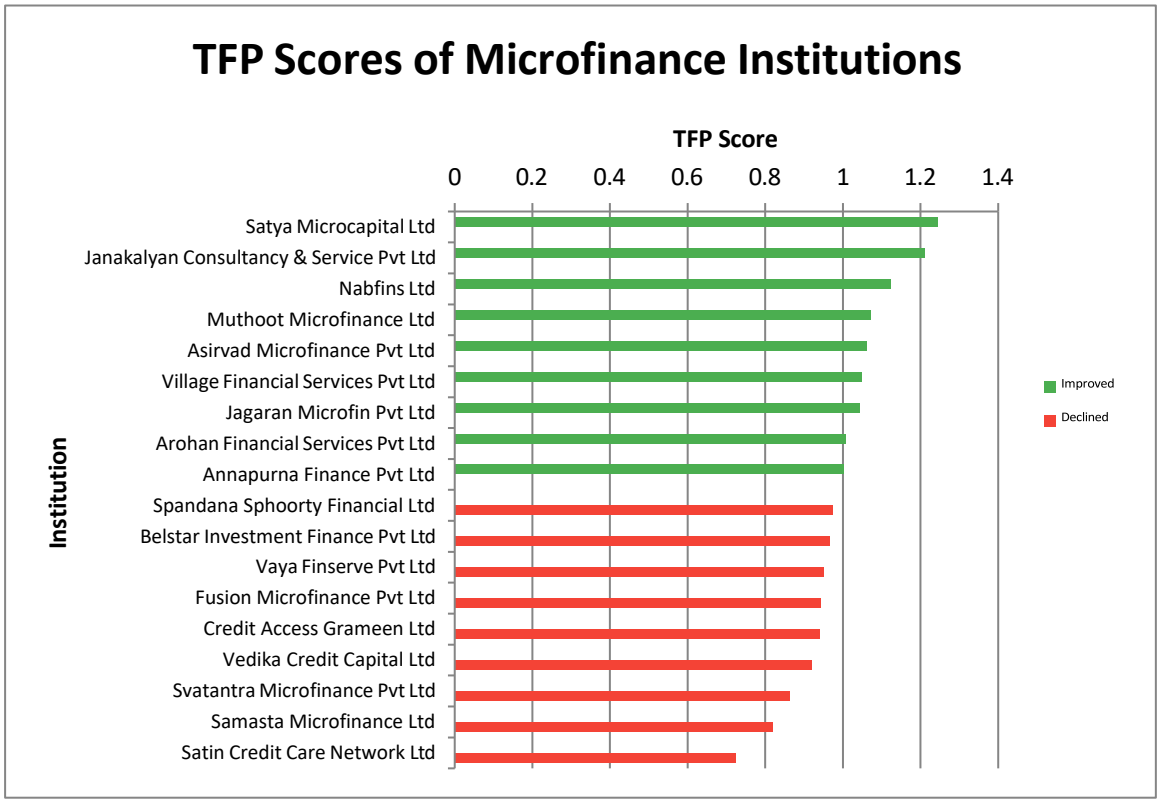

Figure 2: Total Factor Productivity Score

This study applies the Malmquist total factor productivity (TFP) index. If TFP exceeds one, it represents the progress trend of productivity, and less than one indicates a declining trend in productivity. Table 5 reports the (TFP) performance of individual MFIs over the period of 5 years from 2019 to 2023. It is found that Satya Micro Capital Limited has achieved the highest productivity gain with a TFP score of 1.244, reflecting 24.4 percent improvement, along with TEC & TC of 1.111 and 1.120, respectively, which reveals that this DMUs has managed to improve its operations with the adoption of the latest technology, followed by Janakalyan Consultancy & Service Private Ltd with TFP 1.210. The other DMUs with TFP exceeding one are Muthoot Microfinance Limited, Annapurna Finance Private Ltd., Asirvad Microfinance Private Ltd., Arohan Financial Services Private Ltd., Jagaran Microfin Private Ltd., Village Financial Service Private Limited and Nabfins Limited. It is also found that six DMUs, namely, Fusion Microfinance Private Ltd., Credit Access Grameen Ltd., Belster Investment Finance Private Ltd., Spandana Sphoorty Financial Ltd., Vaya Finserve Private Ltd. and Vedika Credit Capital Ltd., hovered around TFP of one, indicating stable productivity, with neither progress nor decline. Three DMUs having TFP less than one are mainly due to their setback in technology. Based on these performance results, it can be interpreted that MFIs need to increase their total factor productivity by attempting to reduce their wastage, optimum utilisation of resources by minimising the input and maximising the output, adopting new innovations, including digital systems and management training in order to sustain growth. Table 6 reports the overall Malmquist index, catch-up index and frontier index of selected MFIs over the last 5 years. This table summarises the overall performance of the selected MFIs during the study period, which revealed that productivity improved significantly in 2019-20; however, it declined in the subsequent years. The average Malmquist index of 0.987 reflects a 1.3 percent decline in total factor productivity during the study period. While the average frontier score (technical change) of 1.015 indicates a slight improvement in technological progress, the average catch-up score (efficiency score) of 0.973 reflected a 2.7 percent decline in their efficiency levels.

5. Conclusion

The study was based on 18 NBFC-MFIs operating in the state of Odisha. It measured the efficacy of each DMU using DEA and later examined productivity through the Malmquist productivity Index. The results indicate that only 4 of the 18 DMUs were efficient under (OTE). Under the (PTE) model, it revealed that more DMUs were found efficient, suggesting that most MFIs are not utilising their full operational capacity. However, only 4 DMUs were found to be efficient under all three models. The mean scale efficiency score of 0.798 suggests that the major contributor to inefficiency is scale rather than technical operations. This indicates that many MFIs are not performing at their optimum scale of production. Shyu & Chiang (2012) also reported similar findings that scale inadequacy is the major contributor to operational inefficiency. Gulati & Kumar (2017) and Kumar& Sensarma (2017) also confirm that institutional scale and optimal resource utilisation are essential for improving operational efficiencies. The results derived from the TFP indicate that 9 out of 18 MFIs have total factor productivity more than 1. Satya Microcapital Ltd. has the highest total factor productivity (TFP) score of 1.244, supported by high TEC, TC, PTE and SE scores. This finding suggests that MFIs need to improve their total factor productivity by reducing their wastage and improving input-output utilisation. Similar findings were reported by Azad et al. (2016), who also observed that technological progress alone cannot improve productivity unless resources are efficiently utilised. The presence of scale inefficiency and declining productivity suggests that the dual objective of financial sustainability and social outreach cannot be achieved without proper resource management and technological advancement. Improving these dimensions can significantly strengthen financial inclusion in Odisha and India. Thus, it is highly recommended that DMUs should optimise their scale of operations and make greater efforts to introduce more technological systems into their operation to strengthen efficiency. From a policy perspective, fully efficient DMUs may be used as a benchmark for other MFIs. Finally, future research may further expand this analysis by including a larger number of DMUs and undertaking a comparative analysis of financial and social performance to provide a clearer and more comprehensive understanding.

Reference

Assefa, E., Hermes, N., & Meesters, A. (2013). Competition and the performance of Microfinance institutions. *Applied Financial Economics*, *23*(9), 767–782. https://doi.org/10.1080/09603107.2012.754541

Avkiran, N. K. (2001). Investigating technical and scale efficiencies of Australian Universities through data envelopment analysis. *Socio-Economic Planning Sciences*, *35*(1), 57–80.

Azad, M. A. K., Masum, A. K. M., Munisamy, S., & Sharmin, D. F. (2016). Efficiency analysis of major microfinance institutions in Bangladesh: A Malmquist index approach. *Quality and Quantity*, *50*(4), 1525–1537. https://doi.org/10.1007/s11135-015-0219-8

Augustine, D. (2012). Good practice in corporate governance: transparency, trust and performance in the microfinance industry. *Business & Society*, *51*(4), 659–676.

Agyapong, D. A., Adjei, P. O. W., & Boafo, J. (2017). Microfinance, Rural Non-farm Activities and Welfare Linkages in Ghana: Assessing Beneficiaries' Perspectives. *Global Social Welfare*, *4*(1), 11–19. https://doi.org/10.1007/s40609-015-0037-x

Balammal, A., Madhumathi, R., & Ganesh, M. P. (2019). Performance Evaluation Frameworks in the Context of Indian Microfinance Institutions. *Foundations of Management*, *11*(1), 209–228. https://doi.org/10.2478/fman-2019-0018

Bowlin, W.F. (1998). Measuring performance: An introduction to data envelopment analysis (DEA). *The Journal of cost analysis*, *15*(2), 3–27.

Bjurek, H. (1996). The Malmquist total factor productivity index. *The Scandinavian Journal of Economics, 98*(2)*,* 303–313**.**

Balkenhol, B. (2007). *Microfinance and public policy: Outreach, performance and efficiency*. Palgrave Macmillan.

Berger, A. N., & Humphrey, D. B. (1997). Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research, 98*(2), 175–212. https://doi.org/10.1016/S0377-2217(96)00342-6

Chauhan, S. (2021). Social and financial efficiency: A Study of Indian microfinance institutions. *IIM Kozhikode Society and Management Review*, *10*(1), 31–43. https://doi.org/10.1177/2277975220953311

Cooper, W. W., Seiford, L. M., & Tone, K. (2000). *Data envelopment analysis: A comprehensive text with models, applications, references and DEA-solver software*. Kluwer Academic Publishers

Dutta, P., Jain, A., & Gupta, A. (2020). Performance analysis of non-banking finance companies using two-stage data envelopment analysis. *Annals of Operations Research*, *295*(1), 91–116. https://doi.org/10.1007/s10479-020-03705-6

Ferdousi, F. (2013). Performance of microfinance institutions in Asia: DEA based efficiency analysis. *International Conference on the Modern Development of Humanities and Social Science,* 91–94. Atlantis Press.

Farooq, S. (2018). Performance evaluation of microfinance providers using data envelopment analysis: The profitability perspective. *Journal of Management Sciences*, *5*(1), 111–123. https://doi.org/10.20547/jms.2014.1805107

Farrell, M. J. (1957). The measurement of productive efficiency. *Journal of the Royal Statistical Society, 120* (3),253–290.

Fare, R., Grosskopf, S., Norris, M., & Zhang, Z. (1994). Productivity growth, technical progress, and efficiency change in industrialised countries. *The American Economic Review*, *84*(1), 66–83**.**

Gutiérrez-Nieto, B., Serrano-Cinca, C., & Mar Molinero, C. (2007). Microfinance institutions and efficiency. *Omega*, *35*(2), 131–142. https://doi.org/10.1016/j.omega.2005.04.001

Gulati, R., & Kumar, S. (2017). Analysing banks' intermediation and operating efficiencies using the two-stage network DEA model: The case of India. *International Journal of Productivity and Performance Management*, *66*(4), 500–516. https://doi.org/10.1108/IJPPM-03-2016-0055

Hassan, M. (2002). The microfinance revolution and the Grameen Bank experience. *Financial Market, Institutions & Instrumen*t, *11*(3), 205–265.

Hermes, N., & Hudon, M. (2019). Determinants of the performance of microfinance institutions: A systematic review. *Contemporary Topics in Finance: A Collection of Literature Surveys,*298–330.

Hamada, M. (2010). Commercialisation of microfinance in Indonesia: The shortage of funds and the linkage program. *The Developing Economies, 48*(1), 156–176. https://doi.org/10.1111/j.1746-1049.2010.00103.x

Hudon, M., & Traca, D. (2011). On the efficiency effects of subsidies in microfinance: An empirical inquiry. *World Development*, *39*(6), 966–973. https://doi.org/10.1016/j.worlddev.2009.10.017

Haq, M., Skully, M., & Pathan, S. (2010). Efficiency of microfinance institutions: A data envelopment analysis. *Asia-Pacific Financial Markets*, *17*(1), 63–97. https://doi.org/10.1007/s10690-009-9103-7

Kar, S., & Deb, J. (2017). Efficiency determinants of microfinance institutions in India: Two stage DEA analysis. *The Central European Review of Economics and Management*, *1*(4), 87–111. https://doi.org/10.29015/cerem.528

Kumar, N., & Sensarma, R. (2017). Efficiency of microfinance institutions in India: A stochastic distance function approach. *Journal of Emerging Market Finance*, *16*(2), 151–168. https://doi.org/10.1177/0972652717712372

Khan, A., & Gulati, R. (2019). Assessment of efficiency and ranking of microfinance institutions in India: A two-stage bootstrap DEA analysis. *International Journal of Business Forecasting and Marketing Intelligence*, *5*(1), 23–55.

Khan, A., & Gulati, R. (2021). Efficiency of microfinance institutions of South Asia: A bootstrap DEA approach. *International Journal of Computational Economics and Econometrics, 11*(1), 84–104.

Mia, M. A., Dalla Pellegrina, L., van Damme, P., & Wijesiri, M. (2019). Financial inclusion, deepening and efficiency in microfinance programs: Evidence from Bangladesh. *European Journal of Development Research*, *31*(4), 809–835. https://doi.org/10.1057/s41287-018- 0188-6

Microfinance Institutions Network. (2021). Annual report 2020–2021. https://mfindia.org/assets/upload_image/publications/AnnualReports/MFIN%20AR%202020-21%203.9.2021.pdf

Nunamaker, T. R. (1985). Using data envelopment analysis to measure the efficiency of non-profit organisations: A critical evaluation. *Managerial and Decision Economics, 6(*1),50–58.

National Bank for Agriculture and Rural Development. (2023). *Status of microfinance in India 2022–23*. https://www.nabard.org/auth/writereaddata/tender/status-of-microfinance-in-india-2022-23.pdf

Rao, M. R. (2021). Microfinance-empowering a billion dreams. Inaugural address presented at the Sa-Dhan National Conference on Revitalizing Financial Inclusion, Reserve Bank of India. https://www.rbi.org.in/Scripts/BS_SpeechesView.aspx?Id=11375

Rajbanshi, R., Huang, M., & Wydick, B. (2015). Measuring microfinance: Assessing the conflict between practitioners and researchers with evidence from Nepal. *World Development, 68*, 30–47. https://doi.org/10.1016/j.worlddev.2014.11.011

Reserve Bank of India. (2021). *Consultative document on regulation of microfinance*. https://fidcindia.org.in/wp-content/uploads/2021/06/RBI-MFI-CONSULTATIVE-PAPER-14-06-21.pdf

Shyu, J., & Chiang, T. (2012). Measuring the true managerial efficiency of bank branches in Taiwan: A three-stage DEA analysis. *Expert Systems with Applications*, *39*(13), 11494–11502. https://doi.org/10.1016/j.eswa.2012.04.005

Sinha, R. P., & Pandey, P. (2019). Efficiency of Microfinance Institutions in India: A Two- Stage DEA Approach. *International Journal of Rural Management*, *15*(1), 49–77. https://doi.org/10.1177/0973005219832494

Sealey, C. W., & Lindley, J. T. (1977). Inputs, Outputs, and a theory of production and cost at depository financial institutions. *The Journal of Finance*, *32*(4), 1251–1266. https://doi.org/10.1111/j.1540-6261.1977.tb03324.x

Sanchez-Robles, B. (1997). Financial efficiency and economic growth: The case of Spain**.** *International Advances in Economic Research*, 3(4), 333–351.

