

A CASE STUDY ON RISK MANAGEMENT SYSTEM OF A RURAL COOPERATIVE BANK IN INDIA



 Aditya Nikam ^(a)

^(a) Manager, National Bank for Agriculture and Rural Development (NABARD), Hyderabad, India; E-mail: aditya.nikam@nabard.org

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ABSTRACT

Rural Cooperative Banks (RCBs) are supervised by National Bank for Agriculture and Rural Development (NABARD) under CAMELSC rating framework. The CAMELSC model is principally performance-oriented while risk factors are not effectively incorporated. NABARD's Enhanced CAMELSC model, which will be fully implemented by the end of FY26, includes additional risk and control indicators. The purpose of this study is to examine liquidity risk, interest rate risk and credit risk of a District Cooperative Central Bank (DCCB) having good financial position as per the C, A, E and L components of CAMELSC model. Name and data of the bank have been partially modified to maintain confidentiality of the data not available in public domain. The study is based on policies, committee proceedings and quantitative data obtained from a DCCB, discussion with bank officials, and periodic returns submitted to NABARD. The study employed various guidelines by RBI and NABARD. The stock and flow approaches suggested that the bank had moderate liquidity risk. Application of Interest Rate Sensitivity Statements, Macaulay Duration of investment portfolio, and MCLR methodology for interest rate benchmarking showed low interest rate risk. Altman's z-score model illustrated credit risk in institutional clients viz. PACS and logistic regression model for retail customer scoring indicated limitation in capturing credit risk of its retail customers. The capital adequacy assessment also indicated the bank had insufficient RoA to give dividend as per its mandate. Bank did not have governance mechanism in place such as Credit Risk Management Committee or having effective ALCO to carry out executive functions of monitoring and controlling risk controls/ limits as per the policy.

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INTRODUCTION

Indian agricultural financial system comprises of Banking and Non-Banking financial institutions, Development Financial Institutions and Central Bank. Rural Cooperative Banks (RCBs), in the financial ecosystem, are a part of three-tier Short Term Cooperative Credit Structure (STCCS), which include State Cooperative Bank (StCB) and District Cooperative Central Bank (DCCB) as Reserve Bank of India (RBI) licensed banks, to cater to the agricultural and other short term credit requirements of the cooperative members primarily. The structure also includes a cooperative credit society at the grass-root level, called a Primary Agriculture Credit Society (PACS). In some states, STCCS caters to both short-term and long-term lending. NABARD has been rating the RCBs under CAMELSC model since 1998-99. The model consists of components viz. Capital Adequacy, Asset Quality, Management, Earning, Liquidity, Systems and Controls and Compliance. As per the Report of the Working Group on Risk Based Supervision (RBS) (2020), while the CAMELSC model, derived from CAMEL model is an important supervisory tool utilized by NABARD for rating the banks based on on-site inspection, the rating system is largely focused on assessment of the past performance of the SE while the risk elements not being adequately incorporated. The rating assigned is therefore, neither forward looking nor dynamic in nature. Hence, based on the recommendations of the report, NABARD has adopted Enhanced CAMELSC rating framework, as a step towards capacity building for RBS. The model includes additional risk and control indicators. Like any other commercial bank, RCBs also are posed with various risks like Liquidity, Credit, Market, Operational risks. Nanda (2024) highlights risk scenarios in 21st century and importance of risk management systems in banks. Rao (2024) emphasizes risk management as a single expression that epitomizes banking business. Risk Management is important due to multiple factors including bank's fiduciary role towards depositors, their critical interaction with real economy and their role in ensuring financial stability. The primary objective of this study is to evaluate the inherent risks in a DCCB which is rated as per CAMELSC model as

¹Corresponding Author: ORCID ID: 0009-0000-1829-7613

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a 'Fundamentally sound bank with sound banking operations'. By application of various risk management tools and indicators prescribed by RBI/ NABARD through guidelines on liquidity, interest rate and credit risk, the study will provide insight into the limitations of traditional CAMELSC model, especially C, A, E and L components. This study will contribute to the literature on understanding the risk management systems of Rural Cooperative Banks and will be helpful for supervisors and RCBs to understand importance of Enhanced CAMELSC rating model to be fully implemented by NABARD by 2026.

This section is followed by review of relevant literature. The methodology and source of data is followed in the third section. The results and discussion of the analysis are presented in the fourth section, and section five concludes with suggestions for future research.

LITERATURE REVIEW

The financial performance of different banks across various countries have been studied using the CAMEL framework. Barker and Holdsworth (1993) noted the importance of CAMEL ratings system as an effective tool for predicting banks' failure and measuring these institutions' performance. Barr et al. (2002) concluded that CAMEL rating system is useful for measuring the financial performance of banks by regulators and examiners. The CAMEL rating model was introduced by RBI based on Report of the Working Group to review the system of on-site supervision over banks (1995). Based on CAMEL model in Indian banks, various studies were published. Bodla and Verma (2006), found that State Bank of India (SBI) fared better than ICICI in terms of capital adequacy between 2000 and 2004. However, ICICI outperformed SBI in terms of asset quality, earning quality, and management quality, while there was no significant difference in the liquidity positions of the two banks. In their study, Mishra and Aspal (2012) assessed the overall performance and economic soundness of the State Bank Group using the CAMEL approach and concluded that different banks ranked differently. However, the difference was not statistically significant based on the ANOVA test. Considering private banks, Kumar and Malhotra (2017) in their study found that the Axis Bank performed best, and the IndusInd Bank performed worst. Liquidity, revenue capacity, and capital sufficiency were the key reasons for the subpar performance of the latter. A study on comparison between private and public sector bank was also conducted by Purohit and Bothra (2018), which revealed that the difference in the parameters reflected SBI's efforts to improve its efficiency, revenue, and liquidity, as well as the attempts by the ICICI Bank to strengthen its capital adequacy and asset quality. Amongst the studies in cooperative banking sector, Chander and Chandel (2010) studied four DCCBs in Haryana, India and found that the DCCBs were not performing well on all parameters viz. profitability, liquidity, solvency, efficiency, and risk. Das (2012) studied StCBs in Northeast Region of India and found that the banks were not in par with all-India in respect of financial parameters. There were challenges of dual control, poor financial base, high CD ratio, poor infrastructure, lack of professionalism, low technology upgradation and poor recovery. A study by Sushmitha and Nagaraja (2019) found that the UCBs and StCBs have shown a significant improvement in the management of NPAs in comparison to the DCCBs. However, there are limitations in analyzing performance of banks only on CAMEL ratios. Raja et al. (2023) reviewed that there are studies which have complemented the CAMEL framework with analytical tools such as regression analysis, while others assessed the performance using CAMEL ratios and alternative techniques. They evaluated performance of commercial banks in Guyana by applying CAMEL rating system and Linear Discriminant Analysis on prudential ratios, and concluded that only four out of five ratios contributed to differentiating banks in good-performing and bad-performing. Nair et al. (2018) compared the performance of private banks with the PSBs using the CAMEL framework and Discriminant Analysis. The study showed that the Debt-to-Equity ratio, Tier I capital ratio, net NPA ratio, and sensitive sector loans to total loans ratio explained the variation in the performance between these two categories of banks in India.

