Pre and Post Merger Analysis of Non-Performing Assets of Public Sector Banks (PSBs) in India

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Abstract: Public Sector Banks (PSBs) in India have undergone significant consolidation since 2017 to address persistent Non-Performing Assets (NPA) crises that peaked at 11.2% of gross advances in 2018. This research evaluates the pre- and post-merger performance of six major PSBs (State Bank of India, Bank of Baroda, Punjab National Bank, Canara Bank, Indian Bank, and Union Bank of India) using the CAMEL framework over a 10-year period (5 years pre-merger and 5 years post-merger). Using descriptive statistics, ratio analysis, and paired t-tests, this study examines whether bank consolidation effectively improved asset quality, capital adequacy, management efficiency, earnings, and liquidity. Key findings reveal statistically significant improvements across all CAMEL dimensions post-merger, with Gross NPA ratios declining by 2-4.5 percentage points, Capital Adequacy Ratios increasing by 2.5-4.2 percentage points, and Return on Assets more than doubling for most banks. The analysis validates consolidation as a viable strategic tool for strengthening PSBs, though sustained improvements require complementary reforms in credit appraisal, governance, and NPA resolution mechanisms. This study contributes to empirical evidence on merger effectiveness in emerging-market banking and provides actionable insights for policymakers and bank management.
Keywords: Non-Performing Assets (NPA), Bank Mergers, Public Sector Banks, CAMEL Model, Asset Quality, Capital Adequacy, Post-Merger Performance, Indian Banking Consolidation, Financial Performance, Risk Management.

Introduction - The Indian banking sector, particularly Public Sector Banks (PSBs), has undergone transformative structural reforms over the past decade, with bank consolidation emerging as a pivotal policy intervention to address systemic challenges. Public Sector Banks form the backbone of India's banking system, accounting for approximately 60-65% of total banking assets and serving over 400 million customers across rural and urban regions. These institutions play a dual role as commercial entities and instruments of government policy, implementing critical financial inclusion initiatives such as the Pradhan Mantri Jan Dhan Yojana (PMJDY) and priority sector lending mandates[1].

However, despite their developmental significance, PSBs have grappled with a persistent challenge that has shaped banking sector dynamics for over a decade: Non-Performing Assets (NPAs). The surge in NPAs—particularly the alarming peak of 11.2% of gross advances in 2018—exposed structural weaknesses in credit appraisal, risk management, and governance within these institutions. This asset quality crisis not only eroded capital bases and profitability but also constrained credit flow to productive sectors, thereby hampering broader economic growth[2].

Non-Performing Assets: Definition and Classification
NPA Definition: A loan where principal or interest is overdue for more than 90 days[3].

Type of Assets	Definition	Provisioning
Standard Assets	Regular payments, normal risk	0.25-1%
Sub-Standard	Non-performing < 12 months	15-25%
Doubtful	Non-performing > 12 months	25-100%
Loss Assets	Uncollectible	100%

Table 1: NPA Classification Framework

Historical NPA Trajectory in Indian Banking
1.   **1990s:** Initial phase post-liberalization; Gross NPAs exceeded 15% (1993-94)
2.   **2000s:** Reforms and economic growth; NPAs fell below 3% by 2008
3.   **2008-2014:** Post-Global Crisis; lending boom masks rising stress
4.   **2015-2018 Crisis:** Asset Quality Review exposes hidden bad loans; Gross NPA peaks at 11.2% (2018)
5.   **2019-2024:** Reforms and consolidation; Gross NPAs decline to <3% (FY2024)

Key Causes of NPA Surge in PSBs
1.   **Poor Credit Appraisal:** Weak due diligence during boom periods (2004-2011)
2.   **Sectoral Stress:** Infrastructure, steel, power sectors

hit by downturn

3. Political Interference: Directed lending ignoring creditworthiness

4. Weak Governance: Lack of accountability and monitoring in PSBs

5. Legal Delays: Poor recovery mechanisms before IBC (2016)

Major PSB Mergers (2017-2020)

The consolidation strategy unfolded in two phases:

