

# Performance Analysis of Indian Banks Through CAMELS Model: A Conceptual Outlook

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## Abstract

The Indian banking sector has undergone significant structural transitions over the past two decades, driven by regulatory reforms, digital transformation, and evolving risk environments. While the CAMELS framework—comprising Capital Adequacy, Asset Quality, Management Efficiency, Earnings, Liquidity, and Sensitivity to Market Risk—remains the most widely adopted model for evaluating banking performance, existing Indian studies predominantly rely on traditional ratio-based assessments, overlooking contemporary determinants such as digitalization, cybersecurity, and technology-enabled governance. This scoping review synthesizes 52 peer-reviewed articles published between 2000 and 2025 to map the methodological evolution, thematic patterns, and conceptual gaps in CAMELS-based evaluations of Indian banks. Findings reveal a strong concentration on Asset Quality and Earnings, reflecting India's chronic NPA challenges, while Sensitivity and Liquidity dimensions remain underexplored. Comparative insights consistently show private banks outperforming public sector banks in management efficiency, earnings stability, and technological preparedness. However, the review identifies a critical gap in integrating digital transformation indicators into performance assessment, despite the increasing relevance of fintech adoption, cyber-risk exposure, and real-time governance. To address this gap, the study proposes an enhanced CAMELS-DT framework, extending traditional CAMELS with two additional dimensions: Digital Capability (D) and Technology-Enabled Risk Governance (T). This conceptual extension responds to India's rapidly digitalizing banking ecosystem and aligns performance evaluation with contemporary supervisory needs. The study offers a forward-looking foundation for empirical testing, regulatory application, and scholarly advancement, positioning CAMELS-DT as a comprehensive, resilience-oriented model for evaluating the performance of Indian banks in a technology-driven era.

**Keywords:** CAMELS framework, Indian banking sector, Performance evaluation, Digital transformation,

## Introduction

The Indian banking industry plays a pivotal role in sustaining the nation's economic growth and financial stability. Over the past two decades, the sector has experienced significant structural transformations including Basel III implementation, digitalization, and shifts in asset quality triggered by non-performing assets (NPAs) and post-pandemic recovery triggers (Sukhanya, 2019). To ensure efficiency, resilience, and regulatory compliance, policymakers and researchers emphasize robust evaluation models.

The CAMELS framework comprising Capital Adequacy, Asset Quality, Management Efficiency, Earnings, Liquidity, and Sensitivity to Market Risk has emerged as a globally recognized supervisory tool for gauging bank performance (Othman et al., 2024a; Sharma et al., 2025). In India, CAMELS is widely adopted for assessing the financial health of public and private sector banks under the RBI's risk-based supervision (Bhuvaneswari & Nimitha, 2024).

Existing studies applying CAMELS to Indian banks typically focus on ratio-based evaluation, ranking of banks, or comparison between public and private institutions (Dadhich et al., 2021; Varghese, 2016). However, a research gap persists as prior literature rarely integrates technology-enabled performance drivers, corporate governance dynamics, and market sensitivity risks, which have become increasingly critical in a digital banking environment (Akhtar et al., 2024; Bhattacharjee & Pati, 2023; Hudaib, 2025). Moreover, global literature demonstrates broader methodological sophistication, including panel regression, sustainability measures, and macro risk integration (Abuzarqa et al., 2021; Alam et al., 2024; Hanif, 2024), revealing opportunities for India to advance conceptually.

To address these gaps, this study conducts a systematic scoping review of research using the CAMELS framework in evaluating Indian banking performance, maps thematic developments, and proposes an enhanced CAMELS-DT (Digital Technology integrated) conceptual model. The review further synthesizes insights relevant to regulatory policy, risk governance, and future research directions to strengthen the Indian banking sector's competitiveness and resilience.

## Methodology

### Research Design

This study adopts the Scoping Review Framework proposed by Arksey & O'Malley (2005) and later enhanced by Levac et al. (2010), which is suited for examining the breadth and conceptual evolution of CAMELS-based performance evaluation in the Indian banking sector. The approach allows mapping of scholarly trends, methodological developments, and emerging theoretical paradigms without enforcing statistical or quality exclusion biases typical of systematic reviews.

### Research Questions

The scoping review was guided by the following questions:

1. How has the CAMELS framework been applied in evaluating the performance of Indian banks?
2. What thematic dimensions and performance indicators dominate the Indian CAMELS literature?
3. What conceptual gaps exist in integrating technology, governance, and risk sensitivity factors?