There have been studies on risk management practices of banks. A High Level Steering Committee (HLSC) constituted under the Chairmanship of Dr. K. C. Chakrabarty, Deputy Governor for Review of Supervisory Processes for Commercial Banks in their report (2012) recommended that under the risk-based approach to supervision, the supervisory rating would be a reflection on the risk elements (inherent risk and control) and not an exercise in performance evaluation as is the case under the CAMELS rating Framework. Based on the study of US banks, Handorf (2016) found that small and community banks were more affected by interest rates, mortgage prepayment and loan demand. By contrast, large banks hedge much of their interest rate risk but are adversely affected by basis risk. Interest rate risk deservedly requires attention from both bank regulators and management. However, interest rate risk is not as important as asset quality, the provision for loan losses and the allowance for loan losses. Indian economy moves gradually to Full Capital Account Convertibility, the banking sector is likely to come under increased stress in view of the exchange rate volatility with adverse repercussions on interest rates and bank default rates. Through their study, Srivastava et al. (2020) suggested ways of capital management of UCBs such as need for uniform guidelines on redemption of borrowing-linked capital, use of hybrid instruments, requirement for capital charge for market and operational risk. The issues in implementation of Asset Liability Management in select cooperative banks in Uttar Pradesh, India by Keshava (2020) were observed as low awareness at the top level, lack of skill among staff and poor-quality MIS report from CBS. Thus, from the extant literature, there is a scope for study in risk management practices and applicability of risk measurement tools in RCBs.

MATERIALS AND METHODS

A governance mechanism, where the risk appetite of the organization is clearly defined, limits are set, and control measures to review and monitor these risks are in place, is necessary for risk management. According to The Institute of Internal Auditors (2020) the three lines of Defense model is a way of explaining the inter-relationship between three crucial functions

of business, risk management and audit. The three lines have different responsibilities in the risk governance framework, of risk ownership, risk control and risk assurance, as indicated in Table 1.

Table 1. Responsibilities of the Three Lines of Defence

1 st Line of Defence	2 nd Line of Defence	3 rd Line of Defence
<ul style="list-style-type: none"> Manages business risks in the organization's processes. The First Line owns the risk and is accountable for the design and execution of the organization's internal controls. 	<ul style="list-style-type: none"> Supports management and provides additional expertise and monitoring to help ensure that the risks and controls are effectively managed. Activities are separate from the First Line of Defence, but they still report functionally to senior management. 	<ul style="list-style-type: none"> Internal audit provides assurance to senior management and board over the effectiveness of First and Second Lines. The Third Line is not allowed to perform management functions to protect its objectivity and independence. It has a direct reporting to the board through Audit Committee.
Risk Ownership	Risk Control	Risk Assurance

Source: Author's compilation

The Risk Management System, or the Second Line of Defence is responsible for controlling risk. A typical structure has been prescribed by NABARD (2020) for cooperative banks, which would be as follows:

- Risk Management Sub-Committee of the board
- Executive Committees
 - Asset Liability Management Committee
 - Credit Risk Management Committee
 - Operational Risk Management Committee
- Compliance Officer
- Risk Management Department

RBI (2020) prescribes responsibilities of the risk management function. NABARD (2020) delineates the roles and responsibilities of the Board of Directors, Risk Management Committee, and other executive functionaries. The entire structure should have responsibilities such as to identify, measure, monitor and control overall risks; to assist the Board in approving policies and strategies, for implementing integrated risk management system, in measuring and reporting risks, risk mitigation and stop-loss parameters; set and approve the risk appetite, within overall parameters; evaluate internal controls and functions through the committees covering Credit, Operational and Market Risks; Internal Capital Adequacy Assessment Process (ICAAP). Risk measurement and control practices have been in place in financial systems covering important business risks. The liquidity risk of a bank can be analysed using two approaches: flow approach and stock approach. NABARD (2009) highlight the use of ALM statements such as Structural Liquidity Statements (SLS) and Interest Rate Sensitivity Statements (IRSS) and using flow approach to examine liquidity and interest rate risk. Guidance notes by RBI (2012) and NABARD (2024) also provide for stock approach in risk management approach. Macaulay Duration can be an important method of identifying interest rate risk on investment portfolio with the changes in interest rate scenario. Banks usually follow Duration strategy depending on the prevailing interest rate scenario. A long-duration strategy is used when interest rates are falling (such as during recessions) where a bond investor focuses on bonds with a high duration value. In this situation, an investor is likely to buy bonds with a long time before maturity and greater exposure to interest rate risks. A short-duration strategy is one where a fixed-income or bond investor is focused on buying bonds with a small duration. This usually means that the investor is focused on bonds with a small amount of time to maturity. This strategy is employed when interest rates will rise or when there is uncertainty about interest rates, to reduce their risk. RBI has not prescribed any methodology for fixing interest rates for RCBs, unlike commercial banks. Hence, RCBs are free to adopt any methodology. However, adopting benchmark methodology such as Marginal Cost of Funds based Lending Rate (MCLR) can be beneficial in maintaining desired Net Interest Margin (NIM), which is issued by RBI (2023). Apart from conventional credit risk parameters focused on NPAs under the loan portfolio, credit risk can be mitigated at the account level. One such method is by assessing the solvency of financed unit using a linear model introduced by Altman (2013), also known as the Z-score Model, which separates defaulting firms from non-defaulting ones based on certain financial ratios. The model was also modified for private-manufacturing and non-manufacturing industries. For retail loans, loan acceptance based on credit scoring can be helpful to reduce the probability of default. Logistic regression model for credit scoring can be developed by banks (Rauhmeier & Engelmann, 2011). There have been guidelines on capital management by NABARD (2024). NABARD has also issued guidance notes on Enhanced CAMELSC Rating Framework, 2023. Basic concepts of risk management and practices in India have been reviewed (Pathak, 2020). Basu and Tasneem (2024) offers an overview of risk management in banks and financial institutions, with special reference to India. Important techniques and tools for risk measurement are also discussed. Though all the guidelines indicated in the literature review have not been issued for the RCBs, the purpose of this paper is to examine applicability of these guidelines and risk measurement techniques on a DCCB through case study of a particular bank, ABC DCCB Ltd. The comparative financial position of the bank is provided in the Appendix A. The name of the bank is changed to ABC District Cooperative Central Bank Ltd. and data is partially modified, while retaining its proportionality, to maintain confidentiality of the information not available in public domain.