1. Phase 1 (2017): State Bank of India merged with 5 Associate Banks + Bharatiya Mahila Bank

2. Phase 2 (2019): Bank of Baroda merged with Vijaya Bank + Dena Bank

3. Phase 3 (2020): Mega-mergers created four strong institutions:

i. Punjab National Bank ← Oriental Bank of Commerce + United Bank of India

ii. Canara Bank ← Syndicate Bank

iii. Union Bank of India ← Andhra Bank + Corporation Bank

iv. Indian Bank ← Allahabad Bank

Strategic Objectives Underlying These Mergers:

1. Strengthening capital bases to meet Basel III and regulatory requirements.

2. Achieving economies of scale and operational efficiencies; branch rationalization, cost reduction.

3. Improving credit appraisal and risk management through better governance integration.

4. Creating institutions robust enough to absorb stressed assets and finance large infrastructure projects.

Research Problem Statement:

1. Limited comprehensive analysis of NPA trends in Indian PSBs before and after mergers.

2. Gap in empirical evidence on whether mergers effectively reduce NPAs.

3. Unclear long-term sustainability of merger-driven NPA improvements.

4. Need for policy evaluation on mergers as a viable instrument for banking sector health.

5. Limited framework linking merger outcomes with asset quality indicators.

Literature Review

Maheswari & Reddy (2022)[4] found that the NPA problem in India is more due to lending to non-priority sectors and sensitive sectors such as personal loans and real estate loans. There is a significant difference in non-performing assets of public sector banks and private sector banks. Management of NPAs in private sector banks is better than public sector banks, with higher ratios of gross and net non-performing assets in PSBs compared to private sector banks[4].

Adhana & Raghuvanshi (2020)[5] documented the Government of India's consolidation plan unveiled on 30th August 2019 to merge 10 public sector banks into four, reducing the number of state-owned banks from 18 to 12. Key factors for the mergers included technological platform, customer reach, cultural similarities, and competitiveness. The authors emphasized that this consolidation aimed to create "next-generation" financial institutions with stronger balance sheets and bigger risk appetite[5].

Agarwala & Agarwala (2019)[6] found that the growth rate of NPAs in private sector banks is lower as compared to nationalized banks and SBI and its associates. The nationalized banks and associate banks of SBI failed to handle poor loans effectively, resulting in phenomenally high growth in NPAs[6].

Serwadda (2018)[7] analyzed the effect of credit risk management on the financial performance of Ugandan commercial banks (2006-2015). The study revealed that credit risk management impacts bank performance, with non-performing credits inversely affecting performance and opening banks to illiquidity and financial emergency. The author recommended upgrading credit risk management strategies and designing suitable credit policies with proper monitoring[7].

Isanzu (2017)[8] analyzed the effect of credit risk on the monetary performance of Chinese banks using data from 2008 to 2014. The study revealed that non-performing advances and capital adequacy have a critical effect on financial performance of Chinese commercial banks, highlighting the need to control credit risk for bank financial performance[8].

Lalon (2015)[9] emphasized that default clients have been a major problem for banking financial institutions for long, with banks continuously trying to minimize default risk problems through policy directives and regulatory guidance from central banks[9].

Rationale of Study: The primary rationale for this study is to examine the influence of mergers on the asset quality of Public Sector Banks in India, with a particular focus on Non-Performing Assets (NPAs). The Indian banking sector has undergone significant transformation through consolidation, particularly via mergers among Public Sector Banks (PSBs), aimed at improving financial stability, efficiency, and asset quality. Therefore, understanding pre-merger and post-merger trends of NPAs is critical to assess whether bank consolidations achieve their intended objectives. This study provides empirical insights into the effectiveness of mergers as a strategy for improving asset quality, contributing to both academic research and policy formulation in the Indian banking sector.

Research Questions: The study is guided by the following research questions:

1. How have the mergers of Public Sector Banks in India affected the level of Non-Performing Assets (NPAs) in the post-merger period compared to the pre-merger period?

2. What is the comparative performance of merged banks in terms of CAMEL parameters (Capital Adequacy, Asset Quality, Management Efficiency, Earnings, and Liquidity) before and after the merger?

3. Have mergers led to a statistically significant improvement in the Asset Quality and reduction of NPAs in PSBs?
4. What trends can be observed in earnings performance, liquidity management, and capital adequacy post-merger?
5. To what extent have mergers contributed to improving operational efficiency and overall financial stability in the Indian public sector banking system?
6. How do internal (management, efficiency) and external (macroeconomic, policy) factors influence the post-merger performance of PSBs with respect to NPAs?

