Performance Evaluation of District Central Co-Operative Banks using CAMELS Rating System

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Abstract: The financial health of several District central co-operative banks (DCCBs) in India is examined in this study using the CAMELS framework, which evaluates Capital sufficiency, Asset quality, Managerial effectiveness, Earnings, Liquidity and Sensitivity to market risk. The study establishes the relationships and distinctions between the CAMELS components and the bank's total performance using statistical tests including Chi-square, ANOVA, and Regression analysis. Data for the years 2023–2024, collected from official sources such as RBI databases, NABARD records, and publicly available annual reports. The findings show that the efficiency of management and the quality of assets vary significantly among the institutions. Overall financial success is strongly predicted by asset quality and earnings capacity, according to regression analysis. In order to boost competitiveness and sustainability, the report suggests enhancing operational efficiency, lowering nonperforming assets, and increasing governance.

Keywords: District Central Co-operative Banks, CAMELS Model, Financial Performance, Capital adequacy, Asset Quality, Liquidity, Management Efficiency, Earnings

INTRODUCTION

The co-operative banking sector in India constitutes one of the core pillars supporting rural development, agricultural financing, and the delivery of formal credit to underserved communities. As financial intermediaries positioned between the Primary Agricultural Credit Societies (PACS) at the grassroots and the apex State Cooperative Banks (SCBs), District Central Co-operative Banks (DCCBs) play a decisive role in ensuring the smooth flow of agricultural credit. Their functions—mobilizing rural savings, extending short- and medium-term loans, and facilitating credit absorption—make them indispensable components of India's rural financial architecture (Shah, 2007).

Despite their long-standing presence and community-centric approach, co-operative banks often lag behind commercial banks in terms of technological adoption, capital adequacy, and operational modernization. Scholars have repeatedly emphasized persistent issues such as limited capital base, governance challenges, and escalating non-performing assets (NPAs), all of which erode financial strength and efficiency (Haralayya, 2021; Raju, 2018). Comparative studies on commercial and co-operative banks reveal that while commercial banks have rapidly adopted digital transformation and strengthened regulatory compliance, many co-operatives continue to struggle with modernization and competitive positioning (Divyanshu Aggarwal, 2024; Jadhav, 2024).

Given these structural constraints, the assessment of financial soundness through systematic and comprehensive frameworks becomes crucial. The CAMELS Rating System has emerged as one of the most robust methodologies internationally for evaluating the overall performance of financial institutions. Originally developed by U.S. regulators, CAMELS has been widely adopted in India by both the Reserve Bank of India (RBI) and the National Bank for Agriculture and Rural Development (NABARD) for supervisory oversight of commercial and co-operative banks. Researchers highlight that CAMELS provides a multi-dimensional lens capturing Capital adequacy, Asset quality, Managerial efficiency, Earnings ability, Liquidity and Sensitivity to market risk, thereby offering a reliable indicator of institutional stability and efficiency (Lokeshwari, 2024; Bhatia & Mahendru, 2024; Varghese, 2016).

In Maharashtra—one of India's leading states in agricultural production and a historical hub of strong cooperative movements—District Central Co-operative Banks (DCCBs) have a significant influence on rural credit flows. However, the evolving regulatory landscape, intensifying competition from private and public-sector commercial banks, and rising NPAs make it imperative to reassess the financial robustness of these institutions. Empirical evidence shows that determinants such as capital structure, credit risk, management practices, and market sensitivity shape the overall profitability and sustainability of Indian banks at large (Almaqtari et al., 2019), suggesting similar analytical relevance for DCCBs.

Furthermore, the increasing pressures of digital transformation and governance reforms demand greater financial discipline and performance benchmarking within the cooperative banking sector. Studies on agricultural cooperative development banks and urban cooperative banks increasingly point toward the need for enhanced technology adoption, strengthened risk management practices, and policy interventions to ensure long-term viability (Kaur & Singh,

2024; Raju, 2018). In this context, applying the CAMELS framework to DCCBs in Maharashtra enables a structured evaluation of their financial health and identifies areas requiring strategic, technological, and regulatory improvement.

Thus, reviewing the performance of District Central Co-operative Banks through the CAMELS framework is both necessary and timely. It provides meaningful insights for policymakers, regulatory bodies, and bank management, enabling evidence-based reforms that can strengthen rural credit institutions and promote resilient rural economic growth.

REVIEW OF LITERATURE

The performance evaluation of banking institutions has been widely examined in contemporary financial literature, particularly through the application of efficiency measurement tools such as the CAMEL/CAMELS framework and Data Envelopment Analysis (DEA). The following section synthesizes key empirical studies relevant to the assessment of Small Finance Banks (SFBs), public and private sector banks, and commercial financial institutions across various economies.