RESULTS AND DISCUSSIONS

Governance

The ABC DCCB Ltd. has been incorporated under State Cooperative Societies Act and is functioning in its area of operation

of ABC district as per its byelaws. The bank is governed by the Board of Directors, representing affiliated PACS in its area and two professional co-opted directors. The board is headed by the President, who is elected by the board members from amongst themselves. The functions of formulating business strategies, setting policies as per the strategy & NABARD/ RBI regulations, and execution is governed by the board directly, through the sub-committees of the Board or through Chief Executive Officer (CEO) and other executive committees. As per NABARD guidelines, Risk Management Committee as a sub-committee of the Board has been setup, with the President, two professional directors, CEO and two General Managers (GMs) as members. Under the Risk Management Committee, an executive committee Asset Liability Management Committee (ALCO) is put in place. However, there are no Credit Risk Management Committee and Operational Risk Management Committee. Bank has a Compliance Officer to ensure compliance to various statutory/ regulatory guidelines, instructions, and compliance testing of its processes/ products. Bank has an Audit Committee as a sub-committee of the board. For ensuring separation of audit function and transparency in its audit and compliance mechanism, President and CEO are not members of the committee. Audit Committee of the Board carries out the important function of risk assurance to the board and gives necessary feedback for strengthening risk control measures. There is a Risk Management Policy which identifies various risks that can impact the functioning of the bank such as credit risk, operational risk, interest rate risk/ market risk, liquidity risk, capital risk, compliance risk. To manage the risks, document puts in place action plan for setting up robust Management Information System (MIS) to capture data such as large credit exposure, system generated asset classification and overdue reports, exception reports, Structural Liquidity and Interest Rate Sensitivity Statements, fund flow statements, setting up risk appetite for various categories and exposure limits. However, the policy was formulated in the fiscal year 2019 and has not been reviewed since then. The limits set by the policy were not reviewed in the agenda of the Committee. MIS was not full-fledged and did not generate all the reports. Bank may put in place a Credit Risk Management Committee and Operational Risk Management Committee to carry out executive functions of monitoring and controlling risk controls/ limits as per the policy. Limits set in the policy can be reviewed periodically and monitored through Risk Management Committee. Bank can identify Key Risk Indicators and adopt a mechanism of Risk Control and Self-Assessment (RCSA) at its business units such as branches and head office departments to analyze Operation Risk.

Liquidity Risk

As per NABARD guidelines on CAMELSC rating (2016), liquidity position of the bank was assessed. During 2022-23, the bank did not default in maintenance of CRR/ SLR or in repayment to higher financing agency and paid insurance premium to DICGC accurately and timely. Bank had an ALCO in place but was not meeting regularly. Funding liquidity position of the bank was sound with 18.9% growth of deposits from previous years and individual deposits being above 200% of the institutional deposits. Flow Approach: As per CAMELSC rating, bank was preparing SLS manually consolidating limited reports generated from their CBS. The assumptions in compilation of statements are given below. For the flow approach, RBI and NABARD have prescribed the banks to prepare SLS to analyse mismatches in various time maturity buckets. Bank had put limits for short-term mismatches viz., 1-14 days and 15-28 days. However, limits for all buckets were fixed. The SLS of the bank as on 31 March 2023 is as indicated in the Table 2.

Table 2. Structural Liquidity Statement of AB DCCB Ltd. as on 31 March 2023

Sr. No.									(₹ million)
	1 to 14 days	15 to 28 days	29 days and up to 3 months	Over 3 months and up to 6 months	Over 6 months and up to 1 year	Over 1 year and up to 3 years	Over 3 years and up to 5 years	Over 5 years	Total
A	5101.87	1071.45	1617.16	4279.75	10440.16	28876.55	15126.28	7366.05	73879.27
B	3758.41	490.33	4260.28	3707.75	11953.49	19693.43	21803.74	8211.83	73879.27
C	-1343.46	-581.12	2643.13	-572.01	1513.33	-9183.12	6677.47	845.78	0.00
D	-1343.46	-1924.58	718.55	146.55	1659.88	-7523.24	-845.77	0.00	0.00
E	-26.33	-54.24	163.44	-13.37	14.50	-31.80	44.14	11.48	
Where									
A = Total Outflows									
B = Total Inflows									
C = Mismatch (B-A)									
D = Cumulative Mismatch									
E = Mismatch as a % of Total Outflows									

(Assumptions in the statements are as follows: i. RBI guidelines issued to the RCBs are followed while bucketing the items. ii. Deposits: Current Accounts and Savings Deposits Accounts Core portion is taken as 85%, whereas volatile portion is taken as 15%. Term Deposits are taken as per the maturity dates. However, the reinvestment or foreclosure is not incorporated. iii. Borrowings are aligned as per the loans which the borrowings are refinancing. iv. Loans: For CC loans, during 2021 and 2022, around 60% of the loans were renewed. Hence, as per RBI guidelines, 60% of the loans were placed in 1-3 years category. Rest was as per limit due date. In Seasonal Agriculture Operations (SAO) for individuals, during 2021 and 2022, around 80% of the loans were renewed. As per RBI guidelines, 80% loans were placed in 1-3 years category. Rest was as per limit due date. For SAO loans for societies, during 2021 and 2022, 100% of the loans were renewed. Generally, societies renew the SAO loans regularly. Hence, all loans were placed in 3-5 years bucket.)

The observations are as follows:

- Against the limits set by the Bank for short-term mismatches viz., 1-14 days and 15-28 days of 20% each, there was a mismatch of 26.33% and 54.24% in the first two time buckets. Thus, the bank can face severe short term liquidity crisis in case of repayment of borrowings or if there is a sudden withdrawal of institutional deposits. It is necessary for the bank to place its liquid assets, over and above the requirement of CRR and SLR maintenance as prescribed by RBI.
- There was a positive mismatch in maturity bucket of 29 days-3 months of 163.44%. Bank can reinvest the assets to minimize the mismatches in first two buckets.
- There is a positive gap in maturity buckets of 6-12 months, 3-5 years, and 5+ years. Generally, banks design

their maturity profile in such a way that there is mismatch in the earlier time buckets to get the benefit of tenor premium/ tenor differences in its assets and liabilities to maximize profitability. Thus, the positive gaps in last two buckets indicate bank can make more profits.

iv. The liquidity position might improve if the behavioral pattern of deposits in reinvestment and foreclosure is incorporated in preparation of the statements. Deposits placed with other banks can be liquidated/ adjusted across time buckets to maintain liquidity.