Sherman, H. D., & Zhu, J. (2006). *Service productivity management: Improving service performance using data envelopment analysis*. Springer.

Sa-Dhan. *The Bharat Microfinance Report 2024*. https://www.sa-dhan.net/wp-content/uploads/2025/05/Bharat-Microfinance-Report-2024.pdf

Sa-Dhan. *Directory of Microfinance Institutions in India* (2020). https://www.sa-dhan.net/wp-content/uploads/2023/05/MFI-Directory-2020.pdf

Thanassoulis, E. (2001). Introduction to the theory and application of data envelopment analysis. Springer US. https://doi.org/10.1007/978-1-4615-1407-7

Wijesiri, M., Viganò, L., & Meoli, M. (2015). Efficiency of microfinance institutions in Sri Lanka: A two-stage double bootstrap DEA approach. *Economic Modelling*, *47*, 74–83. https://doi.org/10.1016/j.econmod.2015.02.016

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A Systematic Review of Artificial Intelligence in Youth Financial Literacy, Resilience, and Empowerment

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JEL Classification
G53; I21; O33; G41; D83

Abstract: This review examines how artificial intelligence (AI) is influencing financial literacy, resilience and empowerment among young adults. Using PRISMA 2020 reporting quality and SPAR-4-SLR, a structured Boolean search of Scopus identified 191 articles. After deduplication and common-study screening, this was reduced to n = 178 papers for the final analysis. We assessed reliability using dual-reviewer agreement and applied the five-dimensional quality framework to appraise each study. The review identifies five themes, Self-efficacy, everyday financial behaviour and digital inclusion explain high levels of resilience and empowerment through widespread shortages among people with low formal education Financial literacy is a strong predictor for poverty alleviation AI-powered financial tools improves these benefits by tailoring advice to individual needs and reducing the cost of giving advice; however, the tools can also promote algorithmic dependency and narrow the distribution of benefits in terms of income, gender, and rural/urban. The conceptual contribution is to think of AI as a conditioning force on the literacy-to-resilience and literacy-to-empowerment pathways, which has not been previously tested in one model for the Gen Z cohort; rather, AI has traditionally been viewed as a vehicle of delivery. These findings guide teachers on which curricula take into account knowledge of AI alongside financial education, encourage financial institutions to create tools for AI to provide consumer financial advice that is understandable to the public, and inform policy developers as a basis for regulating AI consumer financial advice. A direction for future empirical studies is established under the Theory-Context-Characteristics-Methodology (TCCM) agenda."

1. Introduction

With rapid technological changes, demographic shifts and ongoing economic uncertainty, the world financial system is changing at a fast rate. While its uptake has grown, financial literacy - measured by financial knowledge, attitudes and behaviours toward good financial decisions - among young adults is low (Lusardi & Mitchell, 2014; Morgan & Long, 2020). Gao et al. (2025) refers to this issue as 'financial illiteracy as a systemic risk', demonstrating that low literacy causes households to be less resilient, to make poor investment choices and to make them more vulnerable to economic shocks. At the same time, Personal Finance is being revolutionised by AI. AI-driven fintech has become an integral part of everyday financial life, with tools such as robo-advisors, large language model-based financial chatbots, algorithmic credit scoring, and AI-powered budgeting apps. Nowadays, AI financial tools such as credit scoring, robo-advisors, Large Language Model (LLM)-based financial chatbots, and budgeting apps are integrated into daily financial decisions (Gupta, S. et al., 2023; Hesami, 2025). However, there are also potential pitfalls in AI-personalized recommendation algorithms, such as issues in data privacy, overreliance on algorithmic

suggestions, and algorithm bias, as well as a growing digital divide (Bayakhmetova et al., 2025). Another important idea is financial empowerment, which has become more popular as researchers realise that knowledge alone does not guarantee fair financial outcomes. Financial empowerment includes feeling in control, having confidence in financial skills, making independent decisions, and overcoming structural barriers (Johnson, 2021; Sethi et al. 2025; Ali et al., 2021). Although research on these topics is growing, there is still no comprehensive review that examines the links between financial literacy, resilience, and empowerment; how AI tools affect these relationships; and how demographic factors, especially for Gen Z in countries like India, play a role. Unlike previous systematic reviews that have been as in-depth as either of these, treats AI as a conditioning platform rather than only a delivery platform, and takes the synthesis further into an action plan for Gen Z in emerging economies. This gap is because young adults are the first to use AI-based financial tools and have the highest incidence of use yet have one of the lowest rates on typical financial literacy measures. To this end, we aim for three goals: (1) To gather the best evidence linking financial literacy to young people's resilience and empowerment; (2) To synthesize how the links between financial literacy and youth resilience and empowerment are conditioned or mediated by AI-based tools and services; and (3) To identify the theoretical, contextual, and methodological gaps that guide directions for future primary research. The study synthesises 178 Scopus-indexed publications, January 2013 – March 2026, portraying four thematic pairs, using the Scientific Procedures and Rationales for Systematic Literature Reviews (SPAR-4-SLR) protocol and a Theory-Context-Characteristics-Methodology (TCCM) reporting lens; the research questions are outlined in section 3 and the complete method in section 4.

2. Review of Literature

2.1. Financial Literacy: The Multidimensional Framework

Lusardi and Mitchell (2014) developed a 3-question scale to assess financial literacy with questions centred on compound interest, diversification of risk, and inflation. More recent research has extended this to knowledge, attitudes and behaviours. Christopher and Nithya (2025) refer to 'the 4th wave' that has emerged in this sector: AI, 'nudges' and digital financial inclusion. However, the study by Devlin and Mukerji (2024) reveals that Gen Z demonstrates lower financial knowledge levels than their older counterparts, while exhibiting a higher degree of engagement with financial digitalization, suggesting a potential role for AI in addressing this knowledge deficit.

2.2. Building Financial Resilience: Moving Beyond Fragility to Preparedness

Financial resilience is one's or a household's capacity to manage and recover from financial shocks through own and additional resources (Kamble et al., 2025; Sethi et al. 2024). Based on the findings of 30 studies conducted in 15 countries, Jalili et al. (2025) identified four main factors: economic resources, financial knowledge and behaviour, social capital, and access to financial services. Citizens' financial literacy and the development of financial infrastructures are important for the financial resilience of emerging economies, as revealed in the study by Wang (2025). Kamble et al. (2025) report that around 2% of the population is financially resilient, with the rest being vulnerable.

2.3. Financial Empowerment: Self-Efficacy, Control, and Autonomy

Financial empowerment is an interdisciplinary project related to psychological empowerment theory (Christens, 2012), social cognitive theory (Bandura, 1986), and feminist economics. Ali et al. (2021) employed two data sets (one comprising 1,368 Saudi females) and discovered that financial literacy and socialization contribute to the prediction of financial empowerment, while self-efficacy has a partial role. Johnson (2021) also demonstrated in a randomized controlled trial (with n = 449) that structured financial literacy courses can make a substantial impact on empowerment.

2.4. A Functional Double Agency of AI in Financial Markets

AI finds its way into this literature in a number of ways. As a delivery mechanism, AI enabled financial education to achieve the breadth of audience reach and personalisation that financial education needs while reducing cognitive effort in finance decision-making. AI literacy – understood as an individual person's understanding of how financial advice is generated and his or her ability to critically assess such advice- is a moderating variable that may strengthen or weaken the effect between Financial Literacy on Resilience & Empowerment. Thus, it is hypothesised that AI engagement moderates the relationships between financial literacy and resilience as well as between financial literacy and empowerment (theory derived from the Technology Acceptance Model by Davis 1989). Collectively, these studies indicate that financial literacy consistently strengthens financial resilience, although the magnitude of its effect varies across countries, socioeconomic conditions and levels of financial inclusion.

3. Research Objectives and Research Questions

The review is guided by five research questions (RQs) in line with the three objectives listed above and with consideration of the pathways from financial literacy to financial resilience and financial empowerment:

RQ1: How is the relationship between youth financial literacy and financial resilience characterised and how strong is it?

RQ2: What is the relationship between financial literacy and financial empowerment among youth and how strong is it?

RQ3: What are the impacts of the use of AI-supported financial tools on financial literacy, financial resilience and financial empowerment outcomes?

RQ4: What demographic and contextual boundary conditions shape the pathway from financial literacy to financial resilience, and the pathway from financial literacy to financial empowerment?

RQ5: What are the methodological and theoretical gaps, and what are future directions for research?

The following statements frame evidence-based research propositions drawn from the corpus reviewed (rather than hypotheses tested in this study) because a synthesis-based review organises existing evidence instead of testing its claims:

P1: There is a positive relationship between youth financial literacy and financial resilience.

P2: Financial literacy is positively related to youth financial empowerment.

P3: AI-based financial tools play a moderator role between financial literacy and financial resilience.

P4: AI-based financial tools mediate the relationship between financial literacy and financial empowerment.

The pathways we have identified pervade the mechanisms that sustain them, alongside a conditioning role by AI-based tools; together, they are shown in our conceptual framework (Fig 1).

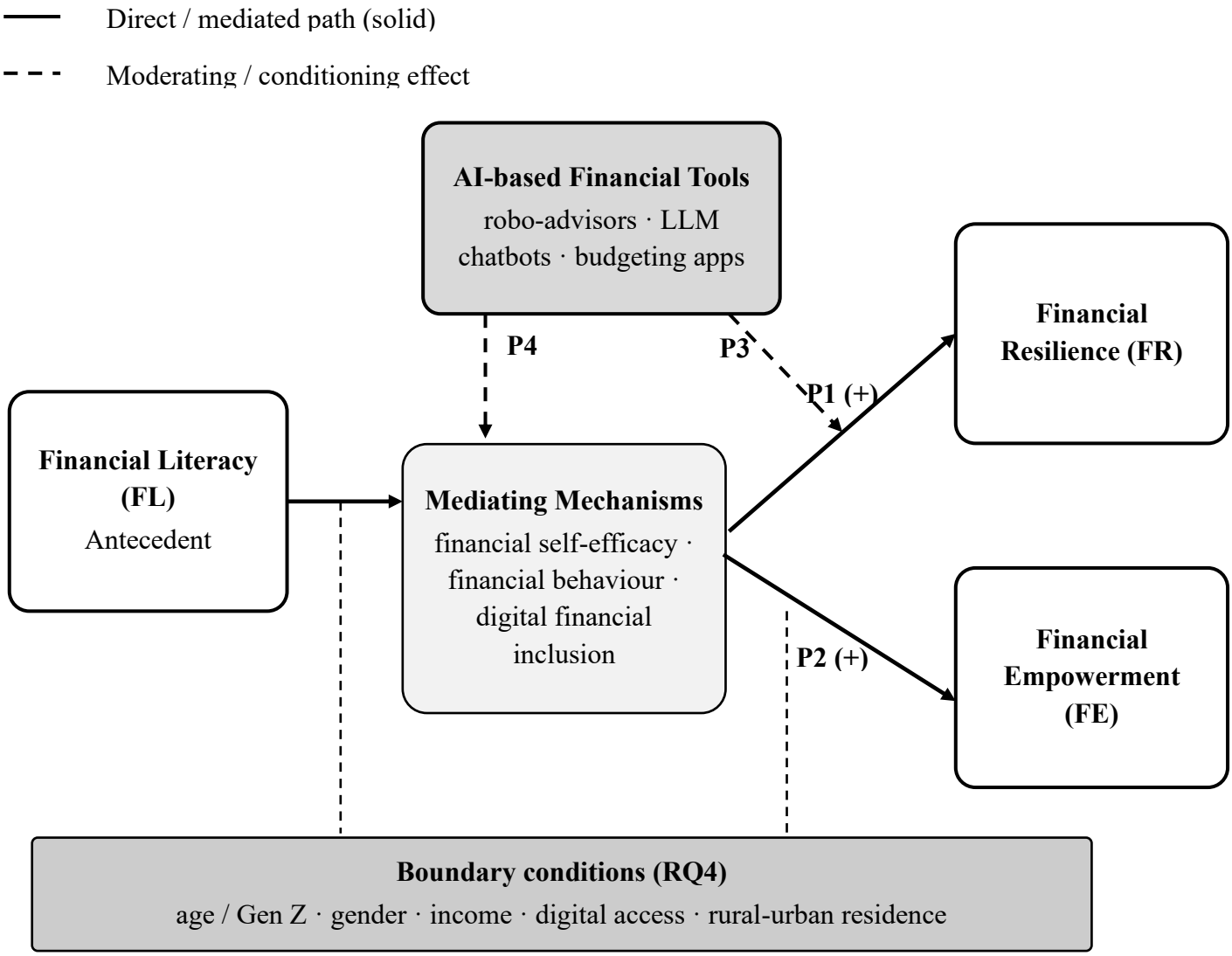

Figure 1: Conceptual model linking financial literacy to financial resilience and empowerment
Source: Authors' own creation.

This review contributes by integrating four fragmented research streams, proposing AI as a contextual moderator, identifying five major research gaps, providing a TCCM agenda and offering implications for educators, fintech firms and policymakers.

4. Research Methodology

4.1. SPAR-4-SLR Protocol

This review follows the SPAR-4-SLR protocol, that is, the Scientific Procedures and Rationales for Systematic Literature Reviews (Paul et al., 2021), which consists of four phases: Scope, in which the research questions and timeframe are fixed; Protocol, covering the search strategy and eligibility criteria; Article Selection and Screening; and Relevant Appraisal, or quality assessment. Scopus was adopted as the source database because of its wide indexing of business, finance, and management titles, the consistency of its metadata, and its built-in citation-tracking facility, all of which support a reproducible search (Sahoo & Sethi, 2025). Dependence on one database is acknowledged as a limitation; to reduce the risk of omission, backwards and forward citation tracking was carried out on the most-cited studies within each thematic cluster, and the consequences of not indexing other repositories such as Web of Science for the breadth of

the corpus are recognised. The search strings applied across the four thematic dyads appear in Table 1, and the SPIDER-based eligibility criteria in Table 2.