Research Objectives:

Primary Objective: To evaluate and compare the pre- and post-merger performance of selected Public Sector Banks in India with a specific focus on Non-Performing Assets (NPAs), using CAMEL models.

Secondary Objectives:
1. To examine the trend and composition of NPAs in selected PSBs during the pre- and post-merger periods
2. To assess the impact of mergers on the financial soundness and stability of PSBs using the CAMEL model parameters
3. To investigate whether mergers have resulted in significant improvements in asset quality and reduction of NPAs
4. To identify key determinants influencing post-merger NPA management, including internal management efficiency and policy interventions
5. To offer policy implications and recommendations for strengthening merger strategies and NPA resolution mechanisms in PSBs

Research Hypotheses:
1. H_{01}: There is no significant difference in the Capital Adequacy Ratio (CAR) of PSBs between the pre- and post-merger periods.
2. H_{02}: There is no significant difference in the Asset Quality (measured through Gross and Net NPA ratios) between the pre- and post-merger periods.
3. H_{03}: There is no significant change in Management Efficiency indicators (Operating Profit per Employee, Business per Employee) before and after the merger.
4. H_{04}: There is no significant change in the Earnings and Profitability (ROA, ROE, Net Profit Margin) of PSBs post-merger.
5. H_{05}: There is no significant difference in Liquidity Ratios (CRR, LCR, Current Ratio) before and after the merger.

Research Methodology: This chapter outlines the methodological framework adopted for the study titled "Pre and Post Merger Analysis of Non-Performing Assets of Public Sector Banks (PSBs) in India." The chapter explains the research design, data collection methods, sampling techniques, sample selection, variables and model (CAMEL), and statistical tools used to evaluate the pre- and post-merger financial performance of selected banks.

The methodological design ensures that the analysis remains both quantitative and comparative, enabling valid inferences about whether mergers have effectively improved asset quality, profitability, and overall financial stability in Indian PSBs.

Research Approach: Quantitative and qualitative research strategies are the two most common approaches to a study. The quantitative paradigm is a research strategy that prioritizes numerical data gathering over statistical models in determining the nature and strength of a link between a set of dependent and independent variables. A quantitative research strategy is used in this work. The purpose of quantitative research approaches is to find significant correlations between variables in a study. As a result, this study takes a quantitative approach to examine if there is a link between NPAs and financial performance.

Research Design:
1. **Descriptive aspect:** To describe and summarize the financial performance and NPA trends in PSBs before and after merger events
2. **Analytical aspect:** To statistically evaluate differences in performance indicators across the two periods using the CAMEL models
3. **Comparative longitudinal approach:** The study adopts a comparative longitudinal design, observing performance over a defined timeline (5 years before and 5 years after the merger)

Population and Sample Selection

Parameter	Description
Population	All Indian Public Sector Banks (PSBs) that underwent mergers between 2017-2020
Sampling Technique	Purposive sampling (based on availability of complete financial data for at least 10 years)
Sample Banks	1. State Bank of India (SBI) \newline 2. Bank of Baroda (BoB) \newline 3. Punjab National Bank (PNB) \newline 4. Canara Bank (CB) \newline 5. Indian Bank (IB) \newline 6. Union Bank of India (UBI)
Sample Period	10 years: 5 years pre-merger and 5 years post-merger (bank-specific timeline)

Table 2: Population and Sample Selection Framework

Nature and Source of Data

Source	Type of Data Collected
Annual Reports of Selected PSBs	Financial statements, NPA ratios, profitability indicators
Reserve Bank of India (RBI) – DBIE	Macro-level data on capital adequacy, NPAs, liquidity ratios
CMIE Prowess/ Money Control/ Capitaline	Time-series data on key financial ratios
Ministry of Finance Reports	Policy and merger documentation
Indian Banks' Associ -ation (IBA) Reports	Sectoral performance statistics

Table 3: Data Sources and Collection Framework

Analytical Framework: CAMEL Model Parameters and Indicators

The CAMEL framework evaluates bank performance across five dimensions[10]:

Table 4: (see in last page)

Analytical Tools and Techniques:

1. **Descriptive Statistics:** To summarize data through mean, median, standard deviation, and coefficient of variation for each variable.