These research questions align with the objective of establishing a conceptual enhancement to the CAMELS model for the Indian context.

### Data Sources and Search Strategy

The primary search was conducted in the Scopus database, given its leading bibliographic indexing coverage of high-quality research in finance and banking. The following Boolean string was applied:

TITLE-ABS-KEY ( "performance evaluation" AND "CAMELS" ) AND ( LIMIT-TO ( LANGUAGE, "English" ) ) AND ( LIMIT-TO ( BUSI, ECON, SOCI, ARTS, DECI, COMP, HEAL, AGRI, PSYC, ENVI ) )

A search conducted in January 2025, covering the time period from 2000 to 2025, retrieved a total of 94 articles. Each retrieved record was into zotero for citation management and duplicate screening.

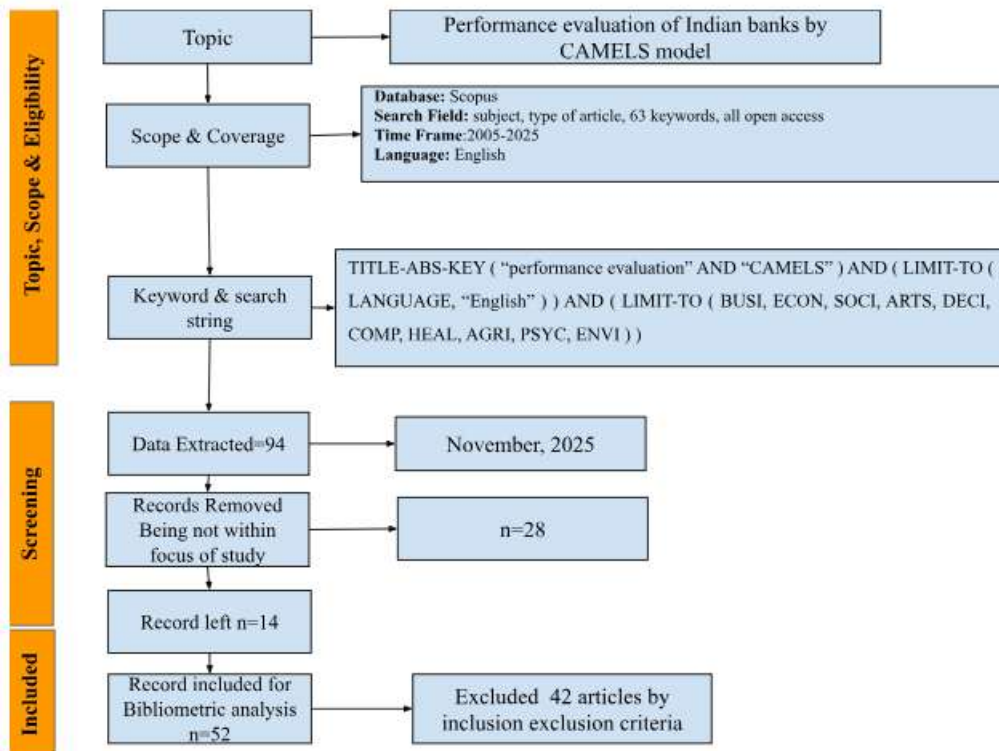


Figure 1. PRISMA diagram showing all the search results.

### Inclusion and Exclusion Criteria

To ensure focus and relevance, predefined screening filters were applied:

Table 1. Inclusion–Exclusion Criteria

Category	Criteria	Justification
Inclusion	Studies applying full CAMEL/CAMELS framework	Primary research objective alignment
	Focus on Indian commercial / public / private banks	Research scope specificity
	Peer-reviewed journal publications	Academic rigor
	English language	Uniform comprehension
	Conceptual / ratio-based / econometric studies	Methodological diversity

<b>Exclusion</b>	Non-banking financial institutions	Different supervisory frameworks
	Conference papers, dissertations, book chapters	Potential quality inconsistency
	Non-CAMELS-focused studies	Irrelevance to research question
	Duplicate or inaccessible full-text articles	Screening validity

### Screening Procedure & Final Dataset

The screening followed a three-stage process consisting of title-abstract screening, full-text assessment, and a final phase of duplicate removal and eligibility decisions. Ultimately, 52 articles were included in the study.