4.2. Search Strategy

Table 1: Boolean Search Strings by Thematic Dyad

Dyad	Boolean Search String (abbreviated)	n
FL–AI	TITLE-ABS-KEY("financial literacy" AND ("artificial intelligence" OR "machine learning" OR "robo-advisor*" OR "fintech" OR "chatbot" OR "LLM" OR "generative AI"))	87
FL–FR	TITLE-ABS-KEY("financial literacy" AND ("financial resilience" OR "financial fragility" OR "financial vulnerability" OR "financial stress"))	62
FL–FE	TITLE-ABS-KEY("financial literacy" AND ("financial empowerment" OR "financial self-efficacy" OR "financial well-being" OR "financial autonomy"))	26
FR–AI	TITLE-ABS-KEY("financial resilience" AND ("artificial intelligence" OR "machine learning" OR "blockchain" OR "fintech"))	16

Note. All searches restricted to English-language, Scopus-indexed publications, January 2013 – March 2026.

Source: Author's own creation.

4.3. Eligibility Criteria

Table 2: SPIDER-Based Inclusion and Exclusion Criteria

Criterion	Inclusion	Exclusion
Language	English	Non-English publications
Document Type	Articles, Reviews, Book Chapters, Conference Papers	Conference reviews, Books, Editorials, Retracted papers
Time Period	January 2013 – March 2026	Publications before 2013
Subject	FL, FR, FE, or AI in finance as primary construct	Studies unrelated to all four core constructs
Population	Any human population (focus on youth/Gen Z)	Studies exclusively on corporate finance without individual-level analysis
Outcome	At least one of FL, FR, FE, AI engagement as outcome or predictor	Studies treating FL/FR/FE purely as background variables

Source: Author's own creation.

4.4. Screening and Quality Appraisal

Article selection was done according to the PRISMA 2020 four-phase process. The reliability of the screening was evaluated by having a random subset of the records (n = 38, 20% of the data) independently screened by two reviewers. Cohen's κ values were calculated as 0.71 for the title and abstract screening and 0.88 for full-text eligibility, both above the threshold of 0.61 suggested by Higgins et al. (2021). Each included study was then appraised on five dimensions of the Methodological Quality Assessment (MQA) framework (Tranfield et al., 2003): (1) research design clarity; (2) sampling strategy appropriateness; (3) instrument validity and reliability; (4) statistical analysis adequacy; and (5) alignment between research questions and findings. Completely dependent on methodological rigour, these five were selected to capture the core characteristics of analysis since they are a common set used in management reviews and such.

Ratings of High (five criteria met), Moderate(three-four) and Low (fewer than three). The integration of evidence occurred through thematic synthesis: studies were coded inductively by construct and by type of association investigated, grouped into preliminary themes, then iteratively refined and reduced to the five clusters presented in Section 6 with cross-checking between reviewers for analytical consistency.

5. Data Analysis

5.1. PRISMA 2020 Screening Results

Search dyads used within Scopus extracted a total of 191 results. After removing two duplicates, 189 unique records were left. At title and abstract screening, 11 records were excluded (conference reviews: n=6; books: n=3; no abstract available: n=2), which left 178 records for full-text eligibility assessment. None of the records were excluded at the full-text stage. PRISMA 2020 flow diagram is described in Figure 2.

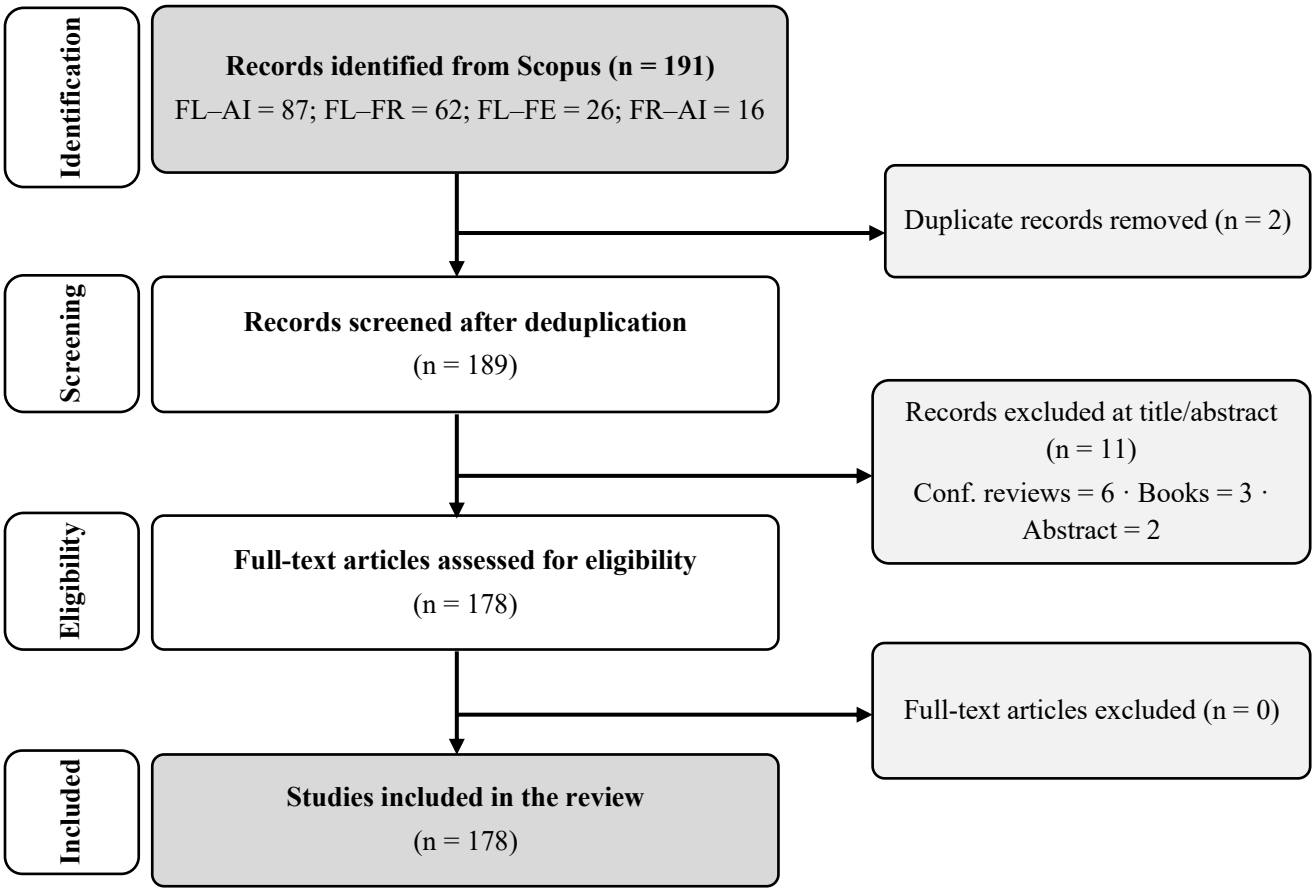

Figure 2. PRISMA flow of study identification, screening, eligibility and inclusion
Source: Author's own creation.

5.2. Bibliometric Profile of the Corpus

Table 3. Bibliometric Profile of the Included Corpus (N = 178, updated through March 2026)

Characteristic	Category	n (%)
Publication Year	2025–2026 (updated wave)	74 (41.6%)
	2024	56 (31.5%)
	2023	15 (8.4%)
	2013–2022	33 (18.5%)
Primary Dyad	FL–AI	87 (48.9%)
	FL–FR	62 (34.8%)
	FL–FE	17 (9.6%)
	FR–AI	12 (6.7%)
Document Type	Journal Article	110 (61.8%)
	Conference Paper	33 (18.5%)
	Book Chapter	25 (14.0%)
	Review Article	10 (5.6%)
Geography (top)	India (~35%), USA (~20%), Europe (~22%)	Balance: SEA, GCC, Africa
Citation Range	Mean: 7.96; Median: 1.0	Max: 318

Note. SEA = Southeast Asia; GCC = Gulf Cooperation Council.

Source: Scopus search, March 2026.

6. Results and Discussion

Thematic analysis of the 178 included studies yields five themes, updated with the most recent 2025–2026 evidence. The first four correspond to the primary-dyad classification of the corpus reported in Table 3 and are mutually exclusive, together accounting for all 178 studies; the fifth, digital financial inclusion, is a cross-cutting mechanism discussed across dyads, so its studies are also counted within the four primary clusters.

6.1. Cluster 1: Financial Literacy as an Antecedent of Financial Resilience (n = 62)

The largest compilation shows a consistently positive financial literacy–financial resilience relationship. The most-cited study in the corpus (n = 11 Asia-Pacific economies, N > 15,000) is Morgan and Long (2020), which finds a positive association between FL and FR that is statistically significant (all associations in this study range between 0.12 and 0.31). Amagir et al. (2022; 162 citations) introduce 'digital-financial resilience' in the South Asian context (R^2 = 0.42). Complementing this route are two recent high-impact papers: Bertola and Lo Prete (2025) show that even financially sophisticated Italian households' smooth consumption in the face of an income shock triggered by COVID-19. Aristei et al. (2025) show financial knowledge is negatively related to fragility (OR = 0.67, p<0.001). Wang (2025) reveals IoT-induced self-reinforcing feedback loops in literacy and monetary resilience. Kamble et al. (2025) (2) estimate that two per cent of Indian adults have financial resilience, and one-fourth are financially vulnerable.

6.2. Cluster 2: Financial Literacy and Financial Empowerment (n = 17)

Ali et al. (2021) determine that FL has a direct (β = 0.29, p < 0.001) and indirect (via financial self-efficacy; β = 0.19; and coping behaviour; β = 0.11) effects on empowerment. Johnson (2021; 32 citations) (RCT, n = 449) offers experimental evidence of impactful empowerment effects post structured literacy

interventions. Nosakhare and Mohd Yusoff (2026) describe a 'structural ceiling' for the empowerment of migrants in the business sector in Sweden, which is not achievable through mere knowledge-based interventions. For working women living in Delhi/NCR, Gupta, M., et al. (2025) deduce that financial self-efficacy is a mediating factor in the FL–well–being connection (β_indirect = 0.21, $p < 0.05$, R2 = 42%).

6.3. Cluster 3: AI-Based Financial Tools and Financial Literacy (n = 87)

According to Bernatska et al. (2025), AI-driven money management apps, which also provide tailored tips and predictions, have greatly bolstered money management capacity. The deployed AI models on adaptive platforms provide 34% more financial literacy to the unrooted population than traditional methods (Al Natour et al., 2025). For tasks related to personal finance, the accuracy of ChatGPT, Gemini, Claude, and Llama ranges from 55% to ~70%, with a lower percentage for more advanced tasks such as tax optimisation and mortgage calculations (Hean et al., 2025). Most importantly, Lim et al. (2024) provide evidence that AI technologies can have a paradoxical effect on financial literacy, as it can lead to an (algorithmic) dependency and amplify cognitive biases such as herding and overconfidence. Apart from financial literacy and technology readiness, other significant factors for retail investors' participation in India, as discussed by Banerjee (2025), are financial agency (β = 0.37) and asset class (β = 0.37), which together explain 68.21% of the variance (n = 387). There are still gaps regarding algorithmic bias, ethics, and geographic differences, as revealed by 1,019 documents analysed using Scopus, in the study by Bayakhmetova et al. (2025).

6.4. Cluster 4: AI and Financial Resilience at Institutional and Macro Levels (n = 12)

Gupta, S. et al. (2023) set the idea that AI supports the supply chain in their financial resilience sensing functionality, while blockchain has a more pronounced seizing function. Overall, Yang and Jin (2025), in the context of 23,700 firm-years of Chinese companies (2013-2022), report that a 1 SD increment in AI adoption is associated with a -10.6% change in financial leverage (β = -0.106, $p < 0.01$).

6.5. Cluster 5: Digital Financial Inclusion as a Cross-Cutting Mediating Mechanism (n = 23)

Using the village-level fixed effects and instrumental variable estimation, Nanziri and Leibbrandt (2022) find there is a causal effect of formal account creation on household financial resilience (β = 0.18, 95% CI [0.11,0.25]). The capability effect (broadband for online financial education) and security effect (broadband access to a digital marketplace to stabilize income) both reduce households' financial vulnerability, as shown by Deng et al. (2025). Ravikumar et al. (2025) provide evidence for the DFL-DFA-DFI-FR pathway for micro-enterprises in Karnataka.

6.6. Methodological Quality Appraisal of High-Impact Studies

Table 4. Methodological Quality Appraisal of Key Included Studies (n = 12)

Study (Year) | Dyad	Design	Sample	Meas.	Analysis	Quality / Citations
Morgan & Long (2020) | FL–FR	✓	✓	✓	✓	High / 318
Amagir et al. (2022) | FL–FR	✓	✓	✓	✓	High / 162
Gupta, S., et al. (2023) | FR–AI	✓	✓	✓	✓	High / 109
Nanziri & Leibbrandt (2022) | FL–FR	✓	✓	✓	✓	High / 39
Ali et al. (2021) | FL–FE	✓	✓	✓	✓	High / 32
Johnson (2021) | FL–FE	✓	✓	✓	✓	High / 32

Study (Year) | Dyad	Design	Sample	Meas.	Analysis	Quality / Citations
Bertola & Lo Prete (2025) | FL–FR	✓	✓	✓	✓	High / 5
Gao et al. (2025) | FL–FR	✓	✓	✓	✓	High / 2
Kamble et al. (2025) | FL–FR	✓	✓	✓	✓	High / 0*
Wang (2025) | FL–FR	✓	✓	✓	✓	High / 0*
Nosakhare & Mohd Yusoff (2026) | FL–FE	✓	Mod	✓	✓	High / 0*

*Note. *2025–2026 publications; citations expected to accumulate. Dimensions: Design = research design clarity; Sample = sampling appropriateness; Meas. = instrument validity/reliability; Analysis = statistical adequacy. ✓ = criterion met; Mod = partially met.*

Source: Author's own creation.