2. **Ratio Analysis:** To compute and compare key financial ratios for pre- and post-merger periods.

3. **Trend Analysis:** To examine movement patterns in NPAs, profitability, and efficiency indicators.

4. **Paired t-Test:** To statistically test whether there is a significant difference between pre- and post-merger means for each indicator.

5. **Correlation Analysis:** To determine relationships among variables such as NPAs, ROA, CAR, and Liquidity.

6. **Regression Analysis:** To assess how merger-related variables impact NPAs and profitability.

Data Analysis Process:

1. **Data Extraction:** Financial indicators for each bank collected for 10 years (5 years pre and 5 years post periods).

2. **Ratio Computation:** Compute all CAMEL indicators using standardized formulas.

3. **Descriptive Analysis:** Identify mean, SD, and coefficient of variation for all ratios.

4. **Statistical Testing:** Apply paired t-test to each indicator to determine significance.

5. **Interpretation:** Analyze the post-merger impact on NPAs, profitability, efficiency, and stability.

6. **Graphical Presentation:** Use bar graphs, line charts, and trend diagrams for visualization.

Major Findings from Secondary Data

Descriptive Statistics

Analysis of six banks over their respective 10-year periods (5 years pre-merger and 5 years post-merger) reveals consistent patterns:

Bank	Indicator	Pre-Mean	Post-Mean	Pre-SD	Post-SD	Pre-CV%	Post-CV%
SBI	CAR	12.70	14.30	1.20	1.10	9.45	7.69
BoB	CAR	11.90	14.00	1.00	1.20	8.40	8.57
PNB	CAR	10.30	13.80	0.90	1.00	8.74	7.25
Canara Bank	CAR	11.50	13.20	1.30	1.40	11.30	10.61
Indian Bank	CAR	13.10	14.70	1.50	1.40	11.45	9.52
Union Bank	CAR	10.80	13.50	1.10	1.30	10.19	9.63

Table 5: Capital Adequacy Ratio Descriptive Statistics

Key Findings Summary:

1. **Capital Adequacy (CAR):** All banks show improved post-merger CAR, with lower coefficient of variation values, indicating greater capital strength and stability[11]

2. **Asset Quality (Gross/Net NPA):** Significant reductions in NPA ratios are visible post-merger, illustrating enhanced asset quality and risk management[11]

3. **Profitability (ROA):** Every bank reports higher post-merger ROA, with reduced variability, confirming operational synergy and improved income[11]

4. **Operational Efficiency (Cost-to-Income Ratio):** Ratios decline after merger, signifying improved cost management and efficiency[11]

5. **Business Productivity:** Business per employee climbs across all banks; post-merger coefficient of variation values decline, indicating more consistent workforce productivity[11]

Capital Adequacy Analysis:

State Bank of India: SBI's average CAR rose from 12.8% before the merger (2012-2017) to 13.7% in the post-merger period (2018-2023). This modest increase of 0.9 percentage points indicates sustained capital retention and strength, coupled with prudent balance sheet management and effective capital planning[12].

Bank of Baroda: Bank of Baroda experienced CAR growth from a pre-merger average of 12.7% (2014-2019) to 16.0% after the merger (2020-2025). An increase of 3.3 percentage points highlights successful consolidation, improved capital planning, and capital infusion[12].

Punjab National Bank: PNB's mean CAR improved from 11.9% pre-merger (2014-2019) to 14.9% post-merger (2020-2025). The 3 percentage point rise is attributed to capital infusions, merger synergies, and recapitalization efforts[12].

Canara Bank: The average CAR climbed from 12.6% pre-merger to 15.9% post-merger. The 3.3 percentage point increase signals enhanced capital planning and efficient capital management post-merger[12].

Indian Bank: CAR averaged 13.2% before the merger and improved to 15.7% after the merger. This 2.5 percentage point growth reflects prudent risk management and efficient integration of Allahabad Bank[12].

Union Bank of India: Average CAR advanced from 12.1% pre-merger to 16.3% post-merger. This significant 4.2 percentage point gain demonstrates robust capital augmentation and effective post-merger financial management, achieving the highest capital adequacy improvement[12].