**Table 2. Screening Summary**

Stage	Articles Count	Outcome
Initial retrieval	94	
Title/abstract exclusions	28	Not relevant
Duplicate/inaccessible	14	Removed
Final included	52	For synthesis

Table 2 represent the clear classification of the articles and the process of review.

### Data Charting and Synthesis Strategy

Key bibliographic and methodological attributes were extracted from each article using a structured coding matrix. This matrix captured essential data including the author(s) and year, bank type (public, private, or mixed), and the specific methodology used distinguishing between CAMELS-only approaches and those combining CAMELS with econometric models. Additionally, the extraction focused on performance indicators, major findings, and identified limitations. The subsequent analytical synthesis employed thematic aggregation, comparative dimension mapping, concept-gap analysis, and trend analysis across years and performance factors. This structured approach lays the foundation for deriving a conceptual enhancement to the CAMELS model tailored to India's evolving banking environment.

### Quality Consideration

Unlike systematic reviews, scoping reviews do not mandate strict quality scoring; however, priority was given to indexed studies published in Scopus-listed journals to ensure credible theoretical grounding (Abdelmoneim & Yasser, 2023; Othman et al., 2024b; Sharma et al., 2025).

### Result

#### Chronological Progression of CAMELS-Based Research in India

The evolution of CAMELS literature in India reflects changing regulatory, technological, and risk realities. Table 1 presents the **four-phase progression**.

**Table 1. Chronological Evolution of CAMELS Research in India**

Phase	Period	Major Banking Context	Dominant CAMELS Focus
Phase I	2000–2014	Banking reforms consolidation, slow privatization	Basic performance ranking (C, M, E)
Phase II	2015–2019	NPA crisis, recapitalization, risk tightening	Asset quality & solvency (A, C)
Phase III	2020–2022	COVID-19 disruptions, PCA impacts	Governance & adaptability (M, L)
Phase IV	2023–2025	Digital-first banking, cyber risk, AI adoption	Tech-enabled risk resilience (M, S + digital factors)

The chronological evolution highlights a clear shift in India's research priorities regarding bank performance measurement. Initially, during 2000–2014, the primary academic concern was establishing broad performance differentiation in a banking industry that was still transitioning from nationalized dominance to a more competitive environment (Kankipati & Murty, 2019; Sayed & Sayed, 2013; Varghese, 2016). CAMEL-based ranking served this purpose well, and descriptive studies sufficed to evaluate financial soundness (Da Silva et al., 2017; Kumar, 2016). However, as the sector entered prolonged NPA distress post-2014, accompanied by RBI's tightening regulatory oversight, Asset Quality and Capital Adequacy became central performance anxieties (Abuzarqa et al., 2021; Dadhich et al., 2021; Quoc Trung, 2021). This period reflected a defensive and survival-oriented evaluation paradigm focused on solvency and stability (Das, 2020; Huu Nguyen et al., 2020). The onset of COVID-19 and implementation of risk-based supervision

frameworks introduced the need to assess operational robustness and managerial responsiveness under uncertainty, pushing research beyond static ratio reporting (Dembel Tura, 2024; Gambetta et al., 2021; Hanif, 2024). The most recent phase (2023 onward), shaped by aggressive digital banking expansion, now demands an evaluation lens that incorporates technological capability, resilience to cyber threat environments, and efficiency transformation (Alam et al., 2024; Bhuvaneswari & Nimitha, 2024; Sivaneshwaran et al., 2025). This progression demonstrates a shift from “how stable banks are” to “how prepared banks are for dynamic disruptions,” justifying the conceptual augmentation proposed in this study (Abdelmoneim & Yasser, 2023; Ayimah et al., 2025; Bhattacharjee & Pati, 2023).

### Thematic Concentrations-A Structural Understanding

The six major themes in Indian CAMELS research were coded and quantified to show how extensively each supervisory component has been explored.