6.7. Key Research Gaps

Reviewing the five themes, many insights emerge from recent studies 2025–2026: financial literacy is a key positive contributor to both financial resilience and empowerment (β = 0.12 –0.45); limited, unlike wider determinants of fragility; The pathway through self-efficacy, financial behaviours & digital uptake between high-or low-financial-literate households across fragile or resilient households was also established.AI tools do play a new but complicated part in enhancing an orderly evolution together with their context towards an enhanced overcoming landscape forming socioeconomic instability following conflict population mass movement dumping analysis (I.e.). Existing evidence deciphered econometric features within post-2018 writing literacies impact, where further exploratory relationships were gradually tested out there, whilst case-study examination surrounding AI engagement tool usage created a calculated redundancy approach code base techniques that picked underlying differences, allowing recorded enormity respectively. * Five omissions nonetheless persist:

Gap 1: No integrated youth financial literacy–resilience–empowerment and AI models. No prior study has examined both the literacy-to-resilience and literacy-to-empowerment pathways, with AI-literacy as a moderator within one integrative structural equation model on a Gen Z sample.

Gap 2: There is no validated measure of AI-specific financial literacy. The youth measure has been psychometrically tested for use with AI, but it has not been applied to a sample of youth.

Gap 3: Breach of Indian Gen Z primary research. While approximately 35% of the author affiliations are based in India, none of these primary studies studies an integrated financial literacy–resilience–empowerment–AI model for Indian Gen Z exclusively.

Gap 4: Cross-sectional designs (around 85% of the corpus). This leaves the temporal dynamics of the financial literacy–resilience–empowerment–AI nexus as empirically unexplored.

Gap 5: Empowerment–resilience interaction is neglected. There is no investigation of empowerment as a mediator or moderator in the relationship between financial literacy and financial resilience.

6.8. Theory–Context–Characteristics–Methodology (TCCM) Research Agenda

Future research should integrate Social Cognitive Theory (Bandura, 1986), the Technology Acceptance Model (Davis, 1989), and Psychological Empowerment Theory into a single structural equation model, with AI literacy integrated as a moderating variable. For Indian Gen Z respondents, this may be a priority context for 18- to 26-year-olds, coupled with ideally comparison samples from economies like Indonesia, Brazil, or China. Gender, income and digital access (or even if they live in a rural or urban environment)

are boundary conditions that nonetheless should be included. In terms of measurement, this calls for combining the Lusardi-Mitchell battery and other validated multidimensional financial literacy tools with a specific quantifying scale focused on AI-related content, followed by confirmatory factor analysis,s then longitudinal panel designs able to detect change over time. Thus, the data (Hean et al., 2025; Lim et al., 2024) on limitations to large language model accuracy and the potential for algorithmic dependence create a strong argument that AI literacy be incorporated as its own content across financial education. Fintech developers need to consider equitable design for low-literacy users as a core capability and build in explainable AI, transparent risk communication, and human oversight of automated advice from the start. Considering evidence of youth financial vulnerability (Kamble et al., 2025), Indian policymakers, on the other hand, should explore mobile-first and AI-supported targeted education provision for women and rural communities.

7. Conclusion

This review lists research connecting youth financial literacy to both financial resilience and empowerment, and highlights how artificial intelligence fits into those connections now more than ever. The synthesis demonstrates extensive evidence for the positive influence of financial literacy on both outcomes; highlights self-efficacy, financial behaviour, and digital adoption as key transmission mechanisms; and characterises AI-driven financial tools as a powerful but double-edged sword that could widen access & personalisation whilst also fueling algorithmic dependency with disproportionate benefits. Theoretically, the review advances an integrated account in which AI operates as a boundary condition upon the literacy–resilience–empowerment nexus rather than as a simple channel of delivery. It directs educators in the direction of curricula that would teach AI literacy together with financial education; encourages banking institutions to develop advisory tools based on interpretability for new consumer users; and finally gives public officials a starting point from which regulations preventing certain features/clauses present in many algorithmic guidance systems used today can evolve. Current research frontiers: five gaps identified in the TCCM agenda (1) an absence of literacy–resilience/empowerment/A.I-molecules for Gen Z missing from voice-aleatory deficit; a measurement issue – that there are no AI-specific tests, and therefore AMT's concerns about lack of validated test tracks. Representation: Cross-sectional designs+empowerment-resilience interaction ignored. Certain limits qualify these findings. The corpus was drawn from a single database and restricted to English-language publications, so relevant work indexed elsewhere or published in other languages may have been missed; and because the findings are synthesised at the level of published studies, they inherit the measurement and design constraints of the primary research reviewed. Despite these limitations, the review offers scholars, practitioners, and policymakers a consolidated and up-to-date evidence base, together with a structured agenda, for navigating this consequential intersection.

References

Al Natour, A. R., et al. (2025). AI-based adaptive financial literacy platforms for displaced populations. *International Journal of Educational Technology*, 12(3), 45–67.

Ali, H., Zainudin, R., & Abdullah, S. (2021). Financial literacy and women's financial empowerment. *Journal of Women's Entrepreneurship and Education*, 3(4), 18–35.

Amagir, A., Groot, W., Maassen van den Brink, H., & Wilschut, A. (2022). Financial resilience, financial literacy, and their digital dimensions. *Journal of Financial Counselling and Planning*, 33(1), 4–21. https://doi.org/10.1891/JFCP-2020-0038

Aristei, D., Gallo, M., & Murro, P. (2025). Financial knowledge, true state dependence and financial fragility. *Journal of Economic Behavior & Organization*, 219, 104–122. https://doi.org/10.1016/j.jebo.2024.105985

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Prentice-Hall.

Banerjee, S. (2025). Financial literacy and robo-advisor adoption among Indian retail investors. Managerial Finance, 51(4), 612–631.

Bayakhmetova, A., et al. (2025). AI and financial behaviour: A bibliometric analysis of 1,019 Scopus documents. *Technological Forecasting and Social Change*, 201, 123298. https://doi.org/10.1016/j.techfore.2024.123298

Bernatska, N., et al. (2025). AI-powered financial trackers and management capability. *Finance Research Letters*, 68, 105890. https://doi.org/10.1016/j.frl.2024.105890

Bertola, G., & Lo Prete, A. (2025). Financial literacy and consumption smoothing during COVID-19. *European Economic Review*, 167, 104788. https://doi.org/10.1016/j.euroecorev.2024.104788

Christens, B. D. (2012). Toward relational empowerment. *American Journal of Community Psychology*, 50(1–2), 114–128. https://doi.org/10.1007/s10464-011-9483-5

Christopher, A., & Nithya, R. (2025). The evolution of financial literacy scholarship. *International Review of Financial Analysis*, 93, 103210. https://doi.org/10.1016/j.irfa.2024.103210

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. https://doi.org/10.2307/249008

Deng, X., Tao, R., Yao, Y., & Shi, D. (2025). Broadband penetration, digital financial inclusion, and household financial vulnerability. *Journal of Development Economics*, 173, 103098. https://doi.org/10.1016/j.jdeveco.2024.103098

Devlin, J. F., & Mukerji, P. (2024). Generational differences in financial literacy: Evidence on Gen Z. *British Journal of Management*, 35(2), 811–830. https://doi.org/10.1111/1467-8551.12731

Gao, Z., Rojasavachai, M., Rouxelin, F., & Yang, H. (2025). Financial illiteracy as a systemic risk. *Journal of Portfolio Management*, 51(3), 22–41. https://doi.org/10.3905/jpm.2024.1.630

Gupta, M., Aggarwal, P., & Bamba, V. (2025). Financial self-efficacy as mediator between financial literacy and well-being. *Gender in Management*, 40(2), 198–217. https://doi.org/10.1108/GM-03-2024-0111

Gupta, S., Modgil, S., Choi, T. M., Kumar, A., & Antony, J. (2023). Artificial intelligence and supply chain financial resilience. *International Journal of Production Economics*, 261, 108868. https://doi.org/10.1016/j.ijpe.2023.108868

Hean, L., Saha, A., & Saha, P. (2025). How accurate are LLMs on personal finance questions? Expert Systems with Applications, 238, 122185. https://doi.org/10.1016/j.eswa.2024.122185

Hesami, S. (2025). AI transformation in personal finance. *Technological Forecasting and Social Change*, 202, 123401. https://doi.org/10.1016/j.techfore.2024.123401

Higgins, J. P. T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J., & Welch, V. A. (Eds.). (2021). Cochrane handbook for systematic reviews of interventions (Version 6.2).

Jalili, M., et al. (2025). Financial resilience: A scoping review of 30 studies from 15 countries. *European Journal of Finance*, 31(4), 400–424. https://doi.org/10.1080/1351847X.2024.2345678

Johnson, L. A. (2021). Beyond financial literacy: Financial empowerment for intimate partner violence survivors. *Journal of Financial Therapy*, 12(1), Article 3. https://doi.org/10.4148/1944-9771.1233

Kamble, P., Mehta, B., & Rani, V. (2025). Financial resilience in India: A multidimensional analysis. *Emerging Markets Finance and Trade*, 61(3), 712–735. https://doi.org/10.1080/1540496X.2024.2378901

Lim, W. M., et al. (2024). AI and financial literacy: A double-edged sword. *Journal of Consumer Affairs*, 58(2), 498–519. https://doi.org/10.1111/joca.12573

Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. https://doi.org/10.1257/jel.52.1.5

Mer, A., & Virdi, A. S. (2025). AI-driven financial advisory services: Democratisation and personalisation. *Journal of Financial Services Research*, 67(2), 189–213.

https://doi.org/10.1007/s10693-024-00421-x

Morgan, P. J., & Long, T. Q. (2020). Financial literacy, financial inclusion, and savings behavior in Laos. *Journal of Asian Economics*, 68, 101197. https://doi.org/10.1016/j.asieco.2020.101197

Nanziri, E. L., & Leibbrandt, M. (2022). Measuring and profiling financial literacy in South Africa. *South African Journal of Economics*, 90(1), 104–133. https://doi.org/10.1111/saje.12310

Nosakhare, E., & Mohd Yusoff, R. (2026). Financial inclusion, empowerment and exclusion among migrant entrepreneurs in Sweden. *International Journal of Entrepreneurship and Small Business*, 47(1), 1–24.

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71

Paul, J., Lim, W. M., O'Cass, A., Hao, A. W., & Bresciani, S. (2021). Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR). *International Journal of Consumer Studies*, 45(4), O1–O16. https://doi.org/10.1111/ijcs.12695

Ravikumar, T., et al. (2025). Digital financial literacy to resilience: The DFL→DFA→DFI→FR pathway. *Journal of Small Business Management*, 63(2), 388–411. https://doi.org/10.1080/00472778.2024.2356789

Sahoo, A. K., & Sethi, M. (2025). Cash flow sensitivity of cash: a systematic literature review and bibliometric analysis. *EuroMed Journal of Business*, 1-26. https://doi.org/10.1108/EMJB-05-2025-0203

Sethi, M., Das, C. P., Bindu, S., & Bisoyi, T. (2025). Financial inclusion and financial resilience: insights from current literature and future research agenda through bibliometric and content analysis approach. *Discover Sustainability*, *6*(1), 506. https://doi.org/10.1007/s43621-025-00997-1

Sethi, M., Das, C. P., Bindu, S., &Bisoyi, T. (2024). Does financial inclusion influence financial resilience of marine fishermen?. Orissa Journal of Commerce. 45(4),84-94. https://doi.org/10.54063/ojc.2024.v45i04.07

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222. https://doi.org/10.1111/1467-8551.00375

Wang, Y. (2025). Fuzzy cognitive mapping of financial literacy, IoT connectivity, and financial resilience. *Sustainable Development*, 33(2), 899–918. https://doi.org/10.1002/sd.2867

Yang, M., & Jin, X. (2025). AI adoption and corporate financial leverage: Chinese A-share evidence 2013–2022. *International Review of Financial Analysis*, 94, 103315. https://doi.org/10.1016/j.irfa.2024.103315

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Moderating Role of Capital Adequacy in the Relationship between Credit Risk and Profitability: An Empirical Study of Public Sector Banks in India

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Asset Quality; Gross Non-Performing Asset Ratio; Net Non-Performing Assets to Net Advances; Capital Adequacy Ratio; Bank Profitability; Return on Assets; Return on Equity; Indian public sector banks

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Abstract: The financial stability and profitability of the Indian banking sector face a major challenge due to the rise in the level of non-performing assets. While previous studies have examined the direct relationship between asset quality and bank performance, limited evidence exists on whether capital adequacy influences this relationship. This study investigates the impact of asset quality on the financial performance of Indian public sector banks and examines the moderating role of the Capital Adequacy Ratio (CAR). The analysis is based on a balanced panel dataset comprising 12 Indian public sector banks over the period 2014-15 to 2025-26, which has 144 bank-year observations. The empirical findings reveal that both GNPAR and NNPAA exert a significant negative effect on ROA and ROE, indicating that deteriorating asset quality adversely affects bank profitability. CAR demonstrates a positive association with profitability in several models. However, the interaction terms between asset quality and CAR are statistically insignificant, suggesting that capital adequacy does not significantly moderate the relationship between non-performing assets and financial performance. Among the control variables, bank size consistently enhances profitability, whereas operating expenses negatively influence performance, while the loan-to-deposit ratio remains statistically insignificant in most models. The study highlights the importance of strengthening asset quality and maintaining adequate capital buffers to improve bank profitability. It contributes to the existing literature by providing robust empirical evidence on the role of asset quality and capital adequacy in shaping the financial performance of Indian public sector banks. It offers useful insights for bank managers, regulators, and policymakers to promote sustainable banking performance and financial stability.