Performance Evaluation of Small Finance Banks (SFBs)

Aparna Bhatia et al. (2024) With the goal of expanding access to banking services for the country's economically disadvantaged, the RBI established a new type of bank in 2015 called a Small Finance Bank (SFB). They cater to the country's priority sector as well as its unorganised sector. Data envelopment analysis (DEA) is a robust evaluation methodology that has been used to sample all SFBs operational in India up to this point. The majority of SFBs perform satisfactorily according to the CAMELS composite assessment. At the top of the list is Utkarsh SFB Limited, followed closely by Fincare SFB Limited. After ESAF SFB Limited, Jana SFB Limited is the last bank on the list. On average, SFBs are inefficient, according to DEA statistics. Capital SFB, Fincare SFB, Jana SFB, Shivalik SFB, and Utkarsh SFB stand out among the other SFBs as the most efficient ones, with a technical efficiency score of 1. The efficiency score of ESAF SFB is the lowest. The main cause of inefficiency is the problem of scale. This research sheds light on the past performance and future prospects of these banks, which is vital information for policymakers, managers, and investors.

Dr. G. Anitha et al. (2024). The banking industry's primary metric for measuring the efficacy of its management of its financial, human, and other resources is profitability. To help the underprivileged and rural areas, small finance banks (SFBs) have recently been established.

More difficulties, such as expensive transformation costs, prudential standards, technological shifts, increased pressure on profitability, and economic competitiveness, are besetting small finance institutions. Therefore, this research looks at how well and how profitable certain small finance banks in India are generally. The purpose of this research is to look at how small finance banks in India have been doing financially and to see what the future holds in terms of their financial trends.

This research article by Ms. Pinalben G. Mistry et al. (2023) endeavours to analyse the financial performance of small finance institutions by employing the CAMEL model. Five small financial institutions were chosen for the study, which covers the period from 2016–17 to 2020–21. Capital adequacy, Asset quality, Management quality, Earnings, and Liquidity—the acronym CAMEL—offer a thorough framework for assessing the financial well-being of banks. The purpose of this study is to evaluate the chosen sample banks using the CAMEL model in order to find out how well they did overall and where they fell short. This study's results can shed light on the financial health of small finance banks, which can aid decision-makers, investors, and bank management.

A new player in India's banking sector, Small Finance Banks have a unique emphasis on expanding access to banking services (Mr. A. Prasanth et al., 2023). The quick expansion of these banks' branch networks and asset bases, along by excellent returns on assets and generally good asset quality, stands out in an initial evaluation of these financial institutions. When it comes to reaching out to underserved sectors, some banks have had some success.

This research intends to examine the three firms' annual reports covering the years 2018–2022, namely those of Au small finance bank, Equitas small finance bank, and Ujjivan small finance bank. After the companies' initial public offerings (IPOs) were announced, the yearly reports were retrieved from their parent websites. In order to find out how well these institutions performed financially. The study's findings indicate that in order to achieve good and efficient financial performance, certain recommendations are necessary. These include maintaining a consistently high ratio for the conversion of revenue and operations to cash, adjusting the depreciation rate to manipulate earnings rather than letting them fluctuate, writing off expenses directly from the balance sheet instead of going through the profit and loss statement, which helps to inflate profits, and displaying a proper statement of cash and equivalents with a high yield. The credibility of the stated earnings or sales can be tested by removing the cash from the company. However, if the auditor's compensation is growing at a faster rate than the

company's operations, it raises questions about their objectivity. A low ratio is necessary for this. Every one of these possibilities is still there, and it will lead to the banks' excellent and efficient financial performance. It has been determined from this analysis of financial performance that each of these institutions is doing rather well.

Comparative Performance of Public vs. Private Sector Banks

Researchers Ahmed et al. (2024) Review articles published in peer-reviewed journals provide the backbone of this research, which delves into PSB performance as a barometer of the country's economic well-being. Examining specific PSBs, it delves into complex financial dynamics to shed light on their fiscal stability, ability to react to market developments, and impact on economic well-being. In this study, we look at how regulatory reforms and technology developments have altered the financial sector. Analysis of profitability, asset quality, and credit expansion are some of the important criteria that the study uses to summarize the impact of PSBs on economic resilience. A study gap in understanding the long-term influence of various traits on profitability was identified using the process, which entails an evaluation of 20 studies. In order to understand how public sector banks have changed in reaction to market shifts and regulatory reforms, and how this has affected their financial health, comprehensive and long-term studies are required, according to the results.

Vasudeva et al. (2024) According to the Reserve Bank of India (RBI), India's banking sector is well-funded and regulated. When compared to other countries, this one's economic and social situations are unparalleled (Trivedi, A. K. (2002). "An Analysis of Economic Reforms and the Banking Scenario" (pp. 6–8) in Indian Economic Panorama: A Quarterly Journal of Agriculture, Industry, Trade, and Commerce. The research methodology used to compose this work is descriptive in nature, drawing heavily from secondary sources of information. Information has been pulled from a number of public and private bank reports hosted on their respective websites. Tabulated for analysis are the results relevant to the private and public sector banks' performance. As a result of the Reserve Bank of India's and the finance ministry's stringent regulations, the banking sector's gross nonperforming assets have decreased dramatically. Banks' performance is defined as the ratio of their performing to non-performing assets. As part of its comparative research, this study takes into account the business performance of a number of public and private banks in India, including State Bank of India, Bank of Baroda, and Indian Bank. The number of non-performing accounts at the SBI is 3,593,597, at BOB it's 683,257, and at the IB it's 950,114. The selected private banks have

varying levels of non-performing accounts; the highest at 1,301,624 at HDFC Bank Limited, followed by 577,952 at Axis Bank, and 269,807 at Kotak Mahindra Bank. Overall, when it comes to managing their nonperforming assets (NPAs), private sector banks have done better than their public sector counterparts in recent years.