Stock Approach helps identify the inter-relation between volatile liabilities, volatile assets, core deposits, long term assets. RBI (2012) and NABARD (2024) has suggested certain liquidity ratios and indicated the industry standards. Banks can also set their own limits. The summary is given against the industry average in Table 3.

Table 3. Stock approach ratios for liquidity

Sr. No.	Ratios	31.03.2020	31.03.2021	31.03.2022	Industry Average
1	Core deposits/Total Assets	48.08	48.53	50.27	>50
2	(Loans + mandatory SLR + mandatory CRR + Fixed Assets)/Total Assets	80.06	81.95	87.62	<80
3	(Loans + mandatory SLR + mandatory CRR + Fixed Assets)/Core Deposits	166.51	168.86	174.30	<150
4	Temporary Assets/Total Assets	19.94	18.05	12.38	<40
5	Temporary Assets/Volatile Liabilities	147.96	133.32	93.42	>60
6	Volatile Liabilities/Total Assets	13.48	13.54	13.25	<60

(Assumptions: i. Deposits are considered as 20% volatile and 80% core deposits. ii. Since the borrowings of the bank in Seasonal Agriculture Operations (SAO) are generally renewed, these short-term borrowings are not considered as a part of volatile liabilities.)

The observations are as follows:

i. The liquidity position of the bank is comparable to industry average or better when it comes to sources of funds. However, bank's uses of funds over the last three years have increased in illiquid assets. Thus, bank should ensure that bank keeps temporary assets more, and manage its loans and fixed assets.

ii. Bank may have other sources of funding liquidity such as overdraft facilities and put in place a contingency fund plan to avoid liquidity crisis in stressed scenario.

iii. Based on the flow approach as well as stock approach, bank needs to make provisions for sufficient liquid assets to avoid liquidity issue.

iv. Bank may have other sources of liquidity such as overdraft facilities and put in place a contingency fund plan to avoid liquidity crisis in stressed scenario.

v. The above indicate that apart from assessing liquidity position as per CAMELSC model, bank can use stock approach to understand risks.

vi. The results indicated moderate levels of liquidity risk.

Market Risk

Bank has not invested in any commodities or derivatives. Hence the main market risk it faces is interest rate risk and equity risk. Focus of the bank was on maintaining Net Interest Margin (NIM) of 3.00% and above. However, there was no cost of funds-based pricing of loans to maintain Net Interest Income (NII). Rates of interest of loans were fixed based on comparative rates in the other banks in its area of operation. For its investment portfolio, bank was not assessing the sensitivity of the portfolio to the changing interest rates. While making fresh investments, desired maturity was not analyzed.

A. Impact of changing interest rate scenario on Net Interest Income (NII)

As per CAMELSC model, the bank was having positive operating and net profit, Return on Assets was 0.61% and Return on Equity was 7.7% as on 31 March 2023. While assessing the impact on NII, based on IRSS, it is assumed that the Rate Sensitive Assets (RSA) and Rate Sensitive Liabilities (RSL) reprice at the midpoint of the time buckets. The impact would be from the midpoint of the time bucket till the end of the year. For example, RSA and RSL in 3-6 months' time bucket assumed to reprice from 4.5 months till the end of the year, i.e., for 7.5 months. If the RSA-RSL is positive, the change will increase NII over the period, whereas if RSA-RSL is negative, the change will decrease NII over the remaining period by amount $(RSA-RSL) * (7.5/12) * 2\%$. Generally, the impact of gap (RSA-RSL) is as given in Table 4.

Table 4. Impact of Gap on Net Interest Income

Gap Position	Change in Interest Rate	Change in Net Interest Income
RSA>RSL	Increase	Increase
RSA>RSL	Decrease	Decrease
RSA<RSL	Increase	Decrease
RSA<RSL	Decrease	Increase
RSA=RSL	Increase	No impact
RSA=RSL	Decrease	No impact

Source: Author's Compilation

Based on IRSS prepared manually by the bank in a similar way as SLS, and the calculation of impact of 2% rise/ fall in interest rate on NII over one year period is given in Table 5.

Table 5. Case Study: Impact of Gap on NII

Time Bucket	1 to 14 days	15 to 28 days	29 days and up to 3 months	Over 3 months and up to 6 months	Over 6 months and up to 1 year
Total Liabilities (A)	51018.69	10714.47	16171.56	42797.54	104401.62
Total Assets (B)	37584.13	4903.26	42602.82	37077.49	119534.94
Gap (B-A)	-1343.46	-581.12	2643.13	-572.00	1513.33
Bucket Start Point (years)	0.0027	0.04	0.079	0.25	0.5
Bucket End Point (years)	0.04	0.08	0.25	0.50	1
Bucket Mid-Point (years) [(H+I)/2]	0.02	0.06	0.1647	0.375	0.75
Repricing Period [I-J]	0.98	0.94	0.84	0.63	0.25
Impact on NII due to change by 2% [E*K*2%]	-26.32	-10.94	44.16	-7.15	7.57
Total Impact up to 1 year	7.32				
Net Interest Income during previous year (₹ million)	100				
Impact as % of NII of previous year	7.32%				

A rise in 2% interest rates would increase the NII by 7.32% over the next year. This is because of the large positive gap in ‘29 days - 3 months’ time bucket. Thus, though the bank will benefit in the rising rate of interest scenario, it will lose in the decreasing interest rate scenario. Bank can also set a limit of up to 5% and adjust its Rate Sensitive Gap accordingly. The analysis has certain limitations viz. i. repricing of all assets/ liabilities are considered at midpoint of the bucket ii. 2% change is considered as parallel shift iii. 2% change at the beginning of the year is followed by no change in rates. Changes are more complex practically.

B. Sensitivity of Investment Portfolio to Interest Rates

Bank has investments in Government of India securities (GSec) and State Development Loans (SDLs), primarily for its Statutory Liquidity Ratio (SLR) requirements. There is no trading in place. Securities once purchased are held till maturity. However, securities held till maturity also face interest rate risk because i. rising interest rates mean cost of opportunity/ excess income forgiven, and ii. Sale of securities at the time of sale for liquidity purposes can lead to loss in value of equity due to booking of capital losses. Hence, it is necessary that the bank analyses its sensitivity to interest rates and makes prudent decisions while making fresh investments. Though the bank is not making active investment decisions for managing its portfolio, its portfolio duration against past five years (from 30 September 2018 to 31 March 2023) is shown in graph in Figure 1.