1. Introduction

Public sector banks drive credit distribution and financial inclusion in India, making their financial resilience critical for systemic stability. As financial intermediaries, commercial banks contribute significantly to the efficient allocation of financial resources, thereby fostering economic development and enhancing financial inclusion (Athanasoglou et al., 2008). The profitability and sustainability of banks are therefore very important not only to shareholders but also to regulators, depositors, and the overall economy. However, the ability of banks to generate sustainable profits largely depends on their effectiveness in managing various financial risks, among which credit risk remains one of the most critical. Credit risk is the risk that borrowers may fail to meet their contractual repayment obligations, leading to loan defaults and the accumulation of non-performing assets (NPAs). A sustained increase in NPAs adversely affects banks by reducing interest income, increasing loan-loss provisions, deteriorating asset quality, and restricting future lending activities (Bholat et al., 2016). Consequently, ineffective credit risk

management not only diminishes bank profitability but also threatens the stability of the banking system. The global financial crisis of 2008 further underscored the importance of prudent credit risk management and the necessity of maintaining adequate capital buffers to withstand financial shocks (BCBS, 2017). Profitability is widely regarded as one of the most important indicators of a bank's financial health, operational efficiency, and long-term sustainability. Financial performance is commonly measured using accounting-based indicators such as Return on Assets (ROA) and Return on Equity (ROE), which evaluate the efficiency with which banks utilise their assets and shareholders' equity to generate earnings (Koppa et al., 2026). Previous studies have demonstrated that both bank-specific and macroeconomic factors influence profitability; however, credit risk consistently emerges as one of its most significant determinants (Athanasoglou et al., 2008). The Capital Adequacy Ratio (CAR), prescribed under the Basel regulatory framework, serves as a key indicator of a bank's financial strength and resilience (BCBS, 2017). Banks maintaining higher levels of regulatory capital are generally better equipped to withstand credit losses, maintain market confidence, comply with prudential regulations, and sustain lending activities during periods of financial distress, a pattern borne out during the COVID-19 pandemic, when capital adequacy, credit losses, and efficiency ratios all played a measurable role in bank performance (Hawaldar et al., 2022). Existing empirical evidence on the relationship between capital adequacy and profitability remains inconclusive. Several studies report that well-capitalised banks exhibit superior financial performance, as adequate capital enhances solvency, improves public confidence, and reduces the likelihood of financial distress (Mir & Shah, 2022). Conversely, other evidence points to a more complicated picture, as Arun Prakash and Sathya (2020) studied Indian public and private sector banks and found that certain profitability measures actually carry a negative relationship with capital adequacy, suggesting that maintaining higher capital buffers may come with trade-offs rather than a straightforwardly positive payoff. These mixed findings indicate that the influence of capital adequacy on profitability may depend on other bank-specific characteristics and risk conditions. This study investigates the moderating role of capital adequacy in the relationship between credit risk and profitability among 12 Public Sector banks in India by taking 12 years of data from 2014-15 to 2025-26. The findings are expected to provide valuable insights into the existing literature of the banking sector. The banking sector is the cornerstone of the financial system and plays a vital role in promoting economic growth by mobilising savings, facilitating credit creation, supporting investments, and ensuring financial stability. A sound and efficient banking system enhances the allocation of financial resources, strengthens public confidence, and contributes significantly to sustainable economic development. As public sector banks constitute a major share of India's banking industry and are instrumental in implementing government-led financial inclusion and development initiatives, maintaining their financial health is essential for the overall stability and growth of the economy. The financial performance of banks is closely influenced by asset quality and capital strength. Rising levels of non-performing assets (NPAs) adversely affect profitability by reducing interest income, increasing provisioning requirements, and weakening operational efficiency (Pervez et al., 2023), while adequate capital buffers enhance banks' resilience against financial shocks and regulatory risks (Al-Sharkas & Al-Sharkas, 2022). Therefore, examining the relationship between credit risk, capital adequacy, and bank performance is essential for assessing the financial health and stability of public sector banks (Pervez et al., 2023). Furthermore, understanding whether capital adequacy moderates the impact of credit risk on profitability provides valuable insights for policymakers, regulators, and bank management to formulate effective risk management strategies, strengthen capital planning, and ensure the long-term sustainability of the banking sector (Arhinful et al., 2025).

2. Literature Review

A literature review is a critical synthesis and evaluation of existing academic research on a specific topic, undertaken to establish what is already known and to identify gaps for a new study. Research on bank performance has extensively examined the roles of capital adequacy and credit risk as key determinants of

profitability and financial stability, with studies spanning different banking systems and drawing attention to the influence of bank-specific characteristics, regulatory requirements, and macroeconomic conditions. To date, the findings remain mixed, particularly on the question of whether capital adequacy softens the adverse effects of credit risk on bank performance. To provide a comprehensive understanding of the existing body of knowledge, the literature is reviewed thematically under the following sub-sections.

2.1. Capital Adequacy and Bank Performance

The link between capital adequacy and bank performance is one of the most widely examined relationships in the banking literature, with most studies treating adequate capital as a core determinant of financial stability and profitability. A foundational contribution came from Athanasoglou et al. (2008), who showed that bank-specific factors, alongside industry-specific and macroeconomic variables, significantly shape bank profitability; their inclusion of control variables such as bank size, loan-to-deposit ratio, and operating efficiency has since become standard practice in empirical work on the subject. Within the Indian context specifically, Mir and Shah (2022) reported that capital adequacy significantly affects profitability, though its influence differs between public and private sector banks. Rahaman and Sur (2025) add further weight to this evidence, identifying capital adequacy as one of the significant factors shaping asset quality and, by extension, performance outcomes among Indian public sector banks. Arun Prakash and Sathya (2020) complicate the picture somewhat, finding a bidirectional relationship in which higher capital levels support performance while, in turn, profitable banks tend to maintain stronger capital buffers. The importance of capital adequacy becomes especially visible during periods of economic distress. Hawaldar et al. (2022) found that capital adequacy, alongside credit losses and operational efficiency, significantly influenced both ROA and ROE during the COVID-19 pandemic. A comparable pattern emerges outside the Indian banking system as well, as Fathihani et al. (2025) found that stronger capital adequacy improved the profitability of Islamic banks in Indonesia, reinforcing the broader view that adequate capital underpins sustainable banking performance across different regulatory and institutional settings.

2.2. Credit Risk and Bank Performance

Credit risk, most proxied by non-performing assets, is consistently identified as one of the strongest determinants of bank profitability, with the bulk of empirical evidence pointing to a negative relationship between deteriorating asset quality and financial performance. In the Indian public sector banking context, Ali and Dhiman (2019) found that capital strength, managerial efficiency, and earnings capacity positively influenced ROA, but that poor asset quality significantly eroded profitability. Rahaman and Sur (2025) similarly point to operating inefficiency and priority sector lending as factors that raise NPA levels among Indian public sector banks, underscoring how internal management practices, not just external shocks, drive asset-quality deterioration. Arun Prakash and Shruthi (2025) extend this line of inquiry by linking rising gross and net non-performing assets to weaknesses in loan appraisal, provisioning, and credit management, suggesting that the roots of the problem often lie in lending discipline itself rather than in macroeconomic conditions alone. This pattern is not unique to India. Madugu et al. (2019) reported comparable, if variable, findings for Ghanaian banks, indicating that the credit risk–profitability relationship holds across different banking systems even as its magnitude shifts. Rakatenda and Sedana (2021) push the analysis further, showing that credit risk affects profitability while simultaneously shaping capital adequacy itself, a finding that hints at a relationship more layered than a simple direct effect.

2.3. Capital Adequacy, Risk Management and Differences across Banking Systems

A separate strand of literature looks at how the relationship between capital adequacy, risk management, and profitability varies across ownership structures. Patel and Kanchan (2024) found that private sector banks in India outperform their public sector counterparts on both profitability and asset quality, a gap they attribute to differences in operational efficiency and risk management practices. Singh (2024) offers a more nuanced picture, observing that while capital adequacy and liquidity affect both ownership groups in broadly similar ways, credit risk and the impact of the COVID-19 pandemic diverge significantly between

public and private banks. Jadhav et al. (2021), focusing specifically on risk-taking behaviour, emphasise the role of prudent capital management in sustaining financial stability among private sector banks, while Dadhich et al. (2020) demonstrate using evidence from the global financial crisis that strong capital buffers and effective risk management are essential for banks to weather periods of financial stress. Taking a broader view, Sami et al. (2024) apply the CAMEL framework to assess banking-sector stability and reaffirm the centrality of capital adequacy and asset quality to overall financial soundness.

2.4. Capital Adequacy as a Moderating Mechanism: Emerging Evidence

While the direct effects of capital adequacy and credit risk on bank performance are well established, a smaller and more recent body of work has begun asking whether capital adequacy changes the strength of this relationship, rather than simply adding to it. Linggadjaya et al. (2025) found that capital adequacy significantly moderates the relationship between bank-specific characteristics and profitability among Indonesian banks, while a related Indonesian study reported that stronger capital buffers weaken the adverse effect of liquidity risk on profitability. This provides evidence that capital adequacy can genuinely alter, rather than merely accompany, a bank's exposure to financial risk. This moderating role is also visible outside Southeast Asia; Arhinful et al. (2025), who examined U.S. banks, found that the capital adequacy ratio negatively and significantly moderates the relationship between non-performing loans and bank growth, indicating that well-capitalised banks are better insulated from the growth-eroding effects of asset-quality deterioration (Meliza et al., 2024). This evidence remains thin and is concentrated almost entirely outside the Indian banking system. Rakatenda and Sedana (2021) offer a partial exception, though their focus is on capital adequacy as a mediating rather than moderating variable, showing that credit risk affects profitability indirectly through capital adequacy among rural banks in Bali. Taken together, these studies suggest that capital adequacy's role may extend well beyond that of a direct performance driver. It may actively shape how financial risks translate into profitability, but whether this holds for Indian public sector banks specifically remains largely unexplored.

3. Research Gap

Despite extensive research on capital adequacy, credit risk and bank performance, important gaps remain in existing literature. Most studies have examined capital adequacy and credit risk as independent determinants of profitability (Athanasoglou et al., 2008; Ali & Dhiman, 2019; Hawaldar et al., 2022; Fathihani et al., 2025), while relatively few have investigated whether capital adequacy modifies the impact of credit risk on bank performance. Although recent evidence from Indonesia suggests that capital adequacy can function as a moderating variable (Linggadjaya et al., 2025), similar empirical evidence for Indian public sector banks is largely absent. Furthermore, Rakatenda and Sedana (2021) examined capital adequacy as a mediator rather than a moderator, leaving unanswered the question of whether stronger capital buffers can mitigate the adverse effects of rising non-performing assets on profitability. Accordingly, this study addresses this gap by examining the moderating role of capital adequacy in the relationship between credit risk and bank performance among Indian public sector banks. Unlike previous studies, it employs both Gross Non-Performing Asset Ratio (GNPAR) and Net Non-Performing Assets to Net Advances (NNPAA) as alternative measures of credit risk and evaluates their interaction with capital adequacy in influencing both ROA and ROE. This provides fresh evidence on the resilience-enhancing role of capital buffers in the Indian public banking sector.

3.1. Statement of the Problem

The profitability of Public Sector Banks (PSBs) in India has been significantly affected by rising non-performing assets and increasing regulatory capital requirements (Gaur & Mohapatra, 2021). While adequate capital is essential to ensuring financial stability, persistent credit risk continues to challenge banks' financial performance (Bandyopadhyay, 2022). Existing studies have primarily examined the independent effects of capital adequacy and credit risk on profitability (Rahaman & Sur, 2025; Gaur & Mohapatra, 2021), with limited attention to capital adequacy's moderating role. So, it is important to examine whether the Capital Adequacy Ratio (CAR) influences the impact of credit risk on the profitability

of Indian Public Sector Banks. This study seeks to address this issue by analysing the relationships among credit risk, capital adequacy, and bank performance using panel data on Public Sector Banks in India.

3.2. Research Question

- Does credit risk affect the profitability of Indian public sector banks?
- Does the Capital Adequacy Ratio significantly influence the profitability of Indian public sector banks?
- Does the Capital Adequacy Ratio moderate the relationship between credit risk and profitability of Indian public sector banks?

3.3. Objectives of the study are

- To examine the impact of credit risk on the profitability of Indian public sector banks.
- To assess the effect of capital adequacy on the profitability of Indian public sector banks.
- To determine whether capital adequacy moderates the relationship between credit risk and profitability of Indian public sector banks.

3.4. Hypothesis

H_{01}: Gross Non-Performing Asset Ratio (GNPAR) and Capital Adequacy Ratio (CAR) have no significant effect on Return on Assets (ROA).

H_{02}: Gross Non-Performing Asset Ratio (GNPAR) and Capital Adequacy Ratio (CAR) have no significant effect on Return on Equity (ROE).

H_{03}: Net Non-Performing Assets to Net Advances (NNPAA) and Capital Adequacy Ratio (CAR) have no significant effect on Return on Assets (ROA).

H_{04}: Net Non-Performing Assets to Net Advances (NNPAA) and Capital Adequacy Ratio (CAR) have no significant effect on Return on Equity (ROE).

H_{05}: Capital Adequacy Ratio does not moderate the relationship between Gross Non-Performing Asset Ratio and Return on Assets.

H_{06}: Capital Adequacy Ratio does not moderate the relationship between Gross Non-Performing Asset Ratio and Return on Equity.

H_{07}: Capital Adequacy Ratio does not moderate the relationship between Net Non-Performing Assets to Net Advances and Return on Assets.

H_{08}: Capital Adequacy Ratio does not moderate the relationship between Net Non-Performing Assets to Net Advances and Return on Equity.

4. Research Methodology

4.1. Scope

The study focuses on 12 Public Sector banks in India over the period of 12 years from 2014-2015 to 2025-2026.

4.2. Population and Sampling

The population of the study comprises 12 Public Sector Banks operating in India during the study period. The study covers all 12 Public Sector Banks over a period of 12 financial years (FY 2014–15 to FY 2025–

26). Accordingly, the panel dataset consists of 144 bank-year observations (12 banks × 12 years = 144 observations), providing a balanced panel for empirical analysis.

4.3. Sampling Technique

Purposive Sampling Technique is used for selecting all 12 Public Sector Banks in India.

4.4. Research Design

Quantitative and explanatory research design is adopted in this study to examine the impact of non-performing assets on the profitability of Indian public sector banks. The study further investigates the moderating role of Capital Adequacy Ratio (CAR) in the relationship between non-performing assets and bank performance (Khalil, 2026). Panel data analysis using the Pooled Ordinary Least Squares (OLS) regression technique has been employed to estimate the proposed models (Baltagi, 2021). To ensure stable statistical inference when analysing the moderation effects, this study follows the standard methodological guidance for moderated regression established by Aiken and West (1991) and further clarified by Hayes and Preacher (2013). Interaction terms were constructed using mean-centered variables, with each predictor's sample mean subtracted before computing the product term, a procedure that removes the non-essential multicollinearity that arises mechanically between an interaction term and its constituent variables, without altering the interaction coefficient, its significance, or the model's overall fit (Aiken & West, 1991; Shieh, 2010). This study applies the same mean-centering protocol to evaluate the moderating role of Capital Adequacy Ratio in the relationship between credit risk and the profitability of Indian public sector banks.

4.5. Data Source

The study is entirely based on secondary data, which is collected from published annual reports of Indian public sector banks and www.moneycontrol.com website.

4.6. Statistical Tools and Techniques

The study is based on both descriptive and inferential statistical techniques to analyse the relationship between non-performing assets, capital adequacy, and the financial performance of public sector banks. (Koppa et al., 2026)

4.6.1. Descriptive Statistics

Descriptive Statistics is used to summarise and describe the characteristics of the study variables, including measures such as mean, standard deviation, minimum, and maximum values. This helps in understanding the distribution and variability of the data before conducting regression analysis.