Asset Quality Analysis: Across all six major public sector banks, the post-merger period (2018-2025) shows a significant downward shift in Gross NPA ratios—ranging from 2 to almost 4.5 percentage points lower than pre-merger levels[13]. This indicates that mergers have generally resulted in better asset quality, enhanced operational efficiency, and more effective NPA management.

Pre-merger period data shows higher and often rising NPA ratios, while post-merger lines exhibit consistent and significant reductions. The improvement is most

pronounced for Union Bank of India, Punjab National Bank, and Canara Bank, which started with high pre-merger NPA levels and showed sharp declines after consolidation[13].

All six banks demonstrate pronounced and sustained improvements in Net NPA Ratios post-merger. The quantitative contraction in Net NPA ratios equips banks for profitable lending, greater resilience to credit cycles, and stronger compliance with international norms[13].

Provision Coverage Ratio: The post-merger phase has seen banks like SBI, Bank of Baroda, Punjab National Bank, and Canara Bank progressively raising their coverage ratios, often surpassing 80%, which represents a robust buffer against asset quality deterioration[13]. This enhanced coverage strengthens banks' capital adequacy and reduces earnings volatility by ensuring earlier recognition and coverage of potential loan losses.

Management Efficiency Analysis: Across all public sector banks, elevated Business per Employee Ratios post-merger signify enhanced human resource deployment, operational efficiencies, and a stronger foundation for sustained financial growth[14]. The rise in this ratio is a key indicator of improved workforce productivity, essential for sustainably managing higher volumes and competing effectively in India's dynamic banking environment.

Profit per employee ratios reveal consistent and remarkable gains post-merger, ranging from over 60% improvement for SBI to nearly 475% for Union Bank of India[14]. These results confirm that bank mergers in India have significantly strengthened operational efficiency, workforce productivity, and the capacity to generate higher profits per employee.

The operating expense to total income ratio declined significantly post-merger across all major banks[15]. These reductions reflect strong gains from integration strategies, resulting in effective cost control, resource rationalization, and scale economies, thereby validating the consolidation policy as an effective tool for boosting competitiveness and long-term financial sustainability.

Earnings Performance: The merger of Indian public sector banks has resulted in clear and statistically significant improvements in financial performance, including higher return on assets, increased profitability, and more efficient asset utilization for all anchor banks[16]. These gains have been driven by enhanced capital strength, operational synergies, better risk management, and the realization of economies of scale.

Indian public sector bank mergers yielded modest but consistent improvements in net interest margins, reflecting enhanced asset-liability management, lending strategy optimization, and stable income streams across the merged entities[17].

Liquidity Analysis: Mergers among Indian public sector banks significantly strengthened the liquidity positions of these banks, as seen from increased liquid assets to total assets ratios post-merger[18]. These improvements

contribute to greater resilience against liquidity risks and market shocks, while supporting enhanced regulatory compliance and the capacity to grow lending portfolios responsibly.

The analysis reveals consistent improvement in credit-deposit ratios across all six banks after their respective mergers. Increases range from approximately 8.4% to 15.7%, demonstrating the positive impact of mergers on improving credit deployment relative to deposits[19]. These trends suggest enhanced operational efficiencies, credit capacity, and better resource utilization following mergers.

Hypothesis Testing Results
Table 6: (see in last page)
All null hypotheses were rejected at p < 0.05 significance level, indicating that mergers have resulted in statistically significant improvements across all CAMEL dimensions.

Conclusion: Mergers have materially strengthened PSBs' capital adequacy, asset quality, profitability, and operational efficiency, validating consolidation as an effective strategic tool rather than just a crisis response[20]. The benefits are most visible in reduced NPA ratios, higher ROA and NIM, improved cost-to-income ratios, and sharp increases in profit per employee, though integration outcomes differ somewhat across banks[20].

Nevertheless, macroeconomic shocks, legacy stressed assets, and governance constraints mean that mergers alone cannot fully resolve structural weaknesses without complementary reforms in credit appraisal, monitoring, and recovery mechanisms[20].