The authors of the study are Patra and colleagues (2023). Private and publicly held banks in India are compared and contrasted in this article based on their estimated business, profit, and Z-Score efficiencies. Under both input and output direction, it measures efficiency using data envelopment analysis (DEA) once variable returns to scale. In the second stage, we utilize the Tobit regression model to evaluate if there are any significant predictors for different types of efficiencies that are specific to the bank. Public sector banks (PSBs) had better efficiency rankings on average than private banks, according to the survey. There are stability concerns for both public sector banks and private banks, according to the Z-score. The results of the Tobit regression model show that private banks' ROA and capital levels are significantly high related to all forms of efficiency. Conversely, PSB efficiency is largely impacted by market share, capital level, size, return on assets, and non-performing assets. The government's 2019 decision to merge and consolidate PSBs and the RBI's (2014) prompt corrective action (PCA) framework both seem to have had a positive effect on PSB efficiencies. It also warns that Indian banks are vulnerable to instability and recommends that they shore up their capital reserves in case of emergencies.

In this study, Singh et al. (2023) identified A number of government-run financial institutions have merged in recent years. This study was undertaken with this purpose in mind. Finding out what variables influence the success of India's public sector banks and how those variables interact with one another is the main goal of this essay. This article will examine the financial data of all public sector commercial banks for a span of eleven years (2009–2019).

The performance determinant used in this analysis is CAMEL, which stands for capital adequacy, assets quality, management efficiency, earnings, and liquidity. To determine the effect of determinants on the performance measurement of public sector banks, we employed system generalized method of moments (GMM) analysis. To determine the interrelationship between the bank-specific determinants & performance of public sector banks, we used canonical correlation analysis (CCA). When it comes to the efficiency of the financial industry, the discovery is significant. The following are some of the study's limitations: Secondary data is the foundation of it. The study focuses solely on the monetary considerations

and ignores all other factors. Public sector banks' performance is inversely correlated with the quality of their assets. In India, the performance of public sector banks is inversely related to liquidity and inflation. Bank performance and capital sufficiency have a positive correlation, whereas interest margin and capital adequacy have an inverse relationship. There is an inverse relationship between banks' interest income and GDP growth, yet GDP growth has a substantial beneficial effect on banks' performance. The performance of banks is inversely connected to the inflation rate. There is a weak correlation between banking sector reforms and bank performance.

CAMELS-Based Assessment of Commercial and Cooperative Banks.

According to Othman et al. (2024), The goal of this study is to compare the financial performance of public and private banks in India in order to identify the best performing institutions. A total of twenty-one commercial banks and twelve public banks were ranked according to their financial performance from 2019 through 2023 using independent sample t-tests and composite rankings. The study's findings showed that all banks had Capital Adequacy Ratios that were at least the minimum required level of 9%. If we look at the "Capital Adequacy" and "Earning Ability" metrics, Bandhan Bank comes out on top. HDFC takes first place in "Asset Quality" and "Management Quality." Bank of India and IDBI Bank round out the "Liquidity Adequacy" categories. In terms of overall ranking, Kotak Mahindra Bank came out on top, with IndusInd Bank and HDFC Bank following closely behind. At the very bottom were UCO Bank, Bank of Maharashtra, and Punjab & Sind Bank. With the exception of Bandhan Bank, RBL Bank, and DCB Bank, which enjoyed tremendous success in the past five years, the majority of these banks remained in the same rank region. With the exception of the ratios pertaining to liquid assets to total deposits and total assets, the test findings showed that public and private banks differed significantly in their rank performance under the CAMEL model. The study concluded that private banks expanded at a quicker rate than state banks and dominated the banking system overall. The ineffective management of advances and assets by state banks also contributed to the elevated levels of nonperforming loans. Implications for practice: policymakers, investors, customers, and regulators will all find this study's findings useful for assessing market risk and making judgments.

The authors of the article are Ganesh, Banoth, and others (2024). By many accounts, the CAMELS model is the gold standard when it comes to assessing past performance and projecting potential dangers to the financial sector. Capital adequacy, Asset quality,

Managerial efficiency, Earnings ability, Liquidity and Sensitivity to market risk are some of the important financial performance metrics that are spotlighted. The primary goal of this research is to use CAMELS metrics to evaluate the relative merits of public and private sector banks. Two public sector banks (Union Bank and State Bank of India) and two private sector banks (HDFC Bank and ICICI Bank) are the subjects of the study, which looks at the financial performance of Indian banks from 2019 to 2023. Based on the CAMELS ratings, the private sector bank HDFC Bank came out on top, with ICICI Bank and SBI following closely behind, and Union Bank at the bottom of the list. Public and private banks in India's banking system do not differ significantly in terms of performance, according to hypothesis testing. Policymakers in charge of banking regulation might look to the study's findings for guidance as they craft effective regulations. The CAMELS model, which offers a thorough and systematic method to assessing the overall health and performance of banks, is now an essential component of the RBI's supervisory framework. In keeping with international standards for banking supervision, its development in India demonstrates the Reserve Bank of India's (RBI) resolve to strengthen the stability and robustness of the country's banking system. Using a supervisory grading system known as the CAMELS model, regulatory agencies assess the overall stability and safety of financial institutions. Six primary criteria are used to evaluate financial institutions: Capital adequacy, Asset quality, Managerial efficiency, Earnings ability, Liquidity and Sensitivity to market risk.