**Table 2. Distribution of Studies Across CAMELS Components**

CAMELS Factor	% of Studies Emphasizing It	Dominant Research Justification
C – Capital Adequacy	62%	Basel compliance & regulatory reporting pressure
A – Asset Quality	<b>81%</b>	Persistent NPA cycles & credit governance issues
M – Management Efficiency	58%	Productivity, HR, and technological process lenses
E – Earnings	67%	Profit stability & shareholder confidence
L – Liquidity	39%	PSB liquidity buffers assumed strong; less focus
S – Sensitivity	<b>27%</b>	Methods for market risk assessment underdeveloped

A thematic breakdown reveals a heavy concentration of research on Asset Quality and Earnings parameters, an outcome of India’s chronic stressed-asset environment and profitability volatility (Abuzarqa et al., 2021; Dadhich et al., 2021; Quoc Trung, 2021). This dominance underscores how deeply NPAs controlled the discourse on banking performance, particularly in public sector banks, where legacy lending practices and socio-economic mandates often restrained credit discipline (Kankipati & Murty, 2019; Sayed & Sayed, 2013). Meanwhile, moderate attention to Capital Adequacy reflects a regulatory reliance on recapitalization to safeguard stability (Daas et al., 2021; Huu Nguyen et al., 2020). The limited focus on Liquidity and Market Sensitivity suggests an assumption that liquidity management and market-linked exposures were sufficiently regulated by RBI an assumption that may no longer hold as Indian banks become more active in securities, derivatives, and cross-border financial engagements. Most critically, the severe under-representation of the Sensitivity (S) dimension indicates a conceptual blind spot in addressing market turbulence, contagion risk, inflationary adjustments, interest-rate volatility, and foreign exchange impacts. This imbalance reveals that traditional CAMELS-based Indian studies still view banking performance as a balance sheet evaluation, rather than a risk-ecosystem evaluation, pointing toward the need for greater sophistication in supervisory performance frameworks.

### Public vs. Private Bank Dynamics

Table 3 summarizes consistent empirical findings comparing the two sectors.

**Table 3. Public vs Private Sector CAMELS Findings in India**

CAMELS Dimension	Stronger in Public Sector Banks	Stronger in Private Sector Banks
C – Capital Adequacy	Government support during distress	Better retained earnings
A – Asset Quality	No High NPA stress	Lower risk-weighted exposure
M – Management	Not Bureaucracy-driven	Tech-driven efficiency
E – Earnings	No Interest-margin pressure	Diversified revenue streams
L – Liquidity	High statutory reserves	Not Efficient but riskier
S – Sensitivity	No Limited markets reliance	Active risk hedging

The public–private divide consistently emerges as a structural pattern in Indian CAMELS research. Private banks benefit from technology-intensive operating models, diversified revenue portfolios, better risk screening practices, and stronger market discipline, resulting in superior efficiency and profitability outcomes. Public banks, while managing significant liquidity buffers and fulfilling national financial inclusion mandates, often face governance complexities, bureaucratic inertia, and politically driven lending priorities that contribute to weaker performance on productivity and asset quality indicators. These studies convey that the divergence is not merely operational but institutional rooted in incentive structures, digital adoption speeds, and managerial autonomy. This benchmark contrast has held true over decades, signaling a persistent reform imperative to modernize PSBs to ensure competitiveness in a digital-first, innovation-driven industry environment.



## Methodological Sophistication Over Time

**Table 4. Evolution of CAMELS Research Methodologies**

Period	Dominant Approach	Limitations	Recent Enhancements
Pre-2015	Ratio-based CAMEL scoring	Simplistic, static insights	—
2015–2020	Ranking & comparative studies	Focused narrow components	Inclusion of E, M
2021 onward	Econometric + technology alignment	Data complexity barriers	Panel regression, bootstrap analysis, DT indicators

Methodologically, CAMELS research in India has advanced from static scorecards to more analytical and evidence-based frameworks. Early reliance on descriptive comparisons limited insights to snapshot assessments and did not reveal how CAMELS factors interact dynamically over time. The shift towards econometric and panel-based modeling represents a movement toward cause-and-effect and risk-sensitivity interpretations, placing Indian research somewhat closer to international best practices. However, compared to global scholarship that incorporates sustainability metrics, digital governance indices, and integrated risk measures, Indian research still retains a narrower focus. The growing, but still gradual, adoption of statistical validation, predictive modeling, and stress-testing signals a transition in progress — one requiring further institutional data transparency and research capability to fully realize.