Recommendations:
1. **Deepen credit risk management:** Standardize and upgrade credit appraisal systems across merged entities with strong sectoral due diligence and early warning frameworks. Use data analytics and AI-based tools more extensively for borrower screening, rating, and monitoring[21]

2. **Strengthen post-merger integration and governance:** Accelerate harmonization of IT systems, HR policies, and performance metrics to lock in efficiency gains. Enhance board-level risk oversight and align management incentives with asset quality targets[21]

3. **NPA resolution and recovery focus:** Maximize use of IBC, SARFAESI, ARCs, and out-of-court settlements for large and mid-size NPAs. Develop specialized teams for sector-specific restructuring[21]

4. **Operational and cost efficiency:** Continue rationalizing overlapping branches while expanding digital channels. Use shared services centres for back-office operations to sustain improvements[21]

5. **Human capital and culture:** Implement structured change-management and training programmes to integrate staff from legacy banks and reduce resistance to process changes[21]

Implications
Policy Implications: The evidence supports the

Government of India and RBI's use of consolidation as a viable instrument to strengthen PSBs, but highlights the need to pair mergers with strong governance, capital, and risk-management reforms[22]. Policymakers can use the CAMEL-based framework and NPA trends developed in this study when designing future consolidation waves or recapitalization packages[22].

Managerial Implications: Bank management can use the pre- and post-merger CAMEL diagnostics to set realistic performance benchmarks for asset quality, earnings, and efficiency[22]. The results demonstrate that synergy realization depends heavily on disciplined integration, technology modernization, and focused NPA resolution strategies[22].

Academic and Practical Implications: The study provides a structured empirical framework for evaluating merger success in emerging-economy banking, linking size, scale, and governance changes with asset quality outcomes[22]. Practitioners, analysts, and rating agencies can apply the same indicator set and hypothesis framework to other banking systems undergoing consolidation[22].

Recommendations for Future Research:

1. Incorporate macroeconomic variables (GDP growth, interest rates, sectoral shocks) and panel-data econometric models to disentangle merger effects from broader economic influences
2. Compare merged PSBs with a matched control group of private and foreign banks to understand whether public sector mergers are closing or widening the performance gap
3. Integrate qualitative methods (interviews with managers, staff surveys, case studies) to capture cultural integration, leadership, and technological challenges not visible in ratio analysis
4. Explore bank-level heterogeneity by studying why some merged entities achieve stronger improvements in NPA management and profitability than others

Limitations:

1. The study relies exclusively on secondary data, which may contain reporting inconsistencies
2. The analysis is limited to selected PSBs, which may not represent the entire banking sector
3. The post-merger period may not be long enough to capture the full impact of mergers
4. External factors such as macroeconomic conditions and policy changes may also influence NPA levels
5. Availability of uniform data for all parameters across banks is a constraint
6. The time frame (5 years pre- and post-merger) may not fully capture long-term merger effects
7. Macroeconomic variables such as inflation, GDP growth, and monetary policy changes are not separately modeled but may influence performance

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Component	Dimension	Key Indicators	Formula/Measurement	Interpretation
C	Capital Adequacy	CAR, Debt-Equity Ratio	(Tier I + II Capital) / RWA	Measures bank's ability to absorb losses
A	Asset Quality	Gross NPA%, Net NPA%, PCR	NPAs / Advances	Lower ratio = better asset quality
M	Management Efficiency	Business per Employee, Profit per Employee	Total Business / Employees	Reflects operational efficiency
E	Earnings	ROA, NIM	Net Profit / Total Assets	Indicates profitability and income generation
L	Liquidity	Liquid Assets Ratio, CD Ratio	Liquid Assets / Total Assets	Assesses short-term solvency

Table 4: CAMEL Model Framework and Components

Hypothesis	CAMEL Dimension	Key Indicators	Expected Change	Result	Interpretation
H_{01}	Capital Adequacy	CAR	Increase	Rejected	CAR improved significantly post-merger
H_{02}	Asset Quality	Gross/Net NPA%	Decrease	Rejected	NPA ratios declined significantly
H_{03}	Management Efficiency	Business/Profit per Employee	Increase	Rejected	Employee productivity rose markedly
H_{04}	Earnings	ROA, ROE, NIM	Increase	Rejected	Earnings indicators improved significantly
H_{05}	Liquidity	Liquidity Ratios, CD Ratio	Optimal/Stable	Rejected	Liquidity remained comfortable

Table 6: Hypothesis Testing Results ($p < 0.05$ for all)

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