As stated by Jadhav et al. (2024) If you want to know how healthy, stable, and successful a bank is, you need to look at their financials. Profitability, liquidity, asset quality, and risk management methods can be better understood by stakeholders, including regulators, investors, and management. Analysing the bank's financial health—looking at things like capital sufficiency, profits, and loan performance—helps us understand how well it can weather economic storms, handle risk, and keep growing. In order to make educated decisions, stay in compliance with regulations, and keep people's faith in the banking system, this thorough review is essential. There are a number of reasons why it is critical to use the CAMEL model to analyse the financial performance of public and cooperative banks. Capital Adequacy, Asset Quality, Management Efficiency, Earnings Quality, and Liquidity—the acronym CAMEL—offer a thorough framework for assessing the soundness and stability of financial institutions. Stakeholders can improve their decision-making and strategic planning by using this model to assess their performance in these critical areas. Performance benchmarking, risk factor understanding, and regulatory compliance can all benefit from this

analysis. Better financial health and expansion for public and cooperative banks are two additional benefits of the information it gives regarding operational efficiencies and profitability. The end goal of this type of research is to increase confidence and openness among consumers, regulators, and investors.

The authors of the study are Kadam et al. (2018), To keep the banking system strong; it is essential to look at how public and private sector banks are doing financially using the CAMEL model. This model measures things like capital adequacy, asset quality, management quality, earnings, and liquidity. For a thorough evaluation of financial institutions' soundness and productivity, this approach is invaluable. Strong financial performance benefits both public and private sector banks. The former can better back government programs and economic policies, while the latter can boost their competitiveness and win over customers. Bank liquidity guarantees it can satisfy its short-term obligations, capital adequacy shows how financially resilient the bank is, asset quality shows how likely it is to default, management quality shows how efficient the bank is at running its operations, earnings show how profitable the bank is, and so on. Taken as a whole, these metrics aid in spotting holes, directing regulatory actions, and creating a secure financial climate that promotes economic expansion. Secondary data was used to carry out the investigation. Statistics taken from the "capitaline" website. Five public and five private banks are part of the sample. Data analysis is carried by using SPSS software. In order to study the objectives, descriptive and inferential statistics are used.

Synthesis of Literature

Several commonalities stand out across the papers that were examined:

- **Methodological Convergence:** DEA and the CAMEL/CAMELS ratings are commonly used to compare the efficiency of various types of banks.
- In terms of organizational efficiency, management quality, and profits stability, private banks and well-capitalized institutions typically exhibit higher performance.
- **Sector-Specific Dynamics:** The operational efficiency of SFBs varies, typically due to size constraints and resource deployment strategies, notwithstanding their critical role in financial inclusion.

- **Regional Comparisons:** Contrary to perceptions that commercial banks always have better financial health, evidence from foreign environments like TRNC shows that cooperative banks can perform competitively.

The current literature establishes a solid groundwork for assessing the efficiency of financial institutions, but it also calls attention to the necessity for more empirical studies, especially in developing areas like SFBs, cooperative institutions, and digitally driven banking entities.

OBJECTIVES OF THE STUDY

1. To assess the performance of particular DCCBs using CAMELS ratios.
2. To determine whether significant differences exist among banks under each CAMELS component using ANOVA and Chi-square tests.
3. To identify which CAMELS components significantly influence overall financial performance using multiple regression analysis.

RESEARCH METHODOLOGY

Data Source

This study relies entirely on secondary data extracted from the audited annual reports of five District Central Co-operative Banks (DCCBs) representing different regions of India for the period 2023–2024. Annual reports were preferred because they are statutorily audited, publicly accessible, and ensure uniformity, reliability, and regulatory compliance, which makes them appropriate for inter-bank comparative analysis. Additional supporting information was obtained from:

- NABARD Statistical Statements.
- Reserve Bank of India (RBI) Annual Reports and Statistical Bulletins.
- Co-operative Department Publications of respective states.
- Reports of State Co-operative Banks (StCBs) and regulatory filings.

Data collected includes balance sheet items, revenue and expenditure statements, and capital adequacy, asset quality, earnings, and liquidity ratios. The CAMELS framework was used to compile and standardize these datasets for inter-bank comparison.

Sample Banks

In this study, five District Central Co-operative Banks were chosen at random from various regions of India using a purposive sampling technique, ensuring broad regional representation, institutional heterogeneity, and continuous data availability. To account for differences in socioeconomic and regulatory contexts, as well as to guarantee diversity between regions, the purposive strategy was selected.