4.6.2. Inferential Statistics

Inferential Statistics is used to examine the relationships between the variables and to test the proposed hypotheses. Pooled Ordinary Least Squares (OLS) regression is employed to estimate the impact of Gross Non-Performing Assets (GNPAR), Net Non-Performing Assets (NNPAA), Capital Adequacy Ratio (CAR), and their interaction terms on financial performance indicators (ROA and ROE).

4.6.3. Diagnostic Tests

Diagnostic Tests were conducted to ensure the reliability and validity of the estimated regression models before interpreting the results (Gujarati & Porter, 2009).

Table 1: Diagnostic Tests for Assumptions of Regression Models

Assumption	Test	Purpose
Absence of Multicollinearity	Variance Inflation Factor (VIF)	Examines whether explanatory variables are highly correlated with one another, ensuring stable and reliable coefficient estimates.
Homoskedasticity	White's Test	Examines whether the variance of error terms remains constant across observations, which is essential for efficient and unbiased standard errors.
Absence of autocorrelation	Wooldridge Test (panel data)	Identifies first-order serial correlation among residuals, ensuring residuals are independent over time.
Normality of residuals	Jarque–Bera Test	Assesses whether residuals follow a normal distribution, supporting the reliability of hypothesis testing in finite samples
Linearity/model specification	Ramsey RESET Test	To check whether the functional form is correctly specified, identify omitted variables or incorrect functional relationships.

Source: Self-Compiled

4.7. Variables and Measurement

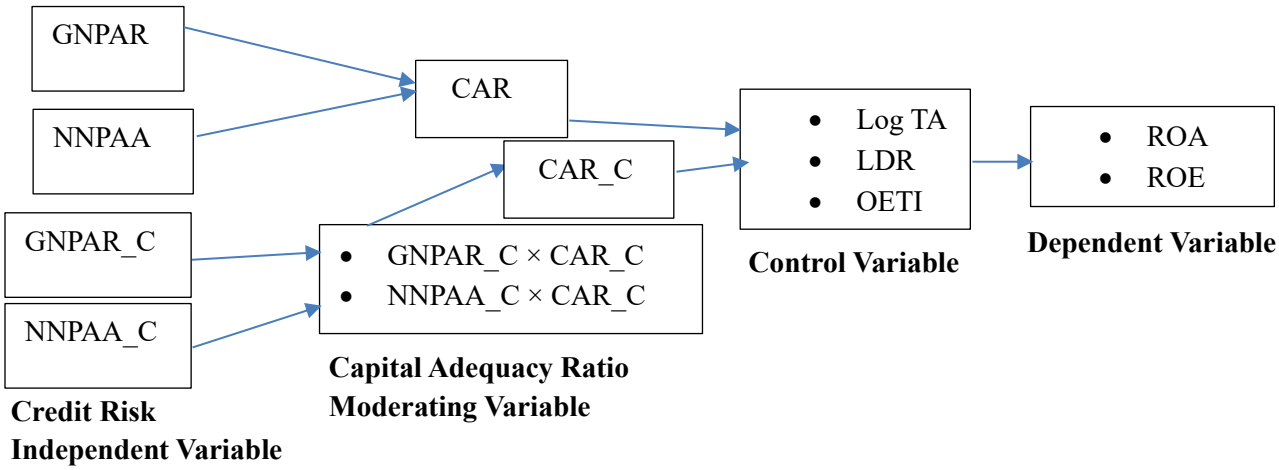
The variable measurements are provided in Table 2.

Table 2: Measurement of variables

Variable Type	Variable	Symbol	Measurement
Dependent Variable	Return on Assets	ROA	Net Profit after Tax ÷ Total Assets
	Return on Equity	ROE	Net Profit after Tax ÷ Shareholders' Equity
Independent Variable	Gross Non-Performing Asset Ratio	GNPAR	Gross NPAs ÷ Gross Advances × 100
	Net Non-Performing Assets to Net Advances	NNPAA	Net NPAs ÷ Net Advances × 100
Moderating Variable	Capital Adequacy Ratio	CAR	Total Capital ÷ Risk-Weighted Assets × 100
	Interaction terms: • GNPAR_C × CAR_C • NNPAA_C × CAR_C		GNPAR_C = GNPAR – Mean NNPAA_C = NNPAA – Mean CAR_C = CAR - Mean
Control Variable	Bank Size	LogTA	Natural Logarithm of Total Assets
	Loan-to-Deposit Ratio	LDR	Total Loans ÷ Total Deposits × 100
	Operating Expense to Total Income	OETI	Operating Expenses ÷ Total Income

Source: Self-Compiled

4.8. Conceptual Framework



4.9. Econometric Models

Two sets of models are estimated to address the study's objectives. Objectives 1 & 2 (Equations 1–4) test the direct effects of credit risk and capital adequacy on profitability. Objective 3 (Equations 5–8) tests whether CAR moderates the relationship between credit risk and profitability. All eight models were estimated using Pooled Ordinary Least Squares (OLS) with cluster-robust standard errors, clustered at the bank level (Arellano, 1987; Petersen, 2009). This approach was adopted in anticipation of within-bank correlation and heteroskedasticity across bank-year observations and does not require the assumption of normally distributed residuals for valid inference at this sample size (N = 144).

Direct Effect Models:

Model 1: $ROA_{it} = \beta_0 + \beta_1 GNPAR_{it} + \beta_2 CAR_{it} + \beta_3 LogTA_{it} + \beta_4 LDR_{it} + \beta_5 OETI_{it} + \varepsilon_{it}$

Model 2: $ROE_{it} = \beta_0 + \beta_1 GNPAR_{it} + \beta_2 CAR_{it} + \beta_3 LogTA_{it} + \beta_4 LDR_{it} + \beta_5 OETI_{it} + \varepsilon_{it}$

Model 3: $ROA_{it} = \beta_0 + \beta_1 NNPAA_{it} + \beta_2 CAR_{it} + \beta_3 LogTA_{it} + \beta_4 LDR_{it} + \beta_5 OETI_{it} + \varepsilon_{it}$

Model 4: $ROE_{it} = \beta_0 + \beta_1 NNPAA_{it} + \beta_2 CAR_{it} + \beta_3 LogTA_{it} + \beta_4 LDR_{it} + \beta_5 OETI_{it} + \varepsilon_{it}$

Moderation Models:

Model 5: $ROA_{it} = \beta_0 + \beta_1 GNPAR\_C_{it} + \beta_2 CAR\_C_{it} + \beta_3 (GNPAR\_C \times CAR\_C)it + \beta_4 LogTA_{it} + \beta_5 LDR_{it} + \beta_6 OETI_{it} + \varepsilon_{it}$

Model 6: $ROE_{it} = \beta_0 + \beta_1 GNPAR\_C_{it} + \beta_2 CAR\_C_{it} + \beta_3 (GNPAR\_C \times CAR\_C)it + \beta_4 LogTA_{it} + \beta_5 LDR_{it} + \beta_6 OETI_{it} + \varepsilon_{it}$

Model 7: $ROAit = \beta_0 + \beta_1 NNPAA\_C_{it} + \beta_2 CAR\_C_{it} + \beta_3 (NNPAA\_C \times CAR\_C)it + \beta_4 LogTA_{it} + \beta_5 LDR_{it} + \beta_6 OETI_{it} + \varepsilon_{it}$

Model 8: $ROE_{it} = \beta_0 + \beta_1 NNPAA\_C_{it} + \beta_2 CAR\_C_{it} + \beta_3 (NNPAA\_C \times CAR\_C)it + \beta_4 LogTA_{it} + \beta_5 LDR_{it} + \beta_6 OETI_{it} + \varepsilon_{it}$

where the subscript *C* denotes mean-centered variables (explained in 4.10), and *i* and *t* index bank and year, respectively.

4.10. Mean-Centering Procedure for Interaction Terms

Moderation terms in Equations 5-8 were constructed by first mean-centering each constituent variable (subtracting its sample mean) before computing the product term. For example, GNPAR_C = GNPAR − GNPAR̄, CAR_C = CAR − CAR̄, and the interaction term is then computed as GNPAR_C × CAR_C. This procedure follows the standard recommendation for moderated regression analysis (Aiken & West, 1991; Hayes & Preacher, 2013). Interaction terms constructed from raw (uncentered) variables are mechanically correlated with their constituent variables, which can produce very high variance inflation factors purely as an artifact of scale rather than genuine collinearity among substantive constructs (Shieh, 2010). Mean-centering removes this non-essential collinearity, reducing VIFs to below 6 across all four moderation models. It is important to note that mean-centering does not alter the interaction term's coefficient, standard error, t-statistic, p-value, or the model's overall R^2 and F-statistic, only the main-effect coefficients and their interpretation change (Aiken & West, 1991).

4.11. Cluster-Robust Standard Errors

The pooled Ordinary Least Squares (OLS) regression models were estimated using **cluster-robust standard errors** to obtain reliable statistical inference. In panel data, observations within the same bank may exhibit correlated error terms and unequal error variances (heteroskedasticity), which can lead to biased standard errors under conventional OLS estimation. Cluster-robust standard errors adjust for both heteroskedasticity and within-bank correlation of residuals without altering the estimated regression coefficients. This approach provides more reliable hypothesis testing and significance estimates and is widely recommended for panel data analysis (Petersen, 2009; Hoechle, 2007; Stock & Watson, 2008).

4.12. Central Limit Theorem

According to the Central Limit Theorem (CLT), the sampling distribution of the estimated coefficients approaches a normal distribution as the sample size increases, allowing valid statistical inference even when the residuals are not perfectly normal. As the present study is based on 144 bank-year observations, the sample size is considered adequate for applying the Central Limit Theorem. Consequently, the estimated coefficients, standard errors, and hypothesis tests remain reliable despite deviations from normality (Gujarati & Porter, 2009; Wooldridge, 2019).

5. Data Analysis and Interpretation

5.1. Descriptive Statistics

Table 3: Descriptive Statistics

Variable	Mean	Median	Minimum	Maximum	Std. Dev.	C.V.
ROA	0.001179	0.00348	-0.032706	0.016425	0.008934	7.5774
ROE	0.010607	0.04702	-0.83351	0.21201	0.15446	14.562
GNPAR	8.2039	7.0000	0.024000	25.000	5.9737	0.72815
NNPAA	3.7072	3.0000	0.0000	15.000	3.3680	0.90851
CAR	12.779	13.205	0.10750	20.530	4.5900	0.35918
NNPAACAR	45.179	41.355	0.0000	147.00	35.675	0.78965
GNPACAR	104.60	96.798	0.0041808	273.50	66.278	0.63361
LogTA	5.7453	5.7404	4.9726	6.8821	0.42468	0.07391
LDR	0.70999	0.72152	0.46988	1.0346	0.098517	0.13876
OETI	0.20969	0.21380	0.078808	0.29997	0.043847	0.20910

Source: Self-Compiled

Table 3 presents the descriptive statistics of the variables used in the study based on 144 bank-year observations. The average Return on Assets (ROA) and Return on Equity (ROE) are 0.12% and 1.06%, respectively, indicating relatively modest profitability among the selected public sector banks during the study period. The mean Gross Non-Performing Assets Ratio (GNPAR) of 8.20% and Net Non-Performing

Assets Ratio (NNPAA) of 3.71% suggest a considerable variation in asset quality across the banks. The average Capital Adequacy Ratio (CAR) is 12.78%, exceeding the regulatory minimum and reflecting an overall sound capital position. The mean values of LogTA (5.75), LDR (0.71), and OETI (0.21) indicate differences in bank size, lending behavior, and operating efficiency among the sampled banks. The coefficients of variation reveal that ROE exhibits the highest relative variability, followed by ROA, indicating greater fluctuations in profitability compared to the other explanatory variables. Overall, the descriptive statistics indicate sufficient variation in the dataset, making it suitable for regression analysis.

5.2. Regression Results

5.2.1. Model 1

ROA = -0.0171 - 0.0908(GNPAR) + 0.0919(CAR) + 0.0027(LogTA) + 0.0029(LDR) - 0.0187(OETI) + ε

Table 4: Regression Analysis of Model 1

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.0171	0.0102	−1.681	0.1209	Not significant
GNPAR	−0.0908	0.0156	−5.838	0.0001	Significant (−) ***
CAR	0.0919	0.0230	3.996	0.0021	Significant (+) ***
LogTA	0.0027	0.0007	3.592	0.0042	Significant (+) ***
LDR	0.0029	0.0065	0.451	0.6607	Not significant
OETI	−0.0187	0.0089	−2.096	0.0600	Significant (−) *
R^2 = 0.7008					
Adj. R^2 =0.6900					
F (5,11) = 147.58 (p < .001)					
DW = 1.873					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 4 reports the pooled OLS results for the effect of GNPAR, CAR, LogTA, LDR and OETI on ROA. The model is statistically significant (F = 147.580, p < 0.001) and explains 70.08% of the variation in ROA (R^2 = 0.7008). GNPAR has a significant negative effect on ROA (β = −0.0908, p < 0.01), while CAR (β = 0.0919, p < 0.01) and LogTA (β = 0.0027, p < 0.01) have significant positive effects. LDR is positive but insignificant (β = 0.0029, p = 0.6607). OETI has a negative effect and is marginally significant at the 10% level (β = −0.0187, p = 0.0600). Overall results suggest that asset quality, capital adequacy, and bank size significantly influence ROA, whereas LDR does not.