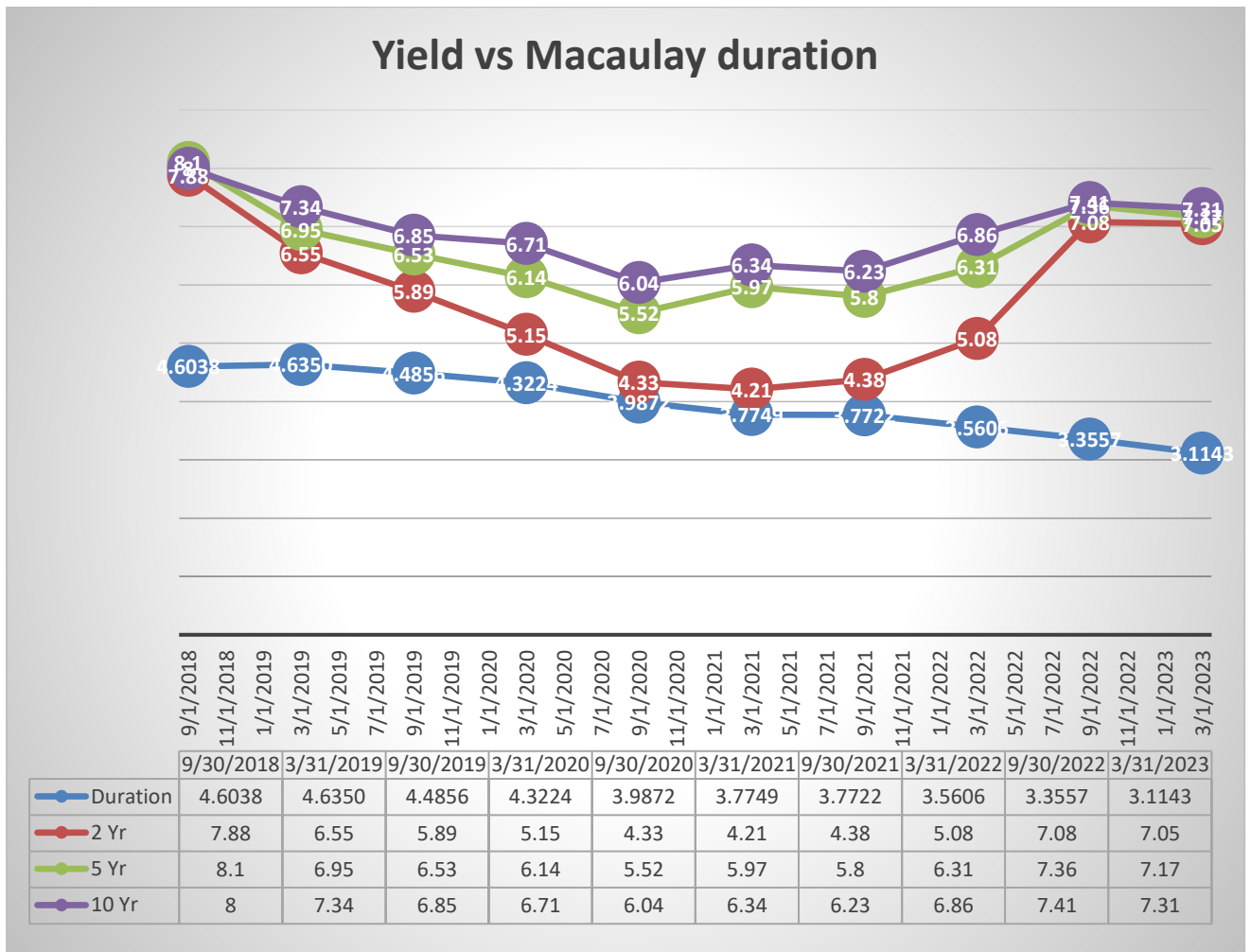


Figure 1. Yield Vs Macaulay Duration of bank’s investment portfolio

The findings are as follows:

i. The Macaulay Duration of the investment portfolio of the bank has reduced from 4.60 to 3.11. There is a weak correlation between interest rate scenario (Yield) and Duration. This is primarily because the bank made investments in 2016-17 in SDLs of 10-year maturity period and is since held till maturity. Thus, very few securities replace earlier portfolio with time. Any new securities are purchased for a maturity period of ten years. Thus, over the last few years, the maturity profile of its portfolio has spread evenly, similar to a maturity ladder. Hence, Duration of the portfolio has been reducing with time.

ii. Modified Duration of the portfolio, which determines the sensitivity of the prices to the interest rate movements, as on 31 March 2023 was 0.08. Thus, 1% increase in rate will reduce the price of the portfolio by 0.08%. The underlying assumption in calculation of sensitivity is that there is parallel shift in the yield curve.

iii. Analysis of fresh investment decisions of the bank during 2022-23 indicates that bank had purchased three securities, viz SDL 7.10% MH SDL 2036 with face value ₹200 million and 6.19% GOI 2034 with face value ₹100 million each. Based on the yield curve analysis as seen from the Figure 3, the interest rates were on an increasing trend, with spread between 2-year yield and 10-year yield decreasing. Since the yield curve was flattening combined with increasing rates, the bank could have made investments in securities which were maturing in 2-3 years, so that the investment would be re-priced sooner. However, the bank had made investments in securities of longer maturity period. Thus, even though the Macaulay Duration of the portfolio is lesser, investing in longer maturity period may incur loss of opportunity of reinvestment and would impact NII in the future. Thus, the bank should analyze yield curve before making investments.

C. Fixing interest rates on loans for maintaining Net Interest Margin

As indicated above, the focus of the Bank was on maintaining Net Interest Margin (NIM) of 3.0%. It is necessary that the interest rates of loans/ deposits are fixed based on cost of funds or external benchmark.

The bank is fixing its interest rates on deposits and loans based on the prevalent rates of competitors (Commercial Banks, RRBs, StCB). For this case study, we will assume that interest rates on deposits are based on demand/ market rates. Thus, the bank has control only over the rates on loans. The areas of portfolio which can be controlled are in Table 6.

Table 6. Loan portfolio where bank has freedom to fix interest rates

(₹ million)					
Sr. No.	Type of Loan	Amount O/s	% to Total Loan O/s	Rate of Interest	Remarks
1	SAO Loans from borrowing	8576.00	16.26	6.00	Wherever Seasonal Agricultural Operation (SAO) funds are available from Government of India, and funds are passed on to PACS for on-lending, rate is fixed by StCB at 6.00% to extend the loan to ultimate borrower at 7.00%.
2	SAO Loans own funds	3730.2.9	7.07	8.50	Wherever own funds are involved, interest subvention of 1.5% is granted, raising rate to effectively 7.00+1.50=8.50%.
3	Agri LT Loans to Societies	8958.70	17.00	8.50	Loans for which refinance is available from NABARD under Long Term Rural Credit Fund (LTRCF), composite rates are fixed by StCB at 8.50% to PACS for on-lending.
4	Agri LT Loans to Individuals	4688.58	8.89	10.50	As per above, the rate for ultimate borrower is fixed at 10.50%.
5	Other Loans	26775.14	50.78	As per Bank	Bank is free to fix its rates on this portfolio.
6	Total	52728.71	100.00		

Thus, we can see that bank can have leverage on up to 50% of its portfolio for fixing interest rates to maintain desired NIM.