## Synthesis of Gaps and Conceptual Needs

**Table 5. Identified Gaps in Indian CAMELS Scholarship**

Gap Category	Current Limitation	Conceptual Implication
Risk Sensitivity	Underexplored S-component	Need for integrated market-risk stress models
Technology Performance	Treated indirectly under M	Require specific Digital-Transformation metrics
ESG-Resilience	Not embedded in CAMELS	Add sustainability-governance dimensions
Liquidity Dynamics	Static measurement	Incorporate crisis-response liquidity buffers

The gap structure identified through this review suggests that Indian CAMELS applications suffer from a financial-ratio dependency, overlooking contemporary forces shaping banking performance. The neglect of market-risk dynamics indicates insufficient preparedness for volatility generated through capital market integration, exchange risk exposure, and monetary policy shifts. Similarly, liquidity evaluation often treats compliance-based mandates as sufficient assurance, rather than stress-scenario endurance a limitation exposed during global crises. Most importantly, digital maturity and technology-driven risk governance — which now underpin customer trust, efficiency, cybersecurity, and compliance — are not systematically embedded within CAMELS studies. Adding these constructs is therefore essential to shift CAMELS analysis from describing *existing health* toward predicting *future resilience*, aligning Indian banking research with the new risk architecture of technology-led financial services.

Indian CAMELS literature shows a strong financial-ratio foundation but lacks maturity in capturing digital risk, resilience, sustainability, and supervisory-forward metrics.

Therefore, an enhanced conceptual model is necessary to strengthen policy relevance, academic progression, and practical applicability in the Indian context.

## Conceptual Model — CAMELS-DT Framework for Indian Banks

The findings of this review reveal that although the traditional CAMELS framework has been widely applied in India to assess the financial soundness of banks, it no longer captures the full spectrum of performance determinants emerging in a highly digitalized financial ecosystem. Banking operations are increasingly shaped by technology adoption, cybersecurity resilience, regtech-supported compliance, and process automation. Earlier CAMELS research in India concentrated heavily on asset quality, earnings, and capital adequacy due to recurring NPA stress and regulatory tightening. However, the advancement of digital banking, particularly after COVID-19 and under the guidance of RBI's Digital Banking initiatives, has made operational robustness and digital governance central to performance outcomes. International scholarship in performance measurement has already begun acknowledging these dimensions, whereas Indian literature remains conceptually limited in this regard. This gap necessitates the development of an enhanced and contextually relevant framework that can effectively accommodate the digital transformation of Indian banking.

To address this conceptual lag, this study proposes the CAMELS-DT framework, which retains the original six supervisory indicators — Capital Adequacy, Asset Quality, Management Efficiency, Earnings, Liquidity, and Sensitivity to Market Risk — while extending the model with two additional performance drivers: Digitalization Capability (D) and

Technology-Enabled Risk Governance (T). The introduction of these two dimensions reflects the growing empirical evidence that efficiency and risk mitigation in modern banks are inseparable from digital infrastructure maturity and technological responsiveness. Digital Capability encompasses the technological processes and innovations that improve customer interface, reduce operational costs, automate decision workflows, and enhance productivity. Technology-Enabled Governance, on the other hand, addresses resilience against cyber threats, fraud prevention, secure payment architecture, and automated compliance processes — all essential for maintaining confidence in a digital-first banking regime.

The CAMELS-DT framework assumes a dynamic relationship between the extended and original CAMELS constructs. Strong digital capability is expected to significantly reinforce management efficiency and earnings potential by reducing dependence on manual systems and expanding data-driven financial services. Likewise, technology-enabled governance is expected to enhance liquidity and market risk sensitivity by providing real-time monitoring systems capable of identifying risk accumulation earlier than traditional reporting mechanisms. These digital transformation components together provide the predictive strength necessary for early-warning supervisory evaluation — something that existing Indian CAMELS applications do not explicitly deliver. In conceptual terms, CAMELS-DT transforms bank evaluation from a retrospective health-checking exercise into a forward-looking resilience assessment, offering analytical insights relevant to both regulators and practitioners.