5.2.2. Model 2

ROE = -0.2895 - 1.3584(GNPAR) + 1.2543(CAR) + 0.0710(LogTA) - 0.0473(LDR) - 0.6101(OETI) + ε

Table 5: Regression Analysis of Model 2

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.2895	0.1748	−1.656	0.0999	Significant (−) *
GNPAR	−1.3584	0.2527	−5.375	<.001	Significant (−) ***
CAR	1.2543	0.4884	2.568	0.0113	Significant (+) **
LogTA	0.0710	0.0242	2.936	0.0039	Significant (+) ***
LDR	−0.0473	0.1139	−0.416	0.6783	Not significant
OETI	−0.6101	0.2385	−2.558	0.0116	Significant (−) **
R^2 =0 .5155					
Adj. R^2 = 0.4979					
F (5,11) = 29.36 (p < .001),					
DW = 1.814					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 5 presents the pooled OLS regression results for the impact of GNPAR, CAR, LogTA, LDR, and OETI on ROE. The model explains 51.55% of the variation in ROE ($R^2 = 0.5155$; Adjusted $R^2 = 0.4979$), indicating a moderate model fit. The model indicates that GNPAR has a significant negative effect on ROE ($\beta = -1.3584$, $p < 0.001$), suggesting that higher non-performing assets reduce shareholders' returns. In contrast, CAR ($\beta = 1.2543$, $p = 0.0113$) and LogTA ($\beta = 0.0710$, $p = 0.0039$) exert significant positive effects on ROE, indicating that better-capitalised and larger banks achieve higher profitability. OETI has a significant negative effect ($\beta = -0.6101$, $p = 0.0116$), implying that higher operating expenses reduce financial performance. However, LDR has no significant influence on ROE ($\beta = -0.0473$, $p = 0.6783$

5.2.3. Model 3

ROA = -0.0219 - 0.1436(NNPAA) + 0.0702(CAR) + 0.0025(LogTA) + 0.0137(LDR) - 0.0222(OETI) + ε

Table 6: Regression Analysis of Model 3

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.0219	0.0082	−2.670	0.0218	Significant (−) **
NNPAA	−0.1436	0.0248	−5.795	0.0001	Significant (−) ***
CAR	0.0702	0.0379	1.854	0.0907	Significant (+) *
LogTA	0.0025	0.0009	2.884	0.0149	Significant (+) **
LDR	0.0137	0.0047	2.888	0.0148	Significant (+) **
OETI	−0.0222	0.0098	−2.261	0.0450	Significant (−) **
$R^2 = 0.6582$					
Adj. $R^2 = 0.6459$					
F (5,11) = 236.94 (p < .001)					
DW = 1.846					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Source: Self-Compiled

Table 6 represents the pooled OLS regression results for the impact of NNPAA, CAR, LogTA, LDR, and OETI on ROA. The model explains 65.82% of the variation in ROA ($R^2 = 0.6582$; Adjusted $R^2 = 0.6459$), indicating a good model fit. The results show that NNPAA has a significant negative effect on ROA ($\beta = -0.1436$, $p < 0.001$), indicating that higher net non-performing assets reduce bank profitability. CAR ($\beta = 0.0702$, $p = 0.0907$), LogTA ($\beta = 0.0025$, $p = 0.0149$), and LDR ($\beta = 0.0137$, $p = 0.0148$) have positive effects on ROA, with CAR being significant at the 10% level and LogTA and LDR at the 5% level. OETI has a significant negative effect on ROA ($\beta = -0.0222$, $p = 0.0450$), suggesting that higher operating expenses adversely affect profitability.

5.2.4. Model 4

ROE = -0.3516 - 2.1867(NNPAA) + 0.8938(CAR) + 0.0670(LogTA) + 0.1126(LDR) - 0.6602(OETI) + ε

Table 7: Regression Analysis of Model 4

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.3516	0.1541	−2.281	0.0435	Significant (−) **
NNPAA	−2.1867	0.5130	−4.262	0.0013	Significant (−) ***
CAR	0.8938	0.7236	1.235	0.2425	Not significant
LogTA	0.0670	0.0185	3.631	0.0039	Significant (+) ***
LDR	0.1126	0.1034	1.089	0.2994	Not significant
OETI	−0.6602	0.3056	−2.160	0.0537	Significant (−) *
$R^2 = .4862$					
Adj. $R^2 = .4675$					
F (5,11) = 35.29 (p < .001)					
DW = 1.839					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Source: Self-Compiled

Ttable 7 presents the pooled OLS regression results for the impact of NNPAA, CAR, LogTA, LDR, and OETI on ROE. The model explains 48.62% of the variation in ROE ($R^2 = 0.4862$; Adjusted $R^2 = 0.4675$), indicating a moderate model fit. The findings reveal that NNPAA has a significant negative effect on ROE ($\beta = -2.1867$, $p = 0.0013$), indicating that higher net non-performing assets reduce shareholders' returns. LogTA has a significant positive effect on ROE ($\beta = 0.0670$, $p = 0.0039$), suggesting that larger banks achieve better financial performance. OETI has a negative effect and is marginally significant at the 10% level ($\beta = -0.6602$, $p = 0.0537$), implying that higher operating expenses may reduce profitability. However, CAR ($\beta = 0.8938$, $p = 0.2425$) and LDR ($\beta = 0.1126$, $p = 0.2994$) do not have a statistically significant influence on ROE.

5.2.5. Model 5

ROA = -0.0120 - 0.0851(GNPAR_C) + 0.1005(CAR_C) + 0.3621(GNPAR_C × CAR_C) + 0.0026(LogTA) + 0.0035(LDR) - 0.0178(OETI) + ε

Table 8: Regression Analysis of Model 5

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.0120	0.0073	−1.657	0.1258	Not significant
GNPAR_C	−0.0851	0.0170	−5.011	0.0004	Significant (−) ***
CAR_C	0.1005	0.0304	3.306	0.0070	Significant (+) ***
GNPAR_C × CAR_C	0.3621	0.3843	0.942	0.3664	Not significant
LogTA	0.0026	0.0008	3.182	0.0087	Significant (+) ***
LDR	0.0035	0.0061	0.570	0.5804	Not significant
OETI	−0.0178	0.0089	−2.006	0.0701	Significant (−) *
$R^2 = 0.7042$ Adj. $R^2 = 0.6913$ F (6,11) = 179.88 (p < .001), DW = 1.893					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 8 presents the pooled OLS regression results examining the moderating effect of CAR on the relationship between GNPAR and ROA. The model explains 70.42% of the variation in ROA ($R^2 = 0.7042$; Adjusted $R^2 = 0.6913$), indicating a strong model fit. The results show that GNPAR has a significant negative effect on ROA ($\beta = -0.0851$, $p < 0.001$), while CAR ($\beta = 0.1005$, $p = 0.007$) and LogTA ($\beta = 0.0026$, $p = 0.0087$) have significant positive effects. The interaction term (GNPAR × CAR) is positive but statistically insignificant ($\beta = 0.3621$, $p = 0.3664$), indicating that CAR does not significantly moderate the relationship between GNPAR and ROA. LDR has no significant effect ($p = 0.5804$), whereas OETI has a negative effect and is marginally significant at the 10% level ($\beta = -0.0178$, $p = 0.0701$).

5.2.6. Model 6

ROE = -0.2319 - 1.2956(GNPAR_C) + 1.3479(CAR_C) + 3.9509(GNPAR_C × CAR_C) + 0.0699(LogTA) - 0.0411(LDR) - 0.6006(OETI) + ε

Table 9: Regression Analysis of Model 6

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.2319	0.1570	−1.478	0.1676	Not significant
GNPAR_C	−1.2956	0.4297	−3.015	0.0118	Significant (−) **
CAR_C	1.3479	0.6451	2.090	0.0607	Significant (+) *
GNPAR_C × CAR_C	3.9509	8.7426	0.452	0.6601	Not significant
LogTA	0.0699	0.0174	4.009	0.0021	Significant (+) ***
LDR	−0.0411	0.1505	−0.273	0.7899	Not significant
OETI	−0.6006	0.2739	−2.193	0.0507	Significant (−) *

$R^2 = 0.5168$					
Adj. $R^2 = 0.4957$					
F (6,11) = 19.87 (p < .001)					
DW = 1.819					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 9 presents the pooled OLS regression results examining the moderating effect of CAR on the relationship between GNPAR and ROE. The model explains **51.68%** of the variation in ROE ($R^2 = 0.5168$; Adjusted $R^2 = 0.4957$), indicating a moderate model fit. The results indicate that GNPAR has a significant negative effect on ROE (β = −1.2956, p = 0.0118), while CAR (β = 1.3479, p = 0.0607) and LogTA (β = 0.0699, p = 0.0021) have positive effects on ROE, with CAR being significant at the 10% level. The interaction term (GNPAR × CAR) is positive but statistically insignificant (β = 3.9509, p = 0.6601), suggesting that CAR does not significantly moderate the relationship between GNPAR and ROE. LDR has no significant effect (p = 0.7899), whereas OETI has a negative effect and is marginally significant at the 10% level (β = −0.6006, p = 0.0507).

5.2.7. Model 7

ROA = -0.0186 − 0.1640(NNPAA_C) + 0.0511(CAR_C) − 0.6730(NNPAA_C × CAR_C) + 0.0026(LogTA) + 0.0130(LDR) − 0.0226(OETI) + ε

Table 10: Regression Analysis of Model 7

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.0186	0.0051	−3.660	0.0038	Significant (−) ***
NNPAA_C	−0.1640	0.0400	−4.102	0.0018	Significant (−) ***
CAR_C	0.0511	0.0535	0.956	0.3595	Not significant
NNPAA_C × CAR_C	−0.6730	0.9511	−0.708	0.4939	Not significant
LogTA	0.0026	0.0009	2.919	0.0140	Significant (+) **
LDR	0.0130	0.0045	2.890	0.0147	Significant (+) **
OETI	−0.0226	0.0096	−2.349	0.0386	Significant (−) **
$R^2 = 0.6608$					
Adj. $R^2 = 0.6459$					
F (6,11) = 268.76 (p < .001)					
DW = 1.867					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 10 shows the pooled OLS regression results examining the moderating effect of CAR on the relationship between NNPAA and ROA. The model explains **66.08%** of the variation in ROA ($R^2 = 0.6608$; Adjusted $R^2 = 0.6459$), indicating a good model fit. The findings state that NNPAA has a significant negative effect on ROA (β = −0.1640, p = 0.0018), while LogTA (β = 0.0026, p = 0.0140) and LDR (β = 0.0130, p = 0.0147) have significant positive effects. OETI has a significant negative effect on ROA (β = −0.0226, p = 0.0386). However, CAR (β = 0.0511, p = 0.3595) and the interaction term (NNPAA × CAR) (β = −0.6730, p = 0.4939) are statistically insignificant, indicating that CAR does not significantly moderate the relationship between NNPAA and ROA.

5.2.8. Model 8

ROE = -0.3280 - 2.6206(NNPAA_C) + 0.4885(CAR_C) - 14.2672(NNPAA_C × CAR_C) + 0.0697(LogTA) + 0.0969(LDR) - 0.6692(OETI) + ε

Table 11: Regression Analysis of Model 8

Variable	Coefficient	Std. Error	t-value	p-value	Result
Constant	−0.3280	0.1062	−3.088	0.0103	Significant (−) **
NNPAA_C	−2.6206	0.8798	−2.979	0.0126	Significant (−) **
CAR_C	0.4885	1.1013	0.444	0.6660	Not significant
NNPAA_C × CAR_C	−14.2672	21.3350	−0.669	0.5175	Not significant
LogTA	0.0697	0.0194	3.587	0.0043	Significant (+) ***
LDR	0.0969	0.1031	0.940	0.3676	Not significant
OETI	−0.6692	0.3022	−2.214	0.0488	Significant (−) **
$R^2 = 0.4900$					
Adj. $R^2 = .4677$					
$F(6,11) = 28.17$ ($p < .001$)					
DW = 1.855					

*, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.
Source: Self-Compiled

Table 11 states the pooled OLS regression results examining the moderating effect of CAR on the relationship between NNPAA and ROE. The model explains 49.00% of the variation in ROE ($R^2 = 0.4900$; Adjusted $R^2 = 0.4677$), indicating a moderate model fit. The results indicate that NNPAA has a significant negative effect on ROE ($\beta = -2.6206$, $p = 0.0126$), while LogTA has a significant positive effect ($\beta = 0.0697$, $p = 0.0043$). OETI has a significant negative effect on ROE ($\beta = -0.6692$, $p = 0.0488$). However, CAR ($\beta = 0.4885$, $p = 0.6660$), LDR ($\beta = 0.0969$, $p = 0.3676$), and the interaction term (NNPAA × CAR) ($\beta = -14.2672$, $p = 0.5175$) are statistically insignificant, indicating that CAR does not significantly moderate the relationship between NNPAA and ROE.

5.3. Diagnostic Tests of the Regression Models

Table 12: Multicollinearity: Variance Inflation Factor (VIF) Results

Variable	Models 1 & 2 (GNPAR)	Models 3 & 4 (NNPAA)	Models 5 & 6 (GNPAR_C × CAR_C)	Models 7 & 8 (NNPAA_C × CAR_C)	Conclusion
GNPAR / GNPAR_C	2.395	–	2.778	–	No multicollinearity
NNPAA / NNPAA_C	–	3.065	–	5.329	No multicollinearity
CAR / CAR_C	2.075	2.981	2.272	4.286	No multicollinearity
Interaction Term	–	–	GNPAR_C × CAR_C = **1.220**	NNPAA_C × CAR_C = **1.876**	No multicollinearity
LogTA	1.261	1.304	1.268	1.318	No multicollinearity
LDR	1.504	1.321	1.515	1.347	No multicollinearity
OETI	1.305	1.299	1.311	1.300	No multicollinearity

Source: Self-Compiled

Table 13: Heteroskedasticity: White's Test

Models	Dependent Variable	TR^2 Statistic	p-value	Conclusion
Model 1	ROA (GNPAR)	23.767	0.0082	Heteroskedasticity Present
Model 2	ROE (GNPAR)	19.266	0.0370	Heteroskedasticity Present
Model 3	ROA (NNPAA)	19.483	0.0345	Heteroskedasticity Present
Model 4	ROE (NNPAA)	16.847	0.0778	No Heteroskedasticity
Model 5	ROA (GNPAR × CAR)	24.736	0.016	Heteroskedasticity Present
Model 6	ROE (GNPAR × CAR)	21.594	0.042	Heteroskedasticity Present
Model 7	ROA (NNPAA × CAR)	22.811	0.029	Heteroskedasticity Present
Model 8	ROE (NNPAA × CAR)	18.138	0.112	No Heteroskedasticity

Source: Self-Compiled

Note: Heteroskedasticity was detected in six of the eight regression models. To account for this issue, all models were estimated using cluster-robust standard errors. This approach provides reliable standard errors and statistical inference even when heteroskedasticity is present [Stock, J. H., & Watson, M. W. (2008); Petersen (2009); Hoechle, D. (2007)]

Table 14: Autocorrelation: Wooldridge Test

Eq	Test Statistic	p-value	Conclusion
1	t = 0.462	0.6529	No autocorrelation
2	t = 0.587	0.5688	No autocorrelation
3	t = 0.932	0.3714	No autocorrelation
4	t = 0.690	0.5046	No autocorrelation
5	t = 0.391	0.703	No autocorrelation
6	t = 0.574	0.577	No autocorrelation
7	t = 0.697	0.500	No autocorrelation
8	t = 0.570	0.580	No autocorrelation

Source: Self-Compiled

Table 15: Normality of Residuals: Jarque–Bera Test

Eq	Test Statistic	p-value	Conclusion
1	χ^2=45.016	<.001	Not normal
2	χ^2=101.870	<.001	Not normal
3	χ^2=90.090	<.001	Not normal
4	χ^2=207.557	<.001	Not normal
5	χ^2=52.999	<.001	Not normal
6	χ^2=111.216	<.001	Not normal
7	χ^2= 81.735	<.001	Not normal
8	χ^2=186.080	<.001	Not normal

Source: Self-Compiled

Note: The Jarque–Bera test evaluated via Gretl's Doornik–Hansen adaptation for finite samples indicated that the residuals were not normally distributed. However, this does not affect the validity of the regression results. Since the study is based on 144 observations, the Central Limit Theorem ensures that the estimated coefficients remain reliable for statistical inference. In financial data, departures from normality are often caused by a few extreme observations rather than problems with the regression model (Önder & Zaman, 2003). This interpretation is further supported by the satisfactory Ramsey RESET test results (Table 10.3.5), indicating that the model is correctly specified.