D. Marginal Cost of Funds Based Lending Rates (MCLR)

As the bank issues all the loans as per fixed rate of interest (not floating rate), there is no reset date for rates. RBI guidelines for assessment of MCLR (2023) for the commercial banks will be used, based on the data available with the bank. As per the guidelines, wherever loans are issued at fixed rate up to three years, loans should not be given less than MCLR up to that tenor.

The MCLR comprises of:

- I. Marginal cost of funds;
- II. Negative carry on account of CRR;
- III. Operating costs;
- IV. Tenor premium.

I. Marginal Cost of Funds

The calculation for marginal cost of funds as on 31 March 2023 are given in Table 7.

Table 7. Calculation of marginal cost of funds as on 31 March 2023

Type of Funds	Amount Outstanding	Rate of interest	Marginal Cost of Funds	O/S as % of funds other than equity/ capital funds	(₹ million)
					Marginal Cost () X (4)
	(1)	(2)	(3)	(4)	(5)
Current Account	1666.44	0.00	0.00	2.49	0.00
SB Deposits	16778.00	3.50	58721.25	25.02	0.88
Fixed Deposits	26829.62	6.25	167685.11	40.02	2.50
ST Borrowings	8576.00	5.00	42880.00	12.79	0.64
LT Borrowings	9042.01	6.50	58773.04	13.49	0.88
SHG Borrowing	2501.79	10.50	26268.75	3.73	0.39
Marginal Cost of Funds	65393.35		354328.16	100.00	5.28

- a. The marginal cost of Borrowings for the Bank was 5.28%
b. Return on Net Worth desired (achieved as on 31 March 2023): 7.72%
c. Marginal Cost of Funds = 92% of Marginal Cost of Borrowings + 8% of Return on Net worth = (92% x 5.28) + (8% x 7.72) = 5.47%

As per RBI, 8% is the Core Tier I equity for commercial banks. However, since no such ratio is prescribed for RCBs, we will also consider 8% as core equity.

II. Negative carry on Cash Reserve Ratio (CRR)

Negative carry on the mandatory CRR which arises due to nil return on CRR balances, was as under:

$$\text{Required CRR} \times (\text{marginal cost}) / (1 - \text{CRR}) = 0.04 \times 5.47 / (1 - 0.04) = 0.23\%$$

III. Operating Cost

All operating costs associated with providing the loan product including cost of raising funds, after subtracting services which are separately recovered by way of service charges, as a percentage of marginal cost of funds is:

$$\text{Operating Cost} = ₹638.75 \text{ million}$$

$$\text{Operating Cost} / \text{Average Earning Assets} = 1.99\%$$

IV. Tenor Premium

Tenor Premium is considered according to premium for corresponding tenor over Government securities as on 31 March 2023 as published on FBIL website.

V. Marginal Cost of Funds Based Lending Rate (MCLR)

Table 8. MCLR for the different time tenors

Sr. No.	Time to Maturity	Marginal Cost of Funds	Negative Carry on CRR	Operating Cost	Tenor Premium	MCLR
1	Overnight	5.47	0.23	1.99	0.00	7.69
2	Up to one month	5.47	0.23	1.99	0.04	7.73
2	Up to 3 months	5.47	0.23	1.99	0.13	7.82
4	Up to 6 months	5.47	0.23	1.99	0.62	8.31
5	Up to 1 year	5.47	0.23	1.99	0.63	8.32
6	Up to 3 years	5.47	0.23	1.99	0.64	8.33
7	Up to 5 years	5.47	0.23	1.99	0.64	8.33

Since the bank issues loans on fixed rates of interest, it is pertinent for the bank to assess MCLR up to five years, which may be used for long term loans above three years.

The earning assets, however, give different yield or the rates are fixed as per refinancing agencies. Contribution of each asset in the yield is given in Table 9.

Table 9. Composition of earning assets and their yields

Sr. No.	Type of Loan	Amount O/s	% to Total Loan O/s	(₹ million)	
				Rate of Interest	
1	SAO Loans from borrowings	8576.00	12.38	6.00	
2	SAO Loans own funds	3730.29	5.39	8.50	
3	Agri LT Loans to Societies	8958.70	12.95	8.50	
4	Agri LT Loans to Individuals	4688.58	6.78	10.50	
5	Deposits with Other banks	7233.64	10.45	6.00	
6	SLR investments	8314.22	12.02	7.46	
7	Shares and MF	929.01	1.34	6.00	
8	Other Loans	26775.14	38.69	As per Bank	
9	Total	52728.71	100.00		

The observations are:

- i. In case of loan products banks where bank is free to fix interest rates, it can have different spread according to desired loan portfolio, credit risk premium, tenor of the loan product.

ii. For example, considering that bank wants to issue all the loans with five years tenor and link its rates with 3yr MCLR, then to achieve 8.33% from the entire earning portfolio, bank will have to charge rate at the 9.54% ($8.33 \times 100 = x \times 38.69 + \Sigma \text{ Sum Product of other assets}$). Thus, the spread will be 1.21%.

iii. Present interest rates of the bank range from 10.00% to 11.00%. Thus, the rates are comparable or more than MCLR + spread. Bank can fine tune their rates as per desired incremental loan portfolio.

iv. If the bank wants to vary the rate of interest as per the borrower's credit risk, it can categorize its customers as per customer score or internal rating method. A preliminary analysis is done in following sections.

As seen from the findings, the NII was highly sensitive to change in rate of interest. The bank needs to set limits to the sensitivity of the Rate Sensitive Gaps on the NII up to 1-year residual period. Investment portfolio of the bank was low at 3.11 and Modified duration was also low at 0.08%. It can adopt the principles of Marginal Cost of Funds based Lending Rate (MCLR) for ensuring consistent Net Interest Margin. Bank may analyze its investments portfolio on a periodic basis to assess the duration and modified duration, desired duration of the portfolio. Compared to CAMELSC ratios, bank had overall low interest rate risk.

Credit Risk

Bank is having effective recovery efforts to have minimum Non-Performing Assets (NPAs). As on 31 March 2023, the Gross NPA to Gross Loans and Advances was 1.42%. Net NPA to Net Loans and Advances was 0.0%. Substandard NPA composed 80.40% of total NPA. The loans were not concentrated in any one portfolio. Thus, there was low concentration risk.