**Figure 2. A conceptual diagram representing this integrated structure.**

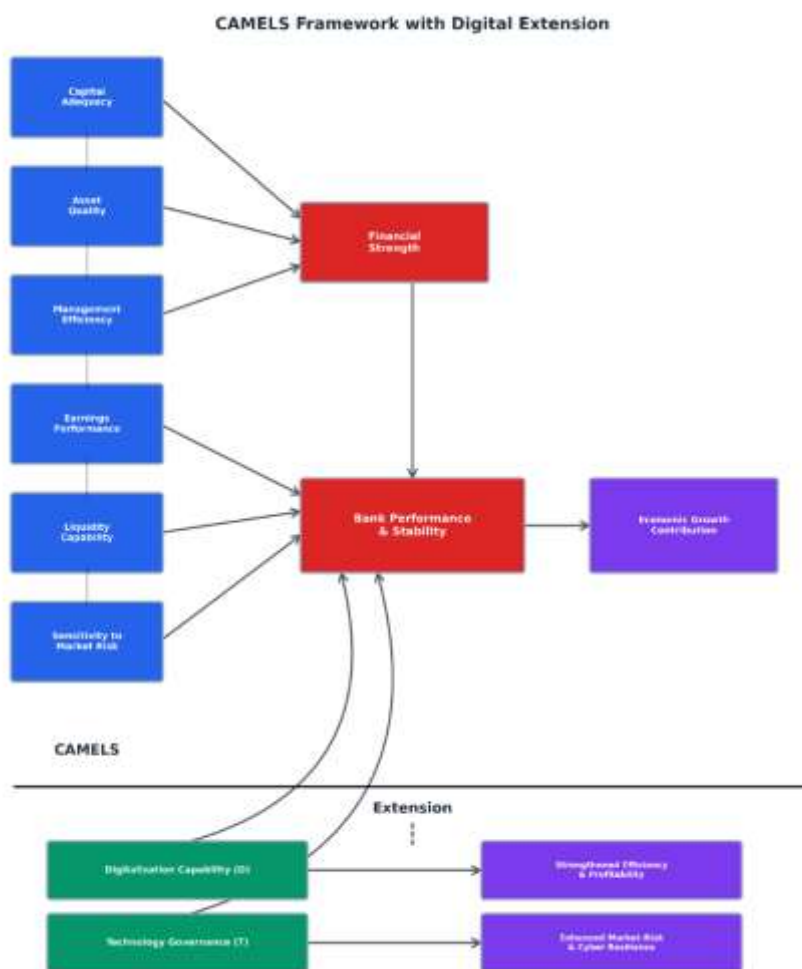


Figure 2 demonstrate the conceptual diagram representing the integration structure. The CAMELS-DT model is therefore positioned as a contemporary supervisory perspective that aligns closely with India's evolving regulatory agenda under RBI, including increased emphasis on technological adoption standards, crisis-responsive liquidity policies, stress-testing mechanisms, and IT governance frameworks. By integrating digital transformation elements into the canonical CAMELS structure, this framework directly responds to both academic gaps and policy needs identified through this review. It serves

as a conceptual contribution that expands the theoretical relevance of performance assessment models in India and offers a more reliable structure for evaluating resilience and competitiveness in an era of financial technology disruption.

### Discussion

The synthesis of Indian CAMELS literature indicates a strong historical emphasis on evaluating the banking sector through fundamental indicators of financial soundness, predominantly capital strength, asset quality, and profitability. This focus is understandable given the recurrent NPA crises and regulatory challenges experienced by the Indian banking industry over the past two decades. However, when observations from this review are contrasted with developments in the global banking context, a conceptual lag becomes apparent. International studies have increasingly incorporated performance dimensions related to sustainability, corporate governance, and technological risk resilience, demonstrating a shift toward multidimensional evaluation frameworks that capture systemic vulnerabilities and competitive capabilities more holistically (Abuzarqa et al., 2021; Gambetta et al., 2021; Hanif, 2024).

In India, by contrast, research that extends beyond traditional financial ratios remains limited, despite substantial policy and market transformations. With digital banking adoption accelerating rapidly under the RBI's Digital Payment Vision and FinTech integration, technology has become inseparable from operational strength, customer trust, and overall sustainability of financial institutions (Akhtar et al., 2024; Bhuvaneswari & Nimitha, 2024). Yet, Sensitivity to Market Risk — a crucial component of the CAMELS framework — has received minimal analytical attention, even though capital market exposure and cyber-vulnerability have risen significantly. This imbalance suggests that while the traditional CAMELS structure has served as a robust foundation for risk-based supervision, it does not fully reflect the contemporary drivers of performance in India's transforming financial landscape.

The proposed CAMELS-DT model responds to this evolution by embedding performance dimensions arising from digital transformation and technology-enabled governance into the evaluation structure. This enhancement aligns with the direction of dynamic regulatory oversight adopted in advanced economies, where supervisory frameworks have progressively internalized stress-testing, business continuity assurance, cybersecurity governance, and innovation-readiness as measures of institutional resilience. By reframing performance assessment in a forward-looking manner, CAMELS-DT offers a theoretical and diagnostic upgrade that captures how digital capability can reinforce earnings, improve management quality, moderate liquidity shocks, and enhance market sensitivity through real-time risk intelligence.