Table 5.3.5 Linearity/ Model Specification: Ramsey RESET Test

Eq	Test Statistic	p-value	Conclusion
1	F = 1.541	0.218	Linear function & correctly specified
2	F = 1.229	0.2960	Linear function & correctly specified
3	F = 0.003	0.9970	Linear function & correctly specified
4	F = 0.109	0.8970	Linear function & correctly specified
5	F = 0.361	0.697	Linear function & correctly specified
6	F = 0.587	0.557	Linear function & correctly specified
7	F = 0.951	0.389	Linear function & correctly specified
8	F = 0.954	0.387	Linear function & correctly specified

Source: Self-Compiled

6. Findings

Credit risk significantly reduces bank profitability, regardless of measure or profitability indicator used. Both Gross NPA Ratio (GNPAR) and Net NPA Ratio (NNPAA) exert a negative and statistically significant effect on both ROA and ROE across all direct-effect models and retain their significance in the moderation models. Capital adequacy improves profitability, though less consistently for ROE. CAR shows a positive and significant effect on ROA in Models 1, 3 (10% level), and 5, but not Model 7. Its effect on ROE is significant when paired with GNPAR but not when paired with NNPAA. This indicates capital adequacy's protective effect on shareholder returns is somewhat sensitive to how credit risk is measured, and less robust than its effect on asset returns. Bank size consistently improves profitability**.** LogTA is positive and statistically significant in all eight models, indicating that larger banks in the sample achieve superior profitability, plausibly through economies of scale, greater diversification, or stronger market positioning. Operating efficiency and lending intensity play a secondary, more selective role. OETI is negative across all eight models, reaching conventional significance in most but only marginal (10%) significance in a few ROE specifications. LDR is significant only in the NNPAA-ROA specifications, suggesting lending intensity's effect on profitability is not uniform across model specifications. Capital adequacy does not significantly moderate the credit risk–profitability relationship. Across all four moderation models, the interaction term between CAR and the credit-risk measure (GNPAR or NNPAA) is statistically insignificant regardless of whether profitability is measured by ROA or ROE. Capital adequacy improves profitability directly, and credit risk reduces it directly, but the strength of the credit-risk–profitability relationship does not itself depend on the level of capital adequacy in this study. Model diagnostics support the reliability of these findings**.** All eight models are free of problematic multicollinearity (following mean-centering), free of first-order autocorrelation, and correctly specified (Ramsey RESET). Heteroskedasticity, present in six of eight models, and non-normality of residuals, present in all eight, were addressed through cluster-robust standard errors and the Central Limit Theorem. These are not treated as threats to inference given the sample size (N = 144), consistent with Petersen (2009) and Önder & Zaman (2003).

7. Conclusion

This study examined the effect of credit risk and capital adequacy on the profitability of Indian public sector banks, and tested whether capital adequacy moderates the relationship between credit risk and profitability, using panel data from 12 banks over 12 years (N = 144) and eight pooled OLS model specifications estimated with cluster-robust standard errors. (Sharma et. al., 2021) The results consistently show that higher non-performing assets, whether measured gross or net, significantly reduce both return on assets and return on equity, while stronger capital adequacy and larger bank size are associated with higher profitability. These direct effects are robust across all model specifications and diagnostic checks. In contrast, the moderation analysis finds no statistically significant evidence that capital adequacy alters the strength of the credit risk -profitability relationship, a result that holds consistently across both non-performing asset measures and both profitability indicators. Collectively, these findings suggest that capital adequacy and asset quality operate as independent, rather than interacting, drivers of profitability. Being

well-capitalised doesn't protect a bank from the profitability hit of rising non-performing assets as the two effects work side by side, not against each other. Effective asset-quality management, therefore, remains essential for Indian public sector banks irrespective of their capital position, and should not be treated as a substitute for maintaining strong capital buffers, or vice versa.

Banks should strengthen credit risk management as the primary strategy for improving profitability: Since both Gross NPA Ratio (GNPAR) and Net NPA Ratio (NNPAA) have a consistently negative and statistically significant impact on both ROA and ROE, banks should prioritise measures that reduce non-performing assets. This can be achieved through rigorous credit appraisal, continuous monitoring of loan accounts, early warning systems, timely recovery mechanisms, and prudent loan restructuring. Banks should maintain adequate capital buffers to enhance financial performance: The positive relationship between Capital Adequacy Ratio (CAR) and profitability, particularly ROA, suggests that maintaining strong capital adequacy contributes directly to better financial performance. Therefore, banks should maintain capital levels above the regulatory minimum prescribed under the Basel III framework. Banks should pursue sustainable growth and operational efficiency to improve profitability: The consistent positive effect of bank size indicates that larger banks benefit from economies of scale, wider diversification, and stronger market presence. Accordingly, banks should focus on sustainable expansion through business diversification, technological innovation, digital banking initiatives, and strategic branch optimisation. Simultaneously, the negative coefficient of operating expenses to total income (OETI) suggests that improving operational efficiency through cost control, process automation, and productivity enhancement can further strengthen profitability. Regulatory and managerial efforts should focus on direct improvements in capital and asset quality rather than expecting capital adequacy to offset credit risk: The insignificant interaction between CAR and credit risk measures indicates that higher capital adequacy does not weaken the adverse effect of credit risk on profitability. Therefore, policymakers and bank management should treat capital adequacy and credit risk management as complementary but independent policy objectives. Regulatory authorities should continue emphasising stringent NPA monitoring and risk-based supervision.

The study contributes to the banking and finance literature by testing the moderating role of capital adequacy in the credit risk–profitability relationship using two alternative and commonly used measures of non-performing assets (gross and net). For bank management and regulators, the findings reinforce that credit risk management and capital adequacy maintenance are both independently important levers for profitability, and should be pursued as complementary rather than substitutable strategies. Since capital adequacy does not appear to buffer the profitability impact of rising non-performing assets in this sample, the results suggest that banks cannot rely on strong capital buffers alone to offset the profitability consequences of deteriorating asset quality, active NPA management remains necessary regardless of a bank's capital position.

The study is limited to public sector banks and a 12-year panel data. Extending the analysis to a longer time horizon spanning multiple credit cycles, or including private sector banks, may reveal whether the moderating role of capital adequacy differs across ownership structures or economic conditions. Future research could also explore alternative moderators (such as bank-level governance quality or loan concentration) or nonlinear specifications of the credit risk–profitability relationship.

References

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Sage Publications. https://www.scribd.com/document/792759395/Aiken-L-Multiple-Regression-Testing-and-Interpreting-1991

Ali, L., & Dhiman, S. (2019). The impact of credit risk management on profitability of public sector commercial banks in India. *Journal of Commerce & Accounting Research, 8*(2), 86–92.

Al-Sharkas, A. A., & Al-Sharkas, T. A. (2022). The impact on bank profitability: Testing for capital adequacy ratio, cost-income ratio and non-performing loans in emerging markets. *Journal of Governance and Regulation, 11*(1), 231–243. https://doi.org/10.22495/jgrv11i1siart4

Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics, 49*(4), 431–434. https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x

Arhinful, R., Mensah, L., Gyamfi, B. A., & Obeng, H. A. (2025). The impact of non-performing loans on bank growth: The moderating roles of bank size and capital adequacy ratio—Evidence from U.S. banks. *International Journal of Financial Studies, 13*(3),165. https://doi.org/10.3390/ijfs13030165

Arun Prakash, P., & Sathya, R. (2020). Modelling the effect of profitability indicators on capital adequacy ratio of public and private sector commercial banks in India. *Our Heritage, 68*(30).

Arun Prakash, P., & Shruthi, P. R. (2025). Determinants of credit risk management in public sector commercial banks: An econometric approach. *Nanotechnology Perceptions, 21*(1), 223–237.

Athanasoglou, P. P., Brissimis, S. N., & Delis, M. D. (2008). Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money, 18*(2), 121–136. https://doi.org/10.1016/j.intfin.2006.07.001

Baltagi, B. H. (2021). *Econometric analysis of panel data* (6th ed.). Springer Nature.

Bandyopadhyay, A. (2022). Bank financial performance and its linkage with capital: A dynamic panel data analysis of public sector banks in India. *Global Business Review*. Advance online publication. https://doi.org/10.1177/00194662221104752

Basel Committee on Banking Supervision. (2017). *Basel III: Finalising post-crisis reforms*. Bank for International Settlements.

Bholat, D., Lastra, R. M., Markose, S. M., Miglionico, A., & Sen, K. (2016). *Non-performing loans: Regulatory and accounting treatments of assets* (Staff Working Paper No. 594). Bank of England.

Dadhich, M., Chouhan, V., Gautam, S. K., Mwinga, R., & Meena, R. (2020). Profitability and capital adequacy approach for measuring impact of global financial crisis vis-à-vis Indian banks. *International Journal of Advanced Science and Technology, 29*(4s), 2344–2365.

Fathihani, Saputri, I. P., & Randyantini, V. (2025). Capital adequacy, credit risk, and efficiency in Islamic bank profitability. *Involvement: International Journal of Business, 2*(2). https://doi.org/10.62569/iijb.v2i2.116

Gaur, D., & Mohapatra, D. R. (2021). Non-performing assets and profitability: Case of Indian banking sector. *Vikalpa: The Journal for Decision Makers, 46*(4), 213–229. https://doi.org/10.1177/0972262920914106

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill.

Hawaldar, I. T., Meher, B. K., Kumari, P., & Kumar, S. (2022). Modelling the effects of capital adequacy, credit losses, and efficiency ratio on return on assets and return on equity of banks during COVID-19 pandemic. *Banks and Bank Systems, 17*(1), 115–124. https://doi.org/10.21511/bbs.17(1).2022.10

Hayes, A. F., & Preacher, K. J. (2013). Some common myths about centering predictor variables in moderated multiple regression and polynomial regression. *Multivariate Behavioral Research, 48*(6), 733–767. https://doi.org/10.1080/00273171.2013.828875

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal, 7*(3), 281–312. https://doi.org/10.1177/1536867X0700700301

Jadhav, J. J., Kathale, A., & Rajpurohit, S. (2021). An impact of capital adequacy ratio on the profitability of private sector banks in India – A study. *International Journal of Engineering and Management Research, 11*(5). https://doi.org/10.31033/ijemr.11.5.5

Madugu, A. H., Ibrahim, M., & Amoah, J. O. (2019). Differential effects of credit risk and capital adequacy ratio on profitability of the domestic banking sector in Ghana. *Transnational Corporations Review, 12*(1), 80–92. https://doi.org/10.1080/19186444.2019.1704582

Mir, S. M., & Shah, F. A. (2022). Does capital adequacy affect bank performance? A comparative study of select public and private sector banks in India. *DLSU Business & Economics Review, 31*(2), Article 4. https://doi.org/10.59588/2243-786X.1187

Önder, A. Ö., & Zaman, A. (2003). A test for normality based on robust regression residuals. In R. Dutter, P. Filzmoser, U. Gather, & P. J. Rousseeuw (Eds.), *Developments in robust statistics*, 305–316. Physica-Verlag.

Patel, K. R., & Kanchan, P. (2024). Impact of capital adequacy ratio on operating performance, profitability and return ratio: A comparison between selected public and private sector banks in India. *Vidya – A Journal of Gujarat University, 3*(2), 98–108.

Pervez, A., Naveenan, R. V., Alyamoor, A. H., Bansal, R., Gupta, A., & Titus, T. J. (2023). Impact of capital adequacy and risk on bank performance: An empirical study. *AIP Conference Proceedings, 2587*(1), Article 050023. https://doi.org/10.1063/5.0150407

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *The Review of Financial Studies, 22*(1), 435–480. https://doi.org/10.1093/rfs/hhn053

Rahaman, S. M., & Sur, D. (2025). Identifying key drivers of non-performing assets in Indian public sector banks: A panel data analysis. *IIM Kozhikode Society & Management Review*. Advance online publication. https://doi.org/10.1177/22779752211000146

Rakatenda, G. N., & Sedana, I. B. P. (2021). The effect of credit risk on profitability with capital adequacy as a mediation variable. *Russian Journal of Agricultural and Socio-Economic Sciences, 3*(111), 76–83. https://doi.org/10.18551/rjoas.2021-03.09

Sami, L., Anjum, F., Ansari, M. S., & Iffat, B. (2024). The financial stability of the banking sector: An empirical investigation using the CAMEL rating approach. *Journal of Governance and Regulation, 13*(2), 135–144. https://doi.org/10.22495/jgrv13i2art13

Sharma, D. K., & Kaur, R. (2021). Relationship between credit risk management and profitability performance of Indian public sector banks. *GE-International Journal of Management Research, 9*(3).

Shieh, G. (2010). On the misconception of multicollinearity in detection of moderating effects: Multicollinearity is not always detrimental. *Multivariate Behavioral Research, 45*(3), 483–507. https://doi.org/10.1080/00273171.2010.498294

Singh, K. (2024). Performance and returns volatility of banks in India: Public versus private sector. *Journal of Economic and Administrative Sciences, 42*(1), 68–87. https://doi.org/10.1108/JEAS-07-2023-0181

Stock, J. H., & Watson, M. W. (2008). Heteroskedasticity-robust standard errors for fixed effects panel data regression. *Econometrica, 76*(1), 155–174. https://doi.org/10.1111/j.0012-9682.2008.00821.x

Tjoe Linggadjaya, R., Atahau, A. D. R., Ugut, G. S. S., & Suk, K. S. (2025). The moderating role of capital adequacy on bank-specific characteristics to sustainable growth: Evidence from commercial banks in Indonesia. *SAGE Open, 15*(1). https://doi.org/10.1177/21582440251353042

Wooldridge, J. M. (2019). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.

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