There was no analysis of quick mortality loans, or loans becoming overdue before effecting recovery. Quick mortality loans are those which become NPA within one year of the sanction. In the bank, many loans are agricultural advances which become NPA after two crop seasons since overdue, whereas many accounts have moratorium period. Hence, for considering quick mortality loans, NPA accounts, which became overdue within one year from the date of first instalment was considered. It was observed that as on 31 March 2023, 30.35% of total NPA amount was which had become overdue within one year of instalment start date. Thus, bank needs to focus on NPA slippage and can focus on attracting customers which have lesser probability of defaulting, than focusing on recovery and collateral.

There was no mechanism of credit rating or credit scoring of customers to assess probability of default in the bank. There was also uniform fixing of interest rates for one loan product. There was no concept of risk premium for a customer. Similarly, there was no rating for loans given to societies, or business units.

A. Altman's Z-Score Model

Loans issued to PACS for their own business activities stand only 1% of the total loans as on 31 March 2023. However, bank has issued loans to individuals, proprietors, firms, milk producer companies for business activities. Bank can evolve a rating system as a part of loan appraisal. The Z-score Model for private non-manufacturing industries is:

$$Z = 6.56(X1) + 3.26(X2) + (6.72X3) + (1.05X4)$$

Where

X1 = (current assets – current liabilities) / total assets

X2 = retained earnings / total assets

X3 = earnings before interest and taxes / total assets

X4 = book value of equity / total liabilities

Zones of discrimination:

$Z > 2.6$ – "safe" zone

$1.1 < Z < 2.6$ – "grey" zone

$Z < 1.1$ – "distress" zone

Following the model, probability of insolvency/ bankruptcy was arrived at for only PACS, since data on other borrowing units were not available. The PACS are audited by the Registrar and Audit classification is awarded to these societies. Audit classification incorporates important financial performance parameters, along with other governance and internal checks parameters. The Z-Score of societies were compared with the audit classification since bank was not performing any separate internal rating. The results are in Table 10.

Table 10. Z-Score vs Audit classification of PACS

Z-Score zones/ Audit Classification	A	B	C	Total
Safe zone	6	5	2	13
Grey zone	43	31	6	80
Distress zone	15	9	9	33
Total	64	45	17	126

As can be seen, the functioning of a PACS, its profitability, solvency and governance is reflected in the Z-score up to a certain extent as follows:

- i. Given the Audit rating A, 76.56% are in Safe zone or Grey zone.

- ii. Given the Audit rating B, 80.00% are in Safe zone or Grey zone.
- iii. Given the Audit rating C, 52.94% are in Distress zone.
- iv. However, given the society is in Distress zone, 72.72% have Audit rating A or B. This might be because audit ratings incorporate parameters other than only financial position, or the Z-Score has false positives (positive being distressed).

Nonetheless, Z-Score model gives an indication of the exposure to credit risk while financing any society or unit.

B. Credit Scoring

For scoring of customers, statistical model of logistic regression was used. Out of 49.78% loans outstanding, loans extended to Self Help Groups (SHGs), Joint Liability Groups (JLGs), jewel loans were excluded. Only loans to individuals were considered. Bank had a total of 8571 loan accounts. For the same, parameters for an individual available in CBS were taken and measured against the respective default probability. The Weight of Evidence (WoE) and Information Value (IV) of the available parameters were calculated in Table 11:

Table 11. Weight of Evidence (WoE) and Information Value (IV)

Gender						
Category	Non-Events	Events	% of Non-Events	% of Events	WOE	IV
Male	5592	345	69.28	69.14	0.0019974	0.0003
Female	2480	154	30.72	30.86	-0.004489	0.0006
Total	8072	499				0.0009
Profession						
Category	Non-Events	Events	% of Non-Events	% of Events	WOE	IV
Agriculture	4878	268	60.43	53.71	0.1179531	0.7931
Allied-Agriculture	988	35	12.24	7.01	0.5567842	2.9097
Business	1344	187	16.65	37.47	-0.811254	16.8942
Employee	862	9	10.68	1.80	1.7784802	15.7845
Total	8072	499				36.3814
Marital Status						
Category	Non-Events	Events	% of Non-Events	% of Events	WOE	IV
Single	895	46	11.09	9.22	0.1846319	0.3451
Married	7177	453	88.91	90.78	-0.020806	0.0389
Total	8072	499				0.3840
Income Slab						
Category	Non-Events	Events	% of Non-Events	% of Events	WOE	IV
Up to 0.1 mn	4667	328	57.82	65.73	-0.128292	1.0153
0.1-0.5 mn	2103	140	26.05	28.06	-0.074073	0.1484
0.5-1 mn	1098	25	13.60	5.01	0.9988193	8.5824
Above 1 mn	204	6	2.53	1.20	0.7428101	0.9841
Total	8072	499				10.7302
Area in the District						
Category	Non-Events	Events	% of Non-Events	% of Events	WOE	IV
A	1779	87	22.04	17.43	0.2343481	1.0790
B	2478	108	30.70	21.64	0.3495254	3.1651
C	1561	114	19.34	22.85	-0.166667	0.5845
D	1926	161	23.86	32.26	-0.301754	2.5360
E	328	29	4.06	5.81	-0.357833	0.6256
Total	8072	499				7.9902

It can be seen from Table 11 that apart from Information Value of 'marital status,' IV of other variables are either exceedingly small or exceptionally large, which makes the parameters not useful to make prediction about default probability. The possible reasons could be:

- i. The number of events (defaults) as a proportion to total event is extremely low.
- ii. The entries made in the CBS by the banking staff might be incorrect. Thus, it is necessary to obtain and feed correct and more customer information in CBS to get correct output.
- iii. Overall data is very less. The data on customers for which bank is lending indirectly, i.e., by on-lending through PACS, is not available. It can add to the value of data.

Apart from CAMELSC credit risk indicators of Gross NPAs, Net NPAs, bank may analyze quick mortality or expenses in recovering overdue loans. Bank may also explore profiling of its customers based on credit scoring mechanism based on historical data and creating logistic regression or neural networks model and can also assess the solvency of borrowing units/societies using Altman's z-score model.

Capital Management

The capital augmentation of bank was done only based on share linkage on extended loans or from net profits. There was no capital charge based on credit risk, market risk or operational risk since the bank was monitored under Basel I norms. However, there was no analysis of incremental capital to incremental risk weighted assets. Similarly, effect of losses/ return

on net worth is not assessed on a periodic basis.

Current CRAR of the bank is at 10.36%. For maintenance of CRAR at the same level, bank needs to have Return on Assets on incremental assets as given in Table 12.