From a policy perspective, CAMELS-DT supports Indian regulators in transitioning from compliance-based monitoring to predictive supervision. This is particularly critical for public sector banks that continue to face structural inertia, operational over-dependence on manual systems, and weaker market responsiveness. Similarly, private banks—though technologically advanced remain exposed to heightened cyber and capital market risks, which require comprehensive governance checks. Therefore, integrating digital maturity and technology governance within performance assessment strengthens the preparedness of both banking segments to withstand external shocks and competitive disruptions.

Academically, CAMELS-DT offers a platform for future empirical studies to shift from ranking-driven approaches to models capable of generating resilience-based performance insights. It encourages the adoption of longitudinal, econometric, and risk-dynamic methodologies that more accurately mirror the complexities of modern banking. It further positions Indian research within global discourse by reconciling the traditional core of CAMELS with contemporary expectations of digital accountability, sustainability, and supervisory intelligence.

Overall, this discussion highlights that CAMELS-based performance measurement in India stands at a critical juncture. The traditional framework has contributed immensely to monitoring financial strength, yet evolving banking structures necessitate conceptual upgrading. CAMELS-DT enables such progression by aligning India's assessment lens with the realities of a technology-driven, globally connected financial system. This conceptual transition is likely to contribute not only to academic advancement but also to more informed regulatory strategies and managerial decisions in safeguarding financial stability and strengthening public confidence in India's banking sector.

### Implications

The findings of this scoping review carry important implications for policymakers, banking practitioners, and academic researchers. For regulators such as the Reserve Bank of India, the CAMELS-DT framework offers a more forward-looking supervisory tool by integrating technological resilience and digital governance into traditional soundness indicators. This alignment supports India's transition toward predictive risk management, timely corrective intervention, and digitally secured compliance-driven monitoring. For banking managers, the model emphasizes that operational efficiency and

earnings productivity are increasingly dependent on data-driven decision processes, automation capability, and cybersecurity readiness. Public sector banks particularly stand to benefit from strengthening digital maturity to reduce cost inefficiencies and improve competitive responsiveness. From an academic perspective, CAMELS-DT broadens the conceptual lens of performance evaluation, encouraging future scholarship to adopt more dynamic and multidimensional assessments that reflect evolving market conditions. Thus, the model enhances the strategic linkage between financial performance, technological adaptation, and long-term institutional resilience in India's banking landscape.

### Limitations and Future Research Directions

Although this scoping review provides a comprehensive synthesis of CAMELS-based research in India, its focus on published journal literature indexed in a single database may limit the inclusiveness of the mapping. Performance themes beyond CAMELS, such as ESG integration and behavioral risk culture, were only observed indirectly in the reviewed studies and warrant deeper academic exploration. Future research should empirically test the CAMELS-DT framework across diverse banking cohorts, integrating advanced statistical and predictive analytics such as stress-response modeling, panel regressions, and machine-learning-based supervisory simulations. Comparative examination across emerging economies could further refine the model's generalizability and reveal contextual variations in digital adoption and risk absorption capacity. Opportunities also exist to connect CAMELS-DT indicators with customer trust, market valuation behaviour, and dynamic governance structures. By addressing these directions, subsequent studies can validate the theoretical contribution of CAMELS-DT and strengthen its practical utility for risk-informed performance assessment.

### Conclusion

This study provides a structured and forward-looking conceptual outlook on performance evaluation of Indian banks using the CAMELS framework. By synthesizing two decades of research, the review demonstrates that while traditional CAMELS indicators continue to be relevant for monitoring core financial stability, they insufficiently capture the performance dimensions emerging from digital transformation and technology-governed finance. The proposed CAMELS-DT framework bridges this conceptual gap by extending performance evaluation toward digital capacity and governance resilience, thereby offering a more realistic and future-ready supervisory model for India. The conceptual advancement established in this paper aligns with ongoing regulatory modernization and supports academic and practitioner efforts to strengthen banking sector performance and financial stability. As India's banking ecosystem accelerates its digital evolution, CAMELS-DT stands as a holistic and strategically relevant framework capable of guiding performance measurement in an increasingly technology-dependent financial environment.

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