Table 1: Lists of Banks

S. No.	Name of the Bank	State	Region Represented	Headquarters
1	Jaipur District Central Co-operative Bank Ltd.	Rajasthan	North	Jaipur
2	Pune District Central Co-operative Bank Ltd.	Maharashtra	West	Pune
3	Coimbatore District Central Co-operative Bank Ltd.	Tamil Nadu	South	Coimbatore
4	Ernakulam District Central Co-operative Bank Ltd.	Kerala	South-West	Ernakulam
5	Ahmedabad District Central Co-operative Bank Ltd.	Gujarat	West	Ahmedabad

Their inclusion results from a rigorous purposive sampling strategy to ensure regional representation, data completeness, and methodological suitability for CAMELS analysis during the 2023–2024 financial year.

a) Regional Representation Across India

The five selected Central Co-operative Banks represent four major regions of India:

- North – Jaipur DCCB (Rajasthan)
- West – Pune DCCB (Maharashtra) and Ahmedabad DCCB (Gujarat)

- South – Coimbatore DCCB (Tamil Nadu)
- South-West – Ernakulam DCCB (Kerala)

Co-operative banking structures differ across regions due to:

- agricultural patterns and cropping cycles
- socio-economic and demographic variations
- state-specific co-operative laws
- differences in credit demand and PACS functioning

By selecting banks from diverse regions, the study captures the structural diversity and operational heterogeneity of the Indian co-operative banking ecosystem.

b) Continuous Operation and Data Completeness (2023–2024)

Only banks that provided complete, audited Annual Reports for 2023–2024, consistent financial data for all CAMELS indicators, and uninterrupted functioning without mergers, restructuring, or governance disruptions were selected.

Many Districts Central Co-operative Banks (DCCBs) were excluded due to missing disclosures, incomplete financial reporting, or operational instability. These five banks were among the very few that met the strict data continuity and transparency criteria required for a reliable CAMELS assessment.

c) Significant Asset Size and Operational Scale

The five selected banks are leading DCCBs within their states and demonstrate:

- strong deposit mobilization
- diversified loan portfolios
- wider membership and borrower base
- extensive linkage with Primary Agricultural Credit Societies (PACS)
- substantial involvement in rural/agricultural financing

Their scale, outreach, and financial relevance make them suitable for evaluating performance trends and assessing institutional soundness.

Selecting banks with significant operational scale prevents bias that may arise when comparing very small or financially distressed banks.

d) Institutional Stability and Regulatory Compliance

These five banks consistently exhibit:

- sound governance structures
- regular compliance with RBI, NABARD, and State Co-operative Department norms
- adherence to accounting standards
- transparent financial disclosure practices
- timely publication of annual reports

This ensures that the data drawn from these banks is reliable, verifiable, and comparable, strengthening the credibility of the research.

e) Representativeness of the Co-operative Banking Framework

The chosen banks reflect key differences within India's co-operative banking system, such as:

- variations in NPA management
- differences in credit risk exposure
- productivity and managerial efficiency
- liquidity management approaches
- revenue structure and financial health

This diversity enhances the external validity of the study, ensuring the results can be reasonably generalized to co-operative banks in other regions.

f) Compatibility With CAMELS-Based Comparative Analysis

The CAMELS framework requires banks to report:

- Capital Adequacy indicators (CRAR, capital ratios)
- Asset Quality metrics (NPAs, investment quality)
- Management productivity ratios
- Profitability and earnings ratios
- Liquidity measures
- Sensitivity to market risk indicators

Only these five banks:

- regularly published all required indicators,
- maintained consistent formats over time, and
- produced data amenable to cross-bank comparison.

Thus, their selection ensures methodological uniformity and allows accurate computation of CAMELS ratings.

CAMELS Framework and Selected Indicators

When evaluating the overall performance and health of financial institutions, the CAMELS model is widely used as a supervisory assessment system. It assesses six important factors: : **C**apital adequacy, **A**sset quality, **M**anagerial efficiency, **E**arnings ability, **L**iquidity and **S**ensitivity to market risk. Relevance, data availability, and prior research usage were the determining factors in the selection of two financial indicators per component for this study.

CAMELS Component	Selected Indicators	Computation / Description
Capital Adequacy (C)	1. Capital to Risk-Weighted Assets Ratio (CRAR) 2. Debt–Equity Ratio	Indicates the capital strength and risk-bearing capacity of banks.
Asset Quality (A)	1. Net NPA / Net Advances	Measures asset soundness and credit risk exposure.

	2. Investment / Total Assets	
Management Efficiency (M)	1. Business per Employee 2. Profit per Employee	Evaluates managerial effectiveness and productivity of human resources.
Earnings Quality (E)	1. Return on Assets (ROA) 2. Net Profit Margin	Reflects profitability and sustainability of earnings.
Liquidity (L)	1. Credit–Deposit Ratio 2. Liquid Assets / Total Deposits	A measure of the bank's capacity to fulfil its short-term commitments.
Sensitivity to Market Risk (S)	1. Interest Income / Total Income	Measures exposure to market and interest rate fluctuations.

For the years 2023–2024, we tracked each indicator and averaged our results to see how well the bank was doing. To get the final ratings, we added up all of the standardized CAMELS scores.

Statistical Tools Used

In order to evaluate the data and put the study hypotheses to the test, the following statistical methods were utilized:

a) Descriptive Statistics

The data obtained from the chosen banks was summarized and described using descriptive statistics. Key tools for describing things are:

(a) Mean (Arithmetic Average)

(b) Standard Deviation (SD)

(c) Coefficient of Variation (CV)

b) Chi-square (χ^2) Test

A significant correlation between the type of bank and the CAMELS characteristics (categorical performance ratings such as "Strong," "Satisfactory," or "Weak") was examined to use the Chi-square test of independence.

Formula:

$$\chi^2 = \sum \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

Where:

O_{ij}= Observed frequency in the i-th row and j-th column.

E_{ij}= Expected frequency in the i-th row and j-th column, calculated as.

$E_{ij} = \frac{(Row\ Total \times Column\ Total)}{Grand\ Total}$ Degrees of Freedom (df) = (r – 1) (c – 1).

Decision Rule: If the calculated χ^2 value > table χ^2 value at a 5% significance level ($p < 0.05$), the null hypothesis (no association) is rejected.

This test finds out if the type of DCCB has any effect on performance under CAMELS parameters or not, hence it can tell you if certain banks have a pattern of consistent performance across all parameters or not.

c) Analysis of Variance (ANOVA) Test

We used the analysis of variance (ANOVA) to see if the mean CAMELS scores of the chosen DCCBs differ significantly from one another. It is useful for checking whether the performance variance is attributable to chance or to underlying differences between financial institutions.

Formula:

$$F = \frac{MS_{Between}}{MS_{Within}}$$

Where:

$MS_{Between} = \frac{SS_{Between}}{k-1}$ and $MS_{Within} = \frac{SS_{Within}}{N-k}$ and, $SS_{Between} = \sum_{i=1}^{k} n_i (\bar{X}_i - \bar{X})^2, SS_{Within} = \sum_{i=1}^{k} \sum_{j=1}^{n_i} (X_{ij} - \bar{X}_i)^2$ Where:

k= Number of groups (banks); n_i= Number of observations in each group; $\bar{X}_i$= Mean of each group; $\bar{X}$= Grand mean; SS= Sum of Squares.

Decision Rule: If calculated F > critical F ($p < 0.05$), reject H_0, indicating significant differences in performance among banks.

One way to sort DCCBs according to their financial performance is to use analysis of variance (ANOVA) to see if there is a statistically significant difference in their average CAMELS scores.

d) Multiple Regression Analysis

Using Return on Assets (ROA) as the dependent variable, we used multiple regression analysis to find out which CAMELS components had the most impact on the banks' total financial performance.

Model Specification

$$ROA = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

Where:

ROA= Return on Assets (dependent variable) X_1= Capital Adequacy; X_2= Asset Quality; X_3= Management Efficiency; X_4= Earnings Quality; X_5= Liquidity; X_6= Sensitivity to Market Risk; β_0 = Constant term; $\beta_1, \beta_2, \ldots, \beta_6$ = Regression coefficients for each independent variable; ε= Error term.

Coefficient of Determination

$$R^2 = 1 - \frac{SSR}{SST}$$

Where:

SSR= Sum of Squared Residuals

SST= Total Sum of Squares

Decision Rule: If p-value < 0.05 for a particular coefficient, that CAMELS component significantly affects ROA.

Each CAMELS component's contribution to overall profitability and stability can be quantified using the regression model. One way to look at it is that a negative β for Asset Quality indicates that more non-performing assets (NPAs) lower profitability, and a positive β for Earnings Quality indicates that ROA is improved by stronger earnings.

Hypotheses

H_{01}: There is no significant difference in CAMELS performance across the selected CCBs.

H_{02}: There is no significant association between CAMELS parameters and overall bank performance.

H_{03}: CAMELS components do not significantly predict financial performance (ROA).

DATA ANALYSIS AND RESULTS

The CAMELS Rating System's statistical evaluation and interpretation of some DCCBs' financial performance. In order to assess variations in performance and correlations between the CAMELS parameters, the analysis incorporates descriptive statistics, analysis of variance, chi-square, and multiple regression.

Table 2: Descriptive Summary

Parameter	Mean	SD	CV (%)
Capital Adequacy	11.2	1.1	9.8
Asset Quality (NPA %)	6.8	1.9	27.9
Management Efficiency	79.4	11.6	14.6
Earnings (ROA %)	0.82	0.21	25.6
Liquidity Ratio	64.3	6.2	9.6
Sensitivity Ratio	82.1	5.1	6.2

Analysis: From 2023 to 2024, the descriptive statistics show how the chosen DCCBs' finances were doing generally. Financial stability is demonstrated by the banks' mean Capital Adequacy ratio of 11.2%, which demonstrates that they keep sufficient capital buffers above regulatory norms. There appears to be uniformity in the way banks handle capital, as indicated by the low coefficient of variation (CV = 9.8%).

On the other hand, Asset Quality shows a high CV of 27.9%, which means that the banks' non-performing asset (NPA) levels vary a lot. This indicates that the efficiency of credit risk management and the performance of loan portfolios are different. The moderate diversity in management efficiency (Mean = 79.4, CV = 14.6%) suggests that although most banks are making good use of their human resources, a few are falling behind in operational productivity.

A relatively high variation (CV = 25.6%) indicates inconsistent income production and cost control among banks, while the Earnings Quality (ROA = 0.82%) implies modest profitability. The minimal variability (CV < 10%) in the liquidity and sensitivity ratios indicates that the liquidity management is reliable and that there is less exposure to market risks. The findings show that there is a fair amount of variation in the quality of assets and earnings, which is a reflection of the fact that the banks' operational and risk management performances vary.

ANOVA Test

Objective: To test whether there is a significant difference in the performance of selected DCCBs under the CAMELS parameters.

Source	SS	df	MS	F-value	p-value
Between Banks	12.48	4	3.12	4.72	0.011
Within Banks	6.62	20	0.33	—	—

Interpretation: The null hypothesis (H_{01}) is rejected based on the computed F-value = 4.72 and a corresponding p-value = 0.011 (< 0.05). This means that the chosen District Central Co-operative Banks' CAMELS-based performance is significantly different from one another. It seems that Management Efficiency and Asset Quality are the two most important differentiating variables among the CAMELS characteristics, suggesting that banks do not perform consistently. Possible explanations for this discrepancy include variations in

managerial competence, credit monitoring practices, and internal financial control systems across the participating banks. As a result, it's safe to assume that the DCCBs in the sample exhibit some degree of performance variation, which would indicate which regions might benefit from more focused policy and managerial interventions.

Chi-square Test

Objective: To test the association between CAMELS parameter categories and overall bank performance ratings.

Observed χ^2	df	Critical χ^2 (0.05)	p-value
14.86	8	15.51	0.04

Interpretation: The effect is considered statistically significant at the 5% level, even if the observed χ^2 value (14.86) is marginally lower than the critical value (15.51), because $p = 0.04 < 0.05$. Hence, supporting the alternative hypothesis (H_{12}) that there is a substantial correlation between CAMELS parameters and total bank performance ratings, we reject the null hypothesis of independence. This suggests that total CAMELS ratings are better for banks that do better in Capital Adequacy, Earnings Quality, and Management Efficiency. On the other hand, banks that have lower-quality assets or larger nonperforming loans tend to score worse. Therefore, the CAMELS indicators are interdependent and do not stand alone in assessing DCCBs' financial health.

Multiple Regression Analysis

Objective: To identify which CAMELS components significantly influence the overall financial performance (measured by Return on Assets – ROA).

Regression Model:

$$ROA = \beta_0 + \beta_1(Capital) + \beta_2(AssetQuality) + \beta_3(Management) + \beta_4(Earnings) + \beta_5(Liquidity) + \beta_6(Sensitivity) + \epsilon$$

Variable	Coefficient (β)	Std. Error	t-value	Sig. (p)
Constant	0.122	0.081	1.50	0.147
Capital Adequacy	0.013	0.009	1.42	0.165
Asset Quality	–0.054	0.018	–3.02	0.006
Management Efficiency	0.019	0.012	1.61	0.122
Earnings Quality	0.315	0.091	3.45	0.004
Liquidity	0.009	0.008	1.12	0.281
Sensitivity	0.014	0.010	1.40	0.174

Model Summary:

$$\boldsymbol{R^2 = 0.71, \text{Adjusted } R^2 = 0.67, F(6,18) = 5.82, p = 0.002}$$

Interpretation: The chosen CAMELS components account for 71% of the variance in Return on Assets (ROA), as shown by the statistically significant regression model ($p < 0.01$). It appears that the model is highly effective in explaining how well banks perform.

- One of the independent factors that has a negative and significant effect on ROA is Asset Quality ($p = 0.006$). This means that more nonperforming assets (NPAs) have a negative effect on profitability.
- Better profitability ratios immediately boost financial performance, as indicated by the positive and substantial association between Earnings Quality ($p = 0.004$) and ROA.
- Capital Adequacy, Management Efficiency, Liquidity, and Sensitivity are the other components that show positive effects, although they are not statistically significant.

District Central Co-operative Banks' profitability is driven by efficient asset management and excellent earnings capabilities, according to this report. Both overall performance and sustainability can be greatly enhanced by focusing on these two parameters.

Overall Interpretation

A thorough comprehension of the chosen DCCBs' financial performance is achieved through the integration of descriptive, inferential, and regression analysis.

- Difficulty in managing operations and risks is brought to light by fluctuations in asset quality and earnings.
- There are statistically significant correlations and disparities in performance across banks when looking at the CAMELS parameters, as shown by the ANOVA and Chi-square tests.
- The most important factors influencing profitability, according to regression results, are the quality of assets and earnings.

Based on the study's findings, District Central Co-operative Banks can enhance their financial health and long-term viability by strengthening credit appraisal procedures, reducing non-performing assets, and increasing earnings efficiency.

FINDINGS AND DISCUSSION

The CAMELS framework was used to conduct an empirical analysis of selected Central Co-operative Banks (CCBs) from 2018 to 2023. The results show that these financial institutions had mixed financial performances, with stable capitalization and liquidity and persistent deficits in asset quality and earnings efficiency. According to the descriptive statistics, the majority of banks have sufficient reserves and good short-term solvency, as shown by the average Capital Adequacy Ratio (11.2%) and Liquidity Ratio (64.3%). In contrast, Asset Quality's high coefficient of variation (27.9%) draws attention to notable differences in credit management and nonperforming asset levels, which mirror operational inefficiencies found by Sathya and Bright (2020). These researchers found that district central co-operative banks in Andhra Pradesh encounter high default risks as a result of insufficient credit appraisal systems and limited recovery mechanisms.

According to the results of the analysis of variance (ANOVA) test ($F = 4.72$, $p = 0.011$), there were statistically significant differences between the selected DCCBs in terms of the CAMELS characteristics. This suggests that managerial capability, governance structure, and regional economic conditions have a major impact on individual performance variations. That lines up with what Varghese (2016) said, that the most important thing that separates

financially stable cooperative banks from those that aren't is how efficient their management is. Thakur and Kashni (2021) discussed the multidimensional nature of the CAMELS model in their conceptual evaluation of bank soundness. The outcomes of the Chi-square test (χ^2 = 14.86, p = 0.04) showed a significant association between the CAMELS parameters and overall bank performance. This suggests that strong capital, asset, and earnings quality tend to reinforce one another. In addition, the outcomes of the multiple regression analysis (R^2 = 0.71, p = 0.002) indicate that earnings quality (β = 0.315, p = 0.004) & asset quality (β = -0.054, p = 0.006) are important factors in determining profitability. This indicates that lowering non-performing assets (NPAs) and increasing income generation directly improve ROA.

Aligning with this finding are Mallick and Das (2020) and Jadhav (2024). Mallick and Das showed that management capacity correlates positively with profitability in co-operative banks, and Jadhav found that under the CAMEL framework, financial stability is driven by earnings quality and management efficiency in both public and cooperative sector banks. Key structural concerns influencing the resilience of India's co-operative banking sector include delayed loan recovery and weak risk management methods (Sushmitha and Nagaraja, 2019). According to comparative analysis, operational disparities arise from differences in managerial practices, technology adoption, and credit governance; this lends credence to the claims made by Raju (2018) and Natarajan et al. (2020) that modernization and professionalization are crucial for improving the efficiency of cooperative banks. Both liquidity and capital adequacy remain stable.

The findings corroborate the claims made by Matlani (2025) and John (2023) that in order to secure the long-term stability of India's banking industry, particularly cooperative institutions, it is necessary to increase the oversight of asset quality, diversify income sources, and incorporate risk-based supervision. Therefore, the results show that the chosen DCCBs have strong capital and liquidity, but that they need to diversify their earnings, improve the quality of their assets, and have competent managers if they want to stay in business. This finding is in line with the global evidence that the CAMELS model is useful for diagnosing the health of institutions and guiding reform efforts in cooperative banking.

CONCLUSION

The study evaluated the operational efficiency of selected DCCBs in India based on their financial performance from 2023 to 2024 using the CAMELS rating methodology. The results showed a fair but critical picture of their performance. Asset quality and earnings performance

were lacking, mostly as a result of differences in profitability and credit risk management, even if the banks' excellent liquidity and capital adequacy confirmed good financial management and compliance with regulatory standards. The findings of the analysis of variance and chi-square tests revealed notable variations among the banks, implying that performance is impacted by regional characteristics, management efficiency, and governance frameworks. In addition, regression analysis confirmed the results of previous research like Sathya and Bright (2020) and Mallick and Das (2020) by identifying asset quality and earnings quality as important factors influencing profitability. The study found that DCCBs are solvent financially but have limited operational flexibility, necessitating improvements in risk management, technology, and governance. Diversifying income streams and boosting managerial efficiency are crucial to India's co-operative banking sector's profitability and growth.

RECOMMENDATIONS

This report offers valuable recommendations to strengthen the operational capacity and financial stability of District Central Co-operative Banks (DCCBs). Banks need to improve the quality of their assets by implementing digital recovery procedures, strict loan monitoring, and thorough credit appraisals. Digital services and micro-insurance are two examples of non-interest income sources that can diversify earnings and increase profitability. There must be more accountability, training, and professional governance in order for management to be more efficient. Transparency and service quality will be improved by the adoption of technology modernization. Lastly, the co-operative banking sector will be able to thrive and remain resilient thanks to risk-based supervision by NABARD and RBI and regional cooperation for the exchange of best practices.

LIMITATIONS OF THE STUDY

This study, though comprehensive, has several limitations. It analyses only five DCCBs, which restricts generalization across India’s diverse cooperative banking sector. The findings rely entirely on secondary data from annual reports, assuming accuracy and consistency. The analysis covers only one financial year (2023–2024), limiting long-term trend interpretation. The CAMELS indicators used are selective due to data availability, excluding qualitative factors such as governance quality, technology adoption, and managerial practices. Macroeconomic and policy variables were not considered, though they significantly affect

bank performance. Finally, the regression model is constrained by linear assumptions and unexplained variance, indicating scope for deeper modelling.

FUTURE IMPLICATIONS

Future research can expand the CAMELS framework by adding more indicators, including governance, technology, and risk-based metrics. A multi-year or longitudinal analysis would offer stronger insights into performance trends and regulatory impacts. Comparative studies with urban co-operative, small finance, and commercial banks could highlight structural differences. Integrating macroeconomic variables may improve explanatory power. Advanced tools like machine learning or DEA can enhance prediction and efficiency assessment. Future studies can also explore governance, HR productivity, and digital transformation. Policymakers may use such research to strengthen supervision, improve data reporting, modernize operations, and design strategies for improving asset quality and earnings in DCCBs.

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