Table 12. RoA required for incremental Risk Weighted Assets

Particulars	Present	Incremental RWA	Incremental Capital Required for 10% CRAR	Return on Assets assuming no dividend*	Return on Assets assuming 5% share-linkage and no dividend	RoA assuming 5% share linkage and 6% dividend
Capital	100		10		=5/0.7=7.14	=5/0.7=7.14
RWA*	1000	100=1100		=10/1100=0.91%	=5/1100=0.45%	=(5+6.6)/1100=1.05%
RWA with 70% Risk Weight of Assets**				=(10/1100) *0.7 =0.64%	=(5/1100) *0.7 =0.32%	=[(5+6.6)/1100] *0.7 =0.74%

* It is assumed over here that all incremental assets have 100% Risk Weight.

**It is assumed that incremental assets have 70% risk weight (based on 31 March 2022)

Bank had RoA of 0.63% and 0.61% during last two years. RoA is not sufficient if it is to declare 6% dividend, as per mandate. Thus, CRAR will reduce in future. Hence bank should review continuously on following indicative parameters to ascertain capital adequacy

- i. NII
- ii. Cost of Management (Operating Cost)
- iii. Risk Cost (Cost of provisions/ write-off)
- iv. RoA

Though bank had CRAR above minimum regulatory requirement of 9.00% as per CAMELSC model, bank can adopt a mechanism of Internal Capital Adequacy Assessment Process (ICAAP) conduct stress tests to analyse impact on capital adequacy due to adverse conditions for example 2% rise in interest rates, 5% increase in NPAs, wage revisions, etc.

CONCLUSIONS

The application of various guidelines issued by RBI and NABARD indicate that though the bank had strong financials, there was moderate liquidity risk, low interest rate risk and moderate credit risk in institutional clients viz. PACS and had limitation in capturing credit risk of its retail customers. The capital adequacy assessment also indicated the bank had insufficient RoA to give dividend as per its mandate. Bank did not have governance mechanism in place such as Credit Risk Management Committee or having effective ALCO to carry out executive functions of monitoring and controlling risk controls/ limits as per the policy. The application of tools such as Macaulay Duration and Modified Duration for assessment of Investment portfolio of the bank, MCLR for interest rate setting, Altman's Z-Score and logistic regression for its clients in a DCCB are the novel features of this study. This study will be helpful in pushing forward an overall understanding the risks present in a Rural Cooperative Bank, especially a DCCB and also limitations of the capacity of the bank in dealing with these risks.

The primary limitation of the study was unavailability of accurate data, because of which various assumptions were made while preparing the statements or while conducting analysis. Another limitation is that the portfolio and functioning of a DCCB being highly localized, these risks may vary in other DCCBs across regions.

The practices discussed in the paper can help the Rural Cooperative Banks adopt risk governance to manage future risks to its financial position. It can also help the banks for preparing itself for Enhanced CAMELSC Supervisory Rating framework to be adopted by NABARD/ RBI, as a step towards Risk Based Supervision (RBS).

Future studies may look into risk management aspects of RCBs, especially credit risk and capital management since there has been limited studies in this area.

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APPENDICES

Appendix A: Comparative Financial Position of the ABC District Cooperative Central Bank Ltd.

		(₹ million)		
Sr. No.	LIABILITIES	31/03/2021	31/03/2022	31/03/2023
1	Paid-up Capital	2091.45	2354.72	2731.14
2	Reserves and Surplus	1049.65	1467.72	1870.34
3	Deposits	32799.49	38069.12	45273.56
a	Fixed Deposits	22478.50	26408.48	26829.62
b	Savings Deposits	9377.42	10104.20	16777.50
c	Current deposits	943.58	1556.45	1666.44
4	Borrowings	16773.53	18695.97	20119.79
a	SAO Borrowing	7920.00	11056.00	8576.00
b	SHG Borrowing	1189.36	865.24	2501.79
c	Long Term Loan	7629.59	6740.57	9007.84
d	ICDP Borrowing	34.58	34.16	34.16
5	Interest Payable on	830.11	788.82	729.90
a	Deposits	81.69	434.85	156.01
b	Borrowings	748.42	353.97	573.89
6	Branch Adjustments (Net)	3.77	0.00	13.16
7	Provision made	1477.04	1739.37	2229.43
a	Provision for Standard Loans	139.70	170.00	210.00
b	Provision for NPAs	970.79	1186.79	1626.79
c	Overdue Interest Reserve	49.95	49.95	49.95
d	Provision for investment depreciation	0.04	16.06	26.12
e	Provision for other assets	316.56	316.56	316.56
8	Other Liabilities	623.15	838.80	911.95
a	Bills Payable/ DDS payable	379.70	434.58	444.91
b	Subsidy Reserve Fund	243.45	404.22	467.04
9	Total Outside Liabilities	51030.04	58392.72	67048.36
10	Total Liabilities	55648.18	63954.52	73879.27
11	Contingent Liabilities	14.94	25.19	33.32

Sr. No.	ASSETS	31/03/2021	31/03/2022	31/03/2023
1	Cash in Hand	904.88	2014.69	1498.73
2	Balances in Current Account	565.51	1138.60	1102.63
3	Term Deposits with other banks	7328.48	7831.25	7233.64
4	Call and short notice money	0.00	0.00	740.00
5	Investments	9040.17	9650.21	9243.24
a	Govt. securities	6693.61	8511.60	8314.22
b	Shares with other cooperatives	512.02	749.02	909.02
c	Mutual Funds	1834.54	389.59	20.00
6	Loans and Advances	35701.09	42064.44	52728.71
A	To Societies	17737.54	20680.32	21515.24
a	SAO/ KCC Loans	9946.63	11442.67	12029.07
b	LT Loans	7388.07	8835.67	8958.70
c	CC Loans to Societies	319.79	360.00	496.45
d	Term Loans to Societies	83.05	41.99	31.03
B	To Individuals	17963.55	21384.11	31213.47
a	SAO/ KCC Loans	102.48	180.15	277.22
b	LT Loans	0.00	0.00	4688.58
c	Retail Loans	17861.07	21203.96	26247.66
i	CC Loans	952.92	1267.15	1671.31
ii	SHG	2139.04	3067.94	3680.51
iii	Rural Housing	2555.37	3509.08	5756.18
iv	Jewel Loans	4650.64	5961.30	6861.59

v	Others	7563.11	7398.49	8278.08
7	Interest Receivable on	1154.76	248.24	227.30
a	Investments	276.55	248.24	227.30
b	Loans and Advances	878.21	0.00	0.00
8	Fixed Assets	369.62	386.40	438.63
9	Other Assets	583.67	620.70	666.40
10	Total Assets	55648.18	63954.52	73879